COKE POINT AREA GROUNDWATER CORRECTIVE MEASURES STUDY REPORT

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TABLE OF CONTENTS

1.0 Introduction 1
1.1 Overall Purpose of the Corrective Measures Study 1
1.2 Approach for Corrective Measures Study 1
2.0 Description of Current Situation 3
2.1 Site Setting and Use 3
2.1.1 Land Use and Surface Features 4
2.1.2 Regional Geology 4
2.1.3 Site Geology/Hydrogeology 4
2.1.4 Groundwater Use 9
2.2 Summary of Previous Investigations 10
3.0 Corrective Action Objectives 14
3.1 Corrective Action Objectives 14
3.2 Identification of Constituents of Potential Concern 14
3.3 Potential Receptors and Exposure Pathways 17
3.3.1 Human Health – Non-Residential 17
3.3.2 Ecological Receptors 17
3.3.3 Resource Restoration 21
3.4 Development of Preliminary Single-Chemical Risk-Based Screening Levels 22
3.4.1 Human Health – Non-Residential 23
3.4.2 Ecological Receptors 30
3.4.3 Resource Restoration 32
3.5 Exposure Pathways of Concern 36
3.6 Final Remedial Goals 37
3.6.1 Cyanide 40
3.6.2 Hexavalent Chromium 40
3.7 Potential Soil Sources 41
4.0 2024 and 2025 Supplemental Investigation 42
4.1 Additional Groundwater Sampling and Delineation (2024) 42
4.2 NAPL Summary 43
4.3 MNA and Microbial Sampling (2024) 44
4.4 Shoreline Groundwater Sampling (2024) 45
4.5 Groundwater Sampling (2025) 45
4.6 Offshore Sampling (2025) 46
5.0 Historical Interim Measures Across Coke Point Area 48
5.1 Cell 1 48
5.2 Cell 2 48
5.3 Cell 3 48

5.4 Cell 4 48
5.4.1 Cells 4 Historical IM 48
5.4.2 Cell 4 Source Remediation 49
5.5 Cell 5 49
5.6 Cell 6 49
5.6.1 Cell 6 Historical IMs 49
5.6.2 Cell 6 Source Remediation 49
5.7 Other Remedial Activities 50
5.7.1 Parcel B18 50
5.7.2 Northern Container Terminal 50
6.0 Conceptual Site Model 52
6.1 Groundwater Assessment Area A – Coke Point Landfill Area 55
6.1.1 Known and Potential Source Identification 55
6.1.2 Geology / Hydrogeology in GAA A 56
6.1.3 Nature and Extent of Contamination in GAA A 56
6.2 Groundwater Assessment Area B – Former Benzol Processing Area (Cell 6 NAPL) .. 59
6.2.1 Known and Potential Source Identification 59
6.2.2 Geology / Hydrogeology in GAA B 59
6.2.3 Nature and Extent of Contamination at GAA B 62
6.3 Groundwater Assessment Area C – Parcel B18 68
6.3.1 Known and Potential Source Identification 68
6.3.2 Geology / Hydrogeology in GAA C 69
6.3.3 Nature and Extent of Contamination in GAA C 70
6.4 Groundwater Assessment Area D – Northeast B10 Area 72
6.4.1 Known and Potential Source Identification 72
6.4.2 Geology / Hydrogeology in GAA D 73
6.4.3 Nature and Extent of Contamination in GAA D 74
6.5 Groundwater Assessment Area E – Cell 4 / 5 and Container Terminal 76
6.5.1 Known and Potential Source Identification 76
6.5.2 Geology / Hydrogeology in GAA E 77
6.5.3 Nature and Extent of Contamination in GAA E 78
6.6 Groundwater Assessment Area F – Parcels B11 and B12 81
6.6.1 Known and Potential Source Identification 81
6.6.2 Geology / Hydrogeology in GAA F 81
6.6.3 Nature and Extent of Contamination in GAA F 82
6.7 Metals 85
7.0 Nature and Extent of CPA Impacts 86
7.1 Final RGs - Groundwater 86
7.2 Soil Screening Levels 87

8.0 Development and Evaluation of Corrective Measures Alternatives 90
8.1 Process Description 90
8.1.1 Overall Process 90
8.1.2 Identification of General Response Actions, Remedial Technologies, and Process Options 92
8.1.3 Evaluation of RCRA Threshold Criteria 92
8.1.4 Evaluation of RCRA Balancing Criteria 93
8.2 Development of Corrective Measures for GAA A 96
8.2.1 Applicability Evaluation for Identified Process Options 96
8.2.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA A 97
8.2.3 Summary of Corrective Measures Alternatives for GAA A 99
8.2.4 Evaluation of GAA A Alternative 1 102
8.2.5 Evaluation of GAA A Alternative 2 103
8.2.6 Evaluation of GAA A Alternative 3 105
8.2.7 Evaluation of GAA A Alternative 4 108
8.2.8 Comparative Analysis of Remedial Alternatives 111
8.2.9 Preferred Remedial Alternative 114
8.2.10 Contingency Remedial Criteria 115
8.3 Development of Corrective Measures for GAA B 116
8.3.1 Applicability Evaluation for Identified Process Options 116
8.3.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA B 116
8.3.3 Summary of Corrective Measures Alternatives for GAA B 120
8.3.4 Evaluation of GAA B Alternative 1 123
8.3.5 Evaluation of GAA B Alternative 2 123
8.3.6 Evaluation of GAA B Alternative 3 127
8.3.7 Evaluation of GAA B Alternative 4 131
8.3.8 Evaluation of GAA B Alternative 5 135
8.3.9 Comparative Analysis of Remedial Alternatives 139
8.3.10 Preferred Remedial Alternative 143
8.3.11 Contingency Remedial Criteria 145
8.4 Development of Corrective Measures for GAA C 146
8.4.1 Applicability Evaluation for Identified Process Options 146
8.4.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA C 147
8.4.3 Summary of Corrective Measures Alternatives for GAA C 150
8.4.4 Evaluation of GAA C Alternative 1 153
8.4.5 Evaluation of GAA C Alternative 2 154

8.4.6 Evaluation of GAA C Alternative 3 157
8.4.7 Comparative Analysis of Remedial Alternatives 160
8.4.8 Preferred Remedial Alternative 163
8.4.9 Contingency Remedial Criteria 164
8.5 Development of Corrective Measures for GAA D 165
8.5.1 Applicability Evaluation for Identified Process Options 165
8.5.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA D 166
8.5.3 Summary of Corrective Measures Alternatives for GAA D 169
8.5.4 Evaluation of GAA D Alternative 1 172
8.5.5 Evaluation of GAA D Alternative 2 173
8.5.6 Evaluation of GAA D Alternative 3 176
8.5.7 Evaluation of GAA D Alternative 4 179
8.5.8 Comparative Analysis of Remedial Alternatives 183
8.5.9 Preferred Remedial Alternative 186
8.5.10 Contingency Remedial Criteria 187
8.6 Development of Corrective Measures for GAA E 188
8.6.1 Applicability Evaluation for Identified Process Options 188
8.6.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA E 189
8.6.3 Summary of Corrective Measures Alternatives for GAA E 192
8.6.4 Evaluation of GAA E Alternative 1 195
8.6.5 Evaluation of GAA E Alternative 2 195
8.6.6 Evaluation of GAA E Alternative 3 199
8.6.7 Evaluation of GAA E Alternative 4 203
8.6.8 Comparative Analysis of Remedial Alternatives 207
8.6.9 Preferred Remedial Alternative 209
8.6.10 Contingency Remedial Criteria 211
8.7 Development of Corrective Measures for GAA F 211
8.7.1 Applicability Evaluation for Identified Process Options 211
8.7.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA F 213
8.7.3 Summary of Corrective Measures Alternatives for GAA F 215
8.7.4 Evaluation of GAA F Alternative 1 218
8.7.5 Evaluation of GAA F Alternative 2 218
8.7.6 Evaluation of GAA F Alternative 3 221
8.7.7 Evaluation of GAA F Alternative 4 224
8.7.8 Comparative Analysis of Remedial Alternatives 227
8.7.9 Preferred Remedial Alternative 230

8.7.10 Contingency Remedial Criteria 230
9.0 Technical Impracticability of Remediating Slag Fill 232
9.1 Nature and Extent of Slag 232
9.2 Site-Specific Conditions Contributing to Impracticability of Groundwater Restoration 234
9.2.1 Contaminant-Related Factors 234
9.2.2 Hydrogeologic Factors 236
9.3 Regulatory Framework for TI Decisions 237
9.4 Extent of TI Zone 238
9.5 Development of Alternative Remedial Strategy 238
9.5.1 Source Control 238
9.5.2 Aqueous Plume Remediation 239
9.5.3 Cost Considerations for Slag Excavation 239
9.6 Technical Impracticability Determinations at Similar Sites 239
9.6.1 Recommended Alternative Remedial Strategy 241
9.6.2 Point of Compliance 241
10.0 References 242

FIGURES

Figure 1	TPA Site Location Map
Figure 2	CPA CMS Site Location Map
Figure 3	CPA Groundwater – Shallow Hydrologic Zone Potentiometric Surface
Figure 4	CPA Groundwater – Intermediate Hydrologic Zone Potentiometric Surface
Figure 5	Approximate Shoreline 1916
Figure 6	Sitewide Groundwater – Shallow pH Concentrations
Figure 7	Sitewide Groundwater – Intermediate pH Concentrations
Figure 8	Sitewide Groundwater – Shallow TDS Concentrations
Figure 9	Sitewide Groundwater – Intermediate TDS Concentrations
Figure 10	Sitewide Groundwater – Shallow Aquifer Transmissivity
Figure 11	Sitewide Groundwater – Intermediate Aquifer Transmissivity
Figure 12	Sitewide Groundwater – Unusable Groundwater Areas, Shallow Zone
Figure 13	CPA CMS – Coke Oven Area Interim Measure Cell Locations
Figure 14	CPA CMS – Sitewide Wells and Piezometers
Figure 15	CPA CMS – Shoreline Wells and Piezometers
Figure 16	CPA CMS – Soil Boring Locations
Figure 17	CPA CMS – New Monitoring Wells (2024)
Figure 18	CPA CMS – Cell 6 Area NAPL Location Map
Figure 19	CPA CMS – Sampled Groundwater Parameters
Figure 20	CPA – Shallow Benzene Concentrations and Isocontours
Figure 21	CPA – Intermediate Benzene Concentrations and Isocontours
Figure 22	CPA – Shallow Naphthalene Concentrations and Isocontours
Figure 23	CPA – Intermediate Naphthalene Concentrations and Isocontours
Figure 24	CPA CMS – Groundwater Assessment Areas
Figure 25A	CPA CMS – Groundwater Assessment Area A
Figure 25B	CPA CMS – Final RG Exceedances (Sitewide) – GAA A
Figure 25C	CPA CMS – Final RG Exceedances (Shoreline) – GAA A
Figure 26A	CPA CMS – Groundwater Assessment Area B
Figure 26B	CPA CMS – New Soil Borings (2024)
Figure 26C	CPA CMS – Cross Section Plan View
Figure 26D	CPA CMS – Cross Section A-A’
Figure 26E	CPA CMS – Cross Section B-B’
Figure 26F	CPA CMS – Cross Section C-C’
Figure 26G	CPA CMS – Cross Section D-D’
Figure 26H	CPA CMS – Cross Section E-E’
Figure 26I	CPA CMS – Final RG Exceedances (Sitewide) – GAA B
Figure 26J	CPA CMS – Final RG Exceedances (Shoreline) – GAA B
Figure 27A	CPA CMS – Groundwater Assessment Area C
Figure 27B	GAA C (Parcel B18) – Shallow Groundwater Contours

Figure 27C GAA C (Parcel B18) – NAPL Investigation Locations
Figure 27D GAA C (Parcel B18) – Cross Section F-F'
Figure 27E GAA C (Parcel B18) – Cross Section G-G'
Figure 27F GAA C (Parcel B18) – Presence of NAPL at Discrete Soil Depths (0-4 feet bgs)
Figure 27G GAA C (Parcel B18) – Presence of NAPL at Discrete Soil Depths (4-8 feet bgs)
Figure 27H GAA C (Parcel B18) – Presence of NAPL at Discrete Soil Depths (8-12 feet bgs)
Figure 27I CPA CMS – Final RG Exceedances (Sitewide) – GAA C
Figure 27J CPA CMS – Final RG Exceedances (Shoreline) – GAA C
Figure 28A CPA CMS – Groundwater Assessment Area D
Figure 28B CPA CMS – GAA D – NAPL Investigation Locations
Figure 28C CPA CMS – Final RG Exceedances (Sitewide) – GAA D
Figure 28D CPA CMS – Final RG Exceedances (Shoreline) – GAA D
Figure 29A CPA CMS – Groundwater Assessment Area E
Figure 29B GAA E (Container Terminal) – Soil Boring Locations and Clay Elevations
Figure 29C GAA E (Container Terminal) – Cross Section H-H'
Figure 29D CPA CMS – Final RG Exceedances (Sitewide) – GAA E
Figure 29E CPA CMS – Final RG Exceedances (Shoreline) – GAA E
Figure 29F Container Terminal Wharf Cross Section
Figure 29G Cell 4 – Completed Excavation Extents
Figure 30A CPA CMS – Groundwater Assessment Area F
Figure 30B CPA CMS – B11-026 NAPL Delineation Area
Figure 30C CPA CMS – Final RG Exceedances (Sitewide) – GAA F
Figure 30D CPA CMS – Final RG Exceedances (Shoreline) – GAA F
Figure 31A CPA CMS – Sitewide Final RG Groundwater Exceedances (Benzene, Shallow Zone)
Figure 31B CPA CMS – Sitewide Final RG Groundwater Exceedances (Benzene, Intermediate Zone)
Figure 31C CPA CMS – Sitewide Final RG Groundwater Exceedances (Naphthalene, Shallow Zone)
Figure 31D CPA CMS – Sitewide Final RG Groundwater Exceedances (Naphthalene, Intermediate Zone)
Figure 31E CPA CMS – Sitewide Final RG Groundwater Exceedances (PAHs)
Figure 31F CPA CMS – Shoreline Final RG Groundwater Exceedances (Toluene, Shallow Zone)
Figure 31G CPA CMS – Shoreline Final RG Groundwater Exceedances (PAHs, Shallow Zone)
Figure 31H CPA CMS – Shoreline Final RG Groundwater Exceedances – Toluene (Intermediate Zone)

Figure 31I CPA CMS – Shoreline Final RG Groundwater Exceedances – Iron (Intermediate Zone)
Figure 32A CPA CMS – Sitewide SSL Exceedances (Benzene)
Figure 32B CPA CMS – Sitewide SSL Exceedances (Naphthalene)
Figure 32C CPA CMS – Sitewide SSL Exceedances (Other PAHs)
Figure 32D CPA CMS – Shoreline SSL Exceedances (All)
Figure 33 CPA CMS – Sitewide Wells and Container Terminal LOD

TABLES

Table 1 Exposure Parameter Values
Table 2 Chemical Specific Toxicological Criteria and Physiochemical Parameter Values
Table 3 Preliminary Risk Based Screening Levels - Ecological Receptors
Table 4 Summary of Preliminary Risk Based Screening Levels (TR = 1E-06)
Table 5 Summary of CPA Groundwater Chemicals with Results that Exceed the Preliminary RBSL Exceedances
Table 6 Non-Cancer Hazard Quotient and Hazard Index by Target Organ for All On-Site Receptors at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations
Table 7 Incremental Lifetime Cancer Risk for All On-Site Receptors at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations
Table 8 Non-Cancer Hazard Quotient and Hazard Index by Target Organ for Off-Site Recreational User at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations
Table 9 Incremental Lifetime Cancer Risk for Off-Site Recreational User at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations
Table 10 Final Remedial Goals – Groundwater
Table 11 Cyanide Groundwater Sampling Results
Table 12 Fall 2024 Supplemental GW Sampling – VOCs and SVOCs
Table 13 Fall 2024 Supplemental GW Sampling – Metals
Table 14 Fall 2024 Supplemental GW Sampling – BTEX and Naphthalene
Table 15 NAPL Characterization Results
Table 16 Fall 2024 Supplemental GW Sampling - Geochemical Parameters
Table 17 Fall 2024 Supplemental GW Sampling – Shoreline Monitoring Wells
Table 18 2025 Supplemental GW Sampling – SVOCs
Table 19 2025 Supplemental GW Sampling – Metals
Table 20 NAPL / VOC Removal Amounts
Table 21A Groundwater Exceedances for GAA A Contaminants of Concern (Sitewide)
Table 21B Groundwater Exceedances for GAA A Contaminants of Concern (Shoreline)
Table 22A Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)

Table 22B Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)

Table 23A Groundwater Exceedances for GAA C Contaminants of Concern (Sitewide)
Table 23B Groundwater Exceedances for GAA C Contaminants of Concern (Shoreline)
Table 24A Groundwater Exceedances for GAA D Contaminants of Concern (Sitewide)
Table 24B Groundwater Exceedances for GAA D Contaminants of Concern (Shoreline)
Table 25A Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
Table 25B Groundwater Exceedances for GAA E Contaminants of Concern (Shoreline)
Table 26A Groundwater Exceedances for GAA F Contaminants of Concern (Sitewide)
Table 26B Groundwater Exceedances for GAA F Contaminants of Concern (Shoreline)
Table 27A Groundwater Exceedances for Metals Exceedances (Sitewide)
Table 27B Groundwater Exceedances for Metals Exceedances (Shoreline)
Table 28A Final Remedial Goals Groundwater Exceedances (GAA A, Sitewide)
Table 28B Final Remedial Goals Groundwater Exceedances (GAA A, Shoreline)
Table 28C GAA A Contaminants of Concern – Statistics
Table 29A Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
Table 29B Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
Table 29C GAA B Contaminants of Concern – Statistics
Table 30A Final Remedial Goals Groundwater Exceedances (GAA C, Sitewide)
Table 30B Final Remedial Goals Groundwater Exceedances (GAA C, Shoreline)
Table 30C GAA C Contaminants of Concern – Statistics
Table 31A Final Remedial Goals Groundwater Exceedances (GAA D, Sitewide)
Table 31B Final Remedial Goals Groundwater Exceedances (GAA D, Shoreline)
Table 31C GAA D Contaminants of Concern – Statistics
Table 32A Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
Table 32B Final Remedial Goals Groundwater Exceedances (GAA E, Shoreline)
Table 32C GAA E Contaminants of Concern – Statistics
Table 33A Final Remedial Goals Groundwater Exceedances (GAA F, Sitewide)
Table 33B Final Remedial Goals Groundwater Exceedances (GAA F, Shoreline)
Table 33C GAA F Contaminants of Concern – Statistics
Table 34 Summary of Final Remedial Goals Groundwater Exceedances by GAA
Table 35A Soil Screening Levels by COPC / Point of Compliance
Table 35B Soil COCs by GAA
Table 36A Applicability Evaluation of Technologies for GAA A – Coke Point Landfill
Table 36B Corrective Measures Alternatives for GAA A - Coke Point Landfill
Table 36C Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA A - Coke Point Landfill
Table 36D Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA A - Coke Point Landfill
Table 37A Applicability Evaluation of Technologies for GAA B – Parcel B10 West

Table 37B Corrective Measures Alternatives for GAA B - Parcel B10 West
Table 37C Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA B - Parcel B10 West
Table 37D Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA B - Parcel B10 West
Table 38A Applicability Evaluation of Technologies for GAA C
Table 38B Corrective Measures Alternatives for GAA C
Table 38C Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA C
Table 38D Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA C
Table 39A Applicability Evaluation of Technologies for GAA D – Parcel B10 East
Table 39B Corrective Measures Alternatives for GAA D – Parcel B10 East
Table 39C Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA D – Parcel B10 East
Table 39D Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA D – Parcel B10 East
Table 40A Applicability Evaluation of Technologies for GAA E – Parcel B10 Cells 4 and 5
Table 40B Corrective Measures Alternatives for GAA E – Parcel B10 Cells 4 and 5
Table 40C Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA E – Parcel B10 Cells 4 and 5
Table 40D Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA E – Parcel B10 Cells 4 and 5
Table 41A Applicability Evaluation of Technologies for GAA F – Parcels B11 and B12
Table 41B Corrective Measures Alternatives for GAA F – Parcels B11 and B12
Table 41C Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA F – Parcels B11 and B12
Table 41D Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA F – Parcels B11 and B12
Table 42 Generalized Remediation Difficulty Scale
Table 43 Initial Screening of Technologies for Alternative Remedy Development

APPENDICES

Appendix A USEPA's Groundwater Use Determination
Appendix B Monitoring Well Details
Appendix B-1 Monitoring Well Construction and Sampling Details
Appendix B-2 Monitoring Well Sampling Dates
Appendix C COPC Screening
Appendix D Offshore Sampling Results
Appendix D-1 CPA Sediment Results
Table A1 April / May 2024 Sediment Sampling Results

Table A2 February 2025 Sediment Sampling Results
Appendix D-2 CPA Surface Water Results
Table A1 May 2018 Surface Water Sampling Results
Table A2 July 2019 Surface Water Sampling Results – Cell 2
Table A3 March 2019 Surface Water Sampling Results – Cell 3
Table A4 July 2019 Surface Water Sampling Results – Cell 5
Table A5 February 2025 Surface Water Sampling Results
Appendix D-3 CPA Pore Water Results
Table A1 April / May 2019 Pore Water Sampling Results – Cell 2
Table A2 April 2019 Pore Water Sampling Results – Cell 3
Table A3 April 2019 Pore Water Sampling Results – Cell 5
Appendix D-4 Southern Shoreline Risk Report (February 2025)
Appendix E Groundwater Screening Level Calculations
Appendix E-1 Target Organs
Appendix E-2 Preliminary Risk Based Screening Level Calculations
Table A1 Preliminary RBSLs, On-Site Utility Worker, Exposure Assumptions
Table A2 Preliminary RBSLs, On-Site Utility Worker, Carcinogenic Calculations
Table A3 Preliminary RBSLs, On-Site Utility Worker, Non-Carcinogenic Calculations
Table A4 Preliminary RBSLs, On-Site Utility Worker, Calculated Preliminary RBSLs
Table B1 Preliminary RBSLs, Recreational User, Exposure Assumptions
Table B2 Preliminary RBSLs, Recreational User, Carcinogenic Calculations
Table B3 Preliminary RBSLs, Recreational User, Non-Carcinogenic Calculations
Table B4 Preliminary RBSLs, Recreational User, Calculated Preliminary RBSLs
Table B5 Preliminary RBSLs, MDE Human Health for Consumption of Organism Only, Water Quality Criteria
Table B6 Preliminary RBSLs, Recreational User Calculated Preliminary RBSLs
Table C1 Preliminary RBSLs, Resource Restoration, Exposure Assumptions
Table C2 Preliminary RBSLs, Resource Restoration, Carcinogenic Calculations
Table C3 Preliminary RBSLs, Resource Restoration, Non-Carcinogenic Calculations
Table C4 Preliminary RBSLs, Resource Restoration, Calculated Preliminary RBSLs
Appendix E-3 Mixing Factor Calculations & Supporting Datasets
Appendix E-4 Mass Balance
Appendix E-5 Final Remedial Goal Calculations
Table A Maximum Groundwater Concentrations
Table B1 Final Remedial Goals, On-Site Industrial Worker, VISLs
Table C1 Final Remedial Goals, On-Site Utility Worker, Exposure Assumptions
Table C2 Final Remedial Goals, On-Site Utility Worker, Carcinogenic Calculations

Table C3 Final Remedial Goals, On-Site Utility Worker, Non-Carcinogenic Calculations
Table D1 Final Remedial Goals, Recreational User, Exposure Assumptions
Table D2 Final Remedial Goals, Recreational User, Carcinogenic Calculations
Table D3 Final Remedial Goals, Recreational User, Non-Carcinogenic Calculations
Table E1 Final Remedial Goals, Resource Restoration, Exposure Assumptions
Table E2 Final Remedial Goals, Resource Restoration, Carcinogenic Calculations
Table E3 Final Remedial Goals, Resource Restoration, Non-Carcinogenic Calculations
Appendix E-6 Historic Groundwater (2013-2016) Data Set Rationale
Appendix E-7 Soil Screening Level Calculations
Table A1 Soil Screening Level Calculations, Sitewide
Table A2 Soil Screening Level Calculations, Shoreline
Appendix F 2024 and 2025 Supplemental Investigation
Appendix F-1 2024 Well Construction Logs
Appendix F-2 2024 Soil Boring Logs
Appendix F-3 Sediment Hydraulic Conductivity Analysis
Appendix G Trend Analysis
Appendix H Historical Documents
Appendix H-1 Historical Figures
Appendix H-2 2022 Parcel B18 Soil Boring Logs
Appendix I Alternatives Analysis Cost Estimate

E-Attachments

E-Attachment #1A Sitewide Groundwater Screening Database (Preliminary RBSLs)
E-Attachment #1B Sitewide Groundwater Screening Database (Final RGs)
E-Attachment #2 Sitewide Soil Screening Database
E-Attachment #3 Lab Reports for 2024 and 2025 Supplemental Sampling
E-Attachment #4 Groundwater Field Parameters
E-Attachment #5 ChemStat Export Data
E-Attachment #6 Historical Well and Soil Boring Logs for Cross Sections
E-Attachment #7 Offshore Reports

ACRONYMS

µg/L	micrograms per liter
mg/L	milligrams per liter
ACH	Air changes per hour
Amsl	Above mean sea level
ARARs	Applicable or Relevant and Appropriate Requirements
AS/SVE	Air sparging/soil vapor extraction
ASTM	American Society for Testing and Materials
AWQC	Ambient water quality criteria
Bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CAMU	Corrective Action Management Unit
CAOs	Corrective Action Objectives
CMS	Corrective Measures Study
COA	Coke Oven Area
COCs	Contaminants of concern
COPCs	Contaminants of potential concern
CPA	Coke Point Area
CPLF	Coke Point Landfill
CSM	Conceptual Site Model
DMCF	Dredged Material Containment Facility
DNAPL	Dense non-aqueous phase liquid
DPE	Dual-phase extraction
DRO	Diesel range organics
ECs	Engineering Controls
EFR	Enhanced fluid recovery
ERH	Electrical Resistance Heating
FCV	Final Chronic Values
GAA	Groundwater Assessment Area
GRAs	General Response Actions
GRO	Gasoline range organics
GWPT	Groundwater pump and treat
HASP	Health and Safety Plan
HI	Hazard Index
ICs	Institutional Controls
ILCR	Incremental lifetime cancer risk
IM	Interim Measure
ISCO	In-situ chemical oxidation
ISCR	In-situ chemical reduction
lbs	Pounds

LNAPL	Light non-aqueous phase liquid
LOD	Limit of disturbance
LUCs	Land Use Controls
MCLs	Maximum contaminant levels
MDE	Maryland Department of the Environment
MNA	Monitored natural attenuation
MPE	Multi-phase extraction
NAPL	Non-aqueous phase liquid
PAHs	Polycyclic aromatic hydrocarbons
PALs	Project Action Levels
PCBs	Polychlorinated biphenyl
PPE	Personal protective equipment
RADWPs	Response and Development Work Plans
RBSLs	Risk Based screening levels
RCRA	Resource Conservation and Recovery Act
RGs	Remedial Goals
SCV	Secondary Chronic Values
SMCLs	Secondary maximum contaminant levels
SSLs	Soil screening levels
SVOCs	Semivolatile organic compounds
SWMUs	Solid Waste Management Units
TDS	Total dissolved solids
THQ	Target Hazard Quotient
TI	Technical Impracticability
TPA	Tradepoint Atlantic
TPH	Total petroleum hydrocarbons
TR	Target Risk
TRV	Toxicity Reference Value
TTU	Total toxic unit
UCLs	Upper confidence limits
USEPA	U.S. Environmental Protection Agency
VCP	Voluntary Cleanup Program
VISL	Vapor Intrusion Screening Level
VOCs	Volatile organic compounds

1.0 INTRODUCTION

The Coke Point Area (CPA) (the Site) is located in the southwestern portion of the Tradepoint Atlantic (TPA) Property and comprises Parcels B10, B11, B12, and B18. This CPA Groundwater Corrective Measures Study (CMS) Report addresses groundwater impacts identified on the Site and excludes historical offshore impacts. In total, the area covered by this CPA CMS is approximately 344.8 acres.

Parcel B10 is the former Coke Oven Area (COA) and includes approximately 174.9 acres. Parcel B11 was used for slag processing and metals reclamation activities and includes approximately 92.1 acres. The Dredged Material Containment Facility (DMCF) is a 24-acre area located in the western portion of B11 that was constructed to hold dredged material from maintenance dredging operations. Parcel B12 is the former Coke Point Landfill (CPLF) that occupies approximately 41 acres in the southwest corner of the CPA and received a variety of non-hazardous waste. Parcel B18 (approximately 36.8 acres) is located just north of the COA and contained several coke oven processes as well as bulk tar and oil storage tanks.

1.1 Overall Purpose of the Corrective Measures Study

On behalf of TPA, ARM Group LLC (ARM) has prepared this CMS will address groundwater impacts and sources of continuing releases to groundwater, which may include non-aqueous phase liquid (NAPL) or impacted soil, associated with the CPA, including the Coke Oven Area and CPLF Special Study Areas. Other soil impacts and potential exposures will be addressed through separate Phase II investigations and Response and Development Work Plans (RADWPs). Assessment and remediation of offshore impacts from a variety of potential sources pre-dated TPA's use and ownership of the TPA Property and are not within the scope of TPA's responsibility. This CMS Report is subject to review by the U.S. Environmental Protection Agency (USEPA) and the Maryland Department of the Environment (MDE), hereafter referred to as the Agencies.

1.2 Approach for Corrective Measures Study

The groundwater concern is contaminants of potential concern (COPCs) in the shallow and intermediate zone groundwater. The approach to addressing groundwater during the CMS is to:

- Identify sources in areas of groundwater impact that need to be controlled to prevent cross-media transfer to groundwater (e.g., soil to groundwater);
- Develop and evaluate alternatives to control any continuing releases of contaminants of concern (COCs) to groundwater from identified source areas; and
- Develop and evaluate alternatives to reduce levels of COCs in groundwater and reduce potential migration of contaminated groundwater to or across the shoreline/property boundary to the extent practicable.

As noted, the CMS will address continuing discharges of groundwater but will not address impacts already present offshore. The CMS will also evaluate exposure control measures (e.g., institutional

and engineering controls). These measures will be evaluated relative to their ability to control exposure in the short-term, while other measures work towards the reduction of contaminant levels and extent over time.

2.0 DESCRIPTION OF CURRENT SITUATION

2.1 SITE SETTING AND USE

The TPA Property is located in Baltimore County, Maryland within the southeastern corner of the Baltimore metropolitan area, and approximately nine miles from downtown. The property encompasses approximately 3,100 acres of land located on a peninsula situated on the Patapsco River near its confluence with the Chesapeake Bay, and physically positioned in the mouth of the heavily industrialized and urbanized Baltimore Harbor / Patapsco River region. **Figure 1** shows the location and boundaries of the Tradepoint Atlantic property.

From the late 1800s until 2012, the property was used for the production and manufacturing of steel. Iron and steel production operations and processes at the TPA Property included raw material handling, coke production, sinter production, iron production, steel production, and semi-finished and finished product preparation. In 1970, Sparrows Point was the largest steel facility in the United States, producing hot and cold rolled sheets, coated materials, pipes, plates, and rod and wire. The steelmaking operations at the facility ceased in fall 2012, and the steel mill has been demolished. Current plans for the TPA Property include redevelopment over the next several years. Some portions of the TPA Property have already undergone remediation and/or redevelopment.

The CPA (the Site) is a man-made peninsula in the southwestern portion of the TPA Property, includes Parcels B10, B11, B12, and B18, and consists of approximately 344.8 acres. **Figure 2** shows the location and boundaries of the CPA. The CPA was the location of the former coking operations from the 1940's to the early 1980's. Prior to that time, the CPA did not exist; slag (a byproduct of iron- and steel-making) has been used as an on-site fill material since operations began at the Sparrows Point facility. Historic aerial photographs show the progression of filling and expansion of operations in the CPA beginning in the 1938 aerial and continuing to the present CPA configuration (as shown in a 1982 photograph). The navigation charts show the depth of the water surrounding the CPA to be roughly 15 to 20 feet. Boring logs show the thickness of the slag fill in the CPA to be 20 to 70 feet.

Parcel B10 (and the southern portion of Parcel B18) included the former coke oven batteries, tar holders, benzol plant, and ancillary facilities including coal handling and storage, fuel oil storage, maintenance shops and service buildings. Parcel B11 was used for slag processing and metals reclamation activities and contains the DMCF on the western portion. The western portion of Parcel B12 is the former CPLF that received a variety of non-hazardous waste. Parcel B18 is located just north of the COA. In addition to some coke oven processes within the southern portion of Parcel B18, numerous tar storage tanks and oil tanks were located throughout Parcel B18, including the two large aboveground storage tanks (ASTs) in the No. 10 Tank Area.

2.1.1 Land Use and Surface Features

The Site is currently zoned Manufacturing Heavy-Industrial Major (MH-IM) and current uses on the Site include recovery of scrap metal, material reclamation and processing of slag. There is currently no groundwater use within the CPA.

2.1.2 Regional Geology

The TPA Property is located within the Atlantic Coastal Plain Physiographic Province. This province is characterized by a relatively thick wedge of alternating layers of sand, gravel, silt, and clay sediments. Near Baltimore, these unconsolidated sediments are primarily of Cretaceous age, but at Sparrows Point are overlain by up to 125 feet of younger Pleistocene sediments. These stratified deposits comprising the Atlantic Coastal Plain form an interbedded sequence of aquifers and confining beds in a thickening wedge to the southeast. The western boundary of the Coastal Plain is referred to as the Fall Line, which separates the Coastal Plain from the Piedmont Plateau Province. The Fall Line runs from northeast to southwest along the western boundary of the Chesapeake Bay, passing through Elkton (MD), Havre de Grace (MD), Baltimore City (MD), and Laurel (MD). The eastern boundary of the Coastal Plain is the offshore Continental Shelf. Within the Atlantic Coastal Plain, the lithology, permeability, and structure of the sediments define the geologic setting and provide the framework for the groundwater-flow system. In general, coarse-grained sandy and gravelly layers capable of yielding water form aquifers, while fine-grained silts and clays impede groundwater flow and form confining units.

Depth to bedrock is approximately 700 feet within the TPA Property.

2.1.3 Site Geology/Hydrogeology

2.1.3.1 Stratigraphy

Stratigraphy at the site from deepest to shallowest begins with Precambrian-aged crystalline basement rocks that are unconformably overlain by Cretaceous-aged Potomac Group units; including the Patuxent Formation (oldest), Arundel Formation, and Patapsco Formation (youngest). Pleistocene sediments of the Talbot Formation unconformably overlie the Cretaceous sediments. The thickness of the Atlantic Coastal Plain sediments vary across the site. At this site, the shallow, intermediate, and deep aquifers comprise sediments approximately 220 to 270 feet thick, and are underlain by the Arundel Formation. In the Baltimore area, the Arundel formation is a dense, plastic clay with thin lenses of silt that functions as an aquitard, completely confining the Patuxent Formation and subsequent aquifers beneath.

Land reclamation and fill placement at the site has significantly altered the original extent of the Sparrows Point peninsula. In general, stream channels and estuaries that originally extended into the peninsula were filled; the southern shoreline of the peninsula was expanded southward into the Patapsco River; and fill was used to create level grades. Fill deposits are thickest in historic stream channels and estuaries (up to 40 feet), and in the two landfill areas, including Greys Landfill and

CPLF (up to 70 feet). Fill deposits consist primarily of iron- and steel-making slag; these man-made deposits are called the Slag-Fill Unit, which is the uppermost stratigraphic unit at the site. This unit is variable in composition, characterized by loose, non-plastic, and well-graded silty to sandy gravels. In many areas, the slag is cementitious, requiring a hammer for excavation.

The CPA (the Site) is a man-made peninsula in the southwestern portion of the TPA Property, with the subsurface geology consisting entirely of slag fill materials. Boring logs show the thickness of the slag fill in the CPA to be 20 to 30 feet. Current ground surface elevation is approximately 10 feet above mean sea level (AMSL).

2.1.3.2 Hydrogeology

The hydrogeology of the TPA property is characterized by three distinct hydrogeologic zones; shallow, intermediate, and deep.

The shallow hydrogeologic zone occurs primarily within the Slag-Fill Unit and behaves as an unconfined aquifer. In some areas the Slag-Fill Unit directly overlies coarse grained beds of the Talbot Formation, forming a single, connected, and unconfined groundwater flow system. The shallow zone typically has transmissivity values of 1,000-10,000 g/d/ft (Fig. 10 – CPA CMS), but areas of lower transmissivity (<1,000 g/d/ft) are also present within the northwestern portion of the larger Sparrows Point property. Wells designated as shallow are typically screened within the Slag-Fill Unit, with bottom-of-screen elevations generally ranging from +5 to -20 feet AMSL. In much of the site, the Slag-Fill unit is underlain by finer-grained silts and clays that comprise the Talbot Clay Aquitard. In these areas, groundwater flow in the Slag Fill Unit is separated from groundwater flow in any underlying coarse-grained layers. The thickness and distribution of this semi-confining layer is variable across the site, significantly impacting groundwater flow and connectivity between shallow and intermediate zone aquifers. Based on boring log classifications, descriptions of the clay semi-confining layer range from ‘clay – firm’ to ‘clayey silt’. When this layer has higher coarse-grained silt and sand content, it likely allows some degree of infiltration into the intermediate zone. Thus, the clay layer is defined as semi-confining due to this variability.

The intermediate hydrogeologic zone includes the unconfined to partially confined groundwater in the Upper Talbot unit. The total thickness of Talbot deposits in the Sparrows Point Area is approximately 125 feet. The presence of clay and silt layers within the intermediate hydrogeologic zone likely retard the vertical recharge of groundwater from upper fill material and cause lower transmissivity values of <1,000 g/d/ft across most of the site (Fig 11 – CPA CMS). Discrete areas of higher transmissivity (1,000-10,000 g/d/ft) are present within the intermediate zone and likely indicate areas of paleo-channel erosion and subsequent backfill. Wells designated as intermediate have bottom-of-screen elevations generally ranging from -20 to -50 feet AMSL.

The deep hydrogeologic zone includes the confined groundwater in the Lower Talbot or Upper Patapsco Sand unit. At Sparrows Point the Patapsco Formation has been interpreted to have a thickness of up to 255 feet. Wells designated as deep have bottom-of-screen elevations ranging

from -50 to -141 feet AMSL. Hydrogeologic zones at greater depth are known to exist based on a review of regional geology; however, these deeper units are isolated from the upper three units by the Arundel Clay and impacts have not been identified from former operations.

Aquifers of the Talbot Formation are susceptible to salt-water intrusion and elevated chloride concentrations. This is a significant factor limiting the development of water supplies in the Talbot Formation and is prevalent within water supply wells proximal to the Patapsco River and its estuaries. Groundwater recharge to the Talbot Formation occurs primarily through the percolation of local precipitation to the water table, with an estimated 10 inches of rainwater per year recharging the surficial shallow water table aquifer.

2.1.3.3 Groundwater Potentiometric Surface

As part of the *Groundwater Study Report* (CH2MHill, 2001), shallow groundwater appeared to flow from the northeast (main Sparrows Point peninsula area) to the Coke Point peninsula. A groundwater divide was then evident, with shallow groundwater to the west going towards the west and north, and shallow groundwater to the east going to the southeast and south. A synoptic groundwater gauging round was conducted in February 2024 for both shallow and intermediate groundwater within the Coke Point Peninsula. Refer to **Figure 3** for the shallow groundwater contours and to **Figure 4** for the intermediate groundwater contours. In the shallow groundwater zone, the groundwater flows from the main Sparrows Point area, and then flows radially towards surrounding shorelines (similar to the 2001 observations). Flow direction within the intermediate zone appears to behave similarly to the overlying shallow zone across most of the property. However, the Graving Dock has a significant influence on groundwater flow in the Coke Point Peninsula, with the pumping inducing migration of impacted groundwater from Cell 6 both downward from the shallow to intermediate groundwater zones, and northward towards the Graving Dock. Approximately 1,080,000 gallons per day (750 gallons per minute) of water is pumped from the Graving Dock underdrain system and then treated and discharged to Patapsco River in accordance with the National Pollutant Discharge Elimination System (NPDES) Permit. The influence of the Graving Dock pumping is observable over 2,000 feet away in the intermediate zone, where flow in the Coke Point Area is shifted to the northwest, while flow in the shallow zone south of Cell 6 is to the southwest. The influence on the shallow zone of groundwater is less apparent. This condition is attributed to; location of the pumps at depths that correspond with the stratigraphy of the intermediate unit, decreased recharge from the Patapsco River, and the partially confined condition of the intermediate zone in this area. The spread of a cone of depression from a pumping center under partially confined conditions occurs more quickly than under unconfined conditions.

In addition, a tidal study was conducted throughout the entire Sparrows Point peninsula. The study concluded that the inland extent of tidal influence ranged from approximately 135 feet (eastern portion of Parcel B10 along the Turning Basin) to 340 feet (western portion of Parcel B10 along the Patapsco River). An average inland extent of tidal influence of 285 feet was projected.

2.1.3.4 Groundwater Quality in the Slag Fill Unit

As discussed in **Section 2.1.3**, the shallow groundwater aquifer lies within the slag-fill unit. As part of the *Sitewide Groundwater Study* (ARM, 2017), an evaluation was conducted of sitewide groundwater quality. The study included an evaluation of boring logs and well construction logs constructed in the Slag Fill Unit, in order to determine and map the thickness of slag fill within the saturated zone. The conclusion presented that most of the locations where groundwater is present in slag fill are located beyond the historical 1916 shoreline (**Figure 5**).

In addition, historic and current groundwater quality data was reviewed, particularly with respect to pH, total dissolved solids (TDS), and chloride. Groundwater associated with slag fill can exhibit extremely basic pH concentrations (pH greater than 10) rendering it unusable for almost any purpose without treatment. pH values obtained from sampling events from each well or piezometer were contoured to create maps (shallow and intermediate) showing pH contours and delineating areas of the TPA Property where the pH exceeds 10 (**Figures 6 and 7**). As expected, the pH values in the shallow zone are indicative of the groundwater being present in slag fill within a large portion of the CPA Peninsula (i.e., pH greater than 10). The general pH concentration in the intermediate zone is within the acceptable range for groundwater use (between 4 and 10).

Saltwater intrusion has been an issue at the TPA Property due to historical pumping for industrial water use. As part of the *Groundwater Study Report* (CH2M Hill, 2001), TDS and chloride concentrations for shallow and intermediate zone wells across the TPA Property were collected. In addition, specific conductance data were collected during the sampling of each well across the TPA Property as part of the Phase II investigations. In the *Sitewide Groundwater Study* (ARM, 2017), the specific conductivity data was converted to equivalent TDS values (1000 micro siemens per centimeter[uS/cm] = 534 milligrams per liter [mg/L] TDS). Refer to **Figures 8** and **9** for TDS concentrations in the shallow and intermediate groundwater aquifers.

In addition, the transmissivity of the shallow and intermediate aquifer was calculated based on the conductivity values and the aquifer thicknesses, respectively. Refer to **Figures 10** and **11** for transmissivity rates in the shallow and intermediate groundwater aquifers.

Locations with elevated TDS (above 1,500 mg/L), low transmissivity (below 1,000 gallons/day/foot), or elevated pH (above 10) in the shallow groundwater are considered to not contain usable groundwater. As part of the *Sitewide Groundwater Study* (ARM, 2017), the pH, TDS, and transmissivity data for the shallow zone were overlaid, presenting areas that exhibit no potential for future groundwater use and are shown in **Figure 12**.

Cobalt, iron, manganese, and vanadium are common in shallow and intermediate groundwater at Sparrows Point. For the groundwater samples with metals analysis included in this CPA CMS, manganese was detected in 88% of groundwater samples, iron was detected in 71% of groundwater samples, vanadium was detected in 63% of groundwater samples, and cobalt was detected in 20% of groundwater samples (note: a portion of the monitoring wells within the CPA have been sampled for volatile organic compounds (VOCs) / semivolatile organic compounds (SVOCs) only,

with metals analysis only occurring at approximately 25% of the groundwater sample locations). USEPA has not set maximum contaminant levels (MCLs) for cobalt, iron, manganese, or vanadium; however, there are Project Action Levels (PALs) established as screening levels for the facility. Secondary maximum contaminant levels (SMCLs) recommended in the National Secondary Drinking Water Regulations are not health-based but rather are set for aesthetic reasons and are not enforceable by USEPA but are intended as guides for the States. The SMCL for iron is 0.3 mg/L (site-specific PAL is 14 mg/L) and the SMCL for manganese is 0.05 mg/L (site-specific PAL is 0.43 mg/L). High levels of these contaminants can result in discolored water, stained plumbing fixtures, and an unpleasant metallic taste to the water. There are no SMCLs for cobalt or vanadium.

As per USEPA's *Role of Background in the CERCLA Cleanup Program* (USEPA, 2002), USEPA defines "background" as constituents or locations that are not influenced by the releases from a site. For the purposes of this CPA CMS, the slag fill is considered a background condition unrelated to releases from the Resource Conservation and Recovery Act (RCRA) regulated units or Solid Waste Management Units (SWMUs). While slag related COPCs (cobalt, iron, manganese, and vanadium) will be evaluated as COPCs, impacts related to slag COPCs and non-slag COPCs will be differentiated in the discussion of the nature and extent of identified groundwater impacts. There are multiple academic articles where cobalt, iron, manganese, and vanadium were identified as components of slag:

United States Environmental Protection Agency, 2013. Final Decision/Response to Comments, Republic Steel, Canton Ohio. March.

- "Due to the fact that the site has been historically built upon non-native fill material known as "mill fill"…the mill fill at the site is steel slag…the concentrations of metals within the mill fill needed to be established as a baseline by which concentrations from actual releases could be compared." USEPA used secondary soil screening criteria to evaluate samples that contained mill fill for arsenic, iron, and manganese.

Bayless et al. 1998. Hydrology and Geochemistry of a Slag-Affected Aquifer and Chemical Characteristics of Slag Affected Ground Water. U.S. Geological Survey Water Resources Investigations Report 97-4198.

- "Trace elements having higher concentrations in water from slag-contact wells include aluminum and barium and less frequently chromium, cobalt, copper, cyanide, manganese, nickel, and vanadium."

- "The range of chromium, cobalt, copper, cyanide, manganese, nickel, and vanadium concentrations in slag-contact groundwater, however, is more variable than in slag-affected or background groundwater; usually the maximum concentration is several times higher in water from slag-contact wells."

Kitamura et al, 2007. Behavior of Cobalt in Iron- and Steel-making Processes. ISIJ International, Vol. 47 (2007), No. 12, pp. 1818-1822.

- "According to a study on the cobalt content in commercial steel bars, it was found to vary widely from 10 to 140 ppm, and the average value was 66 ppm."

Streiffer and Thiboldeaux, 2015. Charter Steel Slag Health Assessment. Wisconsin Department of Health Services. June 2015.

- "Both EAF and ladle slags are primarily composed of "oxides of calcium, iron, silicon, aluminum, magnesium, and manganese…" ".
- "The above exposure scenarios indicate five chemical constituents of Charter Steel slags that may exceed health risk levels: antimony, iron, manganese, thallium, and vanadium."

Wojciech et al, 2015. Environmental and Geotechnical Assessment of the Steel Slags as a Material for Road Structure. Molecular Diversity Preservation International (MDPI) (www.mdpi.com/journal/materials) July 30, 2015.

- "Some steel slags contain higher amounts of toxic metals, such as chromium, nickel, manganese, vanadium and molybdenum…"
- "Other elements that may pose a potential risk of soil degradation occur in samples of slag at levels exceeding the limit values for soil category A: cobalt (Co) and nickel (Ni)…"

Preliminary Site Close Out Report, MIDCO II Superfund Site, Gary, Indiana. September 2020. (https://semspub.epa.gov/work/05/960613.pdf)

- "The area further north of the Site towards Lake Michigan is occupied by steel-related industry. Much of the land between the Site and Lake Michigan has been in-filled with iron-ore slag material, with areas along the lake having up to 40 feet of buried slag."
- "An updated list of site-specific background constituents was finalized in a statistical analysis completed in 2012. The purpose of this analysis was to identify background-related inorganic constituents detected in Site groundwater during five annual monitoring events (2005 to 2011). Based on this document and Explanation of Significant Differences (ESD) #4, the following constituents were excluded from well-by-well cumulative risk calculations at the MIDCO II Site: arsenic, barium, cadmium, chromium, manganese, mercury, thallium, vanadium, and iron. ESD #4 also added 1,4-dioxane as a contaminant of concern at the Site."

2.1.4 Groundwater Use

Historically, the shallow and intermediate groundwater zones have not been used for agricultural or drinking water purposes. The Patapsco aquifer was used as a source of groundwater prior to 1900 and during the early part of the 20th century. Because the Patapsco aquifer widely subcrops beneath the brackish Patapsco River, elevated chloride concentrations became a major problem in areas near the Patapsco River estuary. By 1945, almost all water production from the Patapsco had ended due to excessive chloride near the Harbor, Canton, and Dundalk areas. The Sparrows Point plant was the only major user of the Patapsco aquifer in 1945. Water production totaled about 3

million gallons per day; however, by the late 1940s and 1950s, many of the Sparrows Point wells were affected by elevated levels of chlorides and were abandoned. As of 1985, there was no major use of the Patapsco aquifer in the immediate vicinity of the Patapsco River estuary.

There is no current ongoing usage of groundwater beneath the facility, but there is groundwater extraction for structural maintenance purposes (minimize buoyancy forces on the structure) at the graving dock, located along the western shore and north of the CPA. The Sparrows Point Shipyard (Shipyard, refer to **Figure 2**) contains a "graving dock," used for the repair or scrapping of ships under dry conditions. Ships enter the graving dock when it is filled with water, via the Patapsco River, and then the graving dock is sealed, and the water is removed. A central feature of the graving dock is the underdrain pumping system. The underdrain pumping system collects groundwater and pumps the water to the Patapsco River. The Shipyard's pumping system causes groundwater from the northern regions of the CPA to flow towards the extraction point at the graving dock. The water from the underdrain pumps is discharged to the Patapsco River following treatment pursuant to a National Pollutant Discharge Elimination System discharge permit issued by the MDE.

Groundwater is monitored for various purposes on a regular frequency at the Site. Across the CPA, there are over 150 monitoring wells constructed into the shallow aquifer and over 50 into the intermediate aquifer. There are few monitoring wells constructed into the deeper aquifer.

2.2 Summary of Previous Investigations

There have been multiple investigations at the CPA. Refer to **Figure 13** for the locations of the Interim Measure (IM) remediation cells. Some of the main reports include:

- *Description of Current Conditions* (Rust Environment and Infrastructure, January 1998): Describes current conditions of SWMUs and Areas of Concern (AOCs).
- *Groundwater Study Report* (CH2M Hill, December 2001): Geologic and groundwater investigation across the entire Sparrows Point property.
- *Site-Wide Investigation Release Site Characterization Study* (CH2MHill, 2002): Documented benzene and naphthalene impacts in the shallow and intermediate groundwater in the CPA.
- *Site Wide Investigation – Report of Nature and Extent of Releases to Groundwater from the Special Study Areas* (URS, 2005): Additional work to define the extent of VOCs and SVOCs (predominantly benzene and naphthalene) in the CPA.
- *Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point* (EA, 2009): Identified sources of contamination, primarily benzene, ethylbenzene, toluene, and naphthalene, in the CPA.
- *Phase I Environmental Site Assessment, Former RG Steel Facility* (Weaver, 2014): Identified Recognized Environmental Condition (RECs), SWMUs, and AOCs.

- *Coke Point Pre-Design Investigation Summary Report, Former Coke Oven Area* (Key Environmental, 2015): Used analytical results from groundwater monitoring wells screened in the shallow aquifer to further delineate source areas of the most prevalent organic constituents (benzene, toluene, ethylbenzene, xylenes, and naphthalene).
- *Sitewide Groundwater Study Report* (ARM, 2017): provides a summary of groundwater conditions, including groundwater usability and quality and potential groundwater discharges.
- *Former Coke Oven Area Interim Measures Supplemental Investigation Report* (ARM, 2019b): Groundwater sampling and pore water sampling, focused on Cells 2, 3, and 5 areas.
- *No. 10 Tank Area Investigation Report* (ARM, 2020a): Included installation of 79 supplemental soil borings, six temporary groundwater points, and three permanent monitoring wells, as well as sampling of all available groundwater locations, to determine the presence / absence of NAPL within the No. 10 Tank Area soil, and to characterize the dissolved-phase petroleum hydrocarbons associated with previously identified NAPL in the No. 10 Tank Area.
- *Phase II Investigation Report, Area B: Parcel B18* (ARM, 2020b): A total of 127 soil samples (from 73 soil borings), 10 groundwater samples, and 4 sub slab soil gas samples were collected in 2016 and 2017.
- *Phase II Investigation Report, Area B: Parcel B11* (ARM, 2020c): A total of 74 soil samples (from 33 soil borings) were collected in 2020. Groundwater was not included in the Phase II, as the COA and CPLF are both part of ongoing groundwater monitoring programs.
- *Coke Point Area CMS Investigation Report* (ARM, 2021a): The objective of this investigation was to further delineate the extent of constituents in groundwater in select locations, and to further characterize known and potential source areas, based on previously identified data gaps. Field work included installation of 24 additional groundwater monitoring wells (10 shallow and 14 intermediate) to collect additional data near known zones of contamination as well as in supplemental areas. Groundwater samples were collected from the 24 new wells and from 39 existing wells.
- *Former Coke Oven Area Northeast Delineation Letter Report* (ARM, 2021c): Eight shallow zone monitoring wells and two intermediate zone monitoring wells were installed and sampled to delineate groundwater impacts in the vicinity of three shallow groundwater zone locations (CO05-PZM006, CO08-PZM005, and CO212-MWS) and one intermediate zone location (CO08-PZM036).
- *CPA Combined Delineation Interim Report (Revision 1)* (ARM, 2023b): investigation into NAPL extent and recoverability in several locations throughout Parcels B10 and B18, as well as a soil boring investigation on Parcel B18 related to a potential cutoff wall.

- *Coke Point Container Terminal Phase II Investigation Report* (ARM, January 2024): Phase II included 24 soil borings and 70 soil samples from within the Container Terminal footprint (encompassing portions of Parcels B10, B11, B12, and B18). Based on the results, several hot spot excavations and NAPL delineation activities were recommended.
- *Coke Point Container Terminal Interim Status Updates* (ARM, 2024a): Shallow soil hotspot excavation of approximately 20 cubic yards (CY) at CT-007-SB due to VOC and SVOC exceedances. Test pits advanced for NAPL delineation.
- *Cell 4 DNAPL Excavation Report* (ARM, 2024d): Summarizes Cell 4 excavation activities undertaken between January and June 2023. The excavation was advanced to approximately 22 ft bgs, and 18,165 tons of impacted material (approximately 336,000 pounds [lbs] of naphthalene) were removed and disposed of at Greys Landfill.
- *Coke Point Container Terminal Interim Status Updates* (ARM, 2024e and 2024g): Ongoing NAPL delineation, with test pits monitored for NAPL, with NAPL removal as needed.
- *Cell 6 Hotspot Removal / Treatment Final Report* (ARM, 2024i): multiple rounds of excavation / treatment from three areas of residual benzene contaminated material (soil and NAPL on groundwater) located within the Cell 6 multi-phase extraction (MPE) system recovery field. The goal to maximize and expedite source mass removal, resulted in a total of approximately 628 CY material treated.
- *CPA Delineation Final Report* (ARM, 2024j): includes results from additional NAPL delineation via test pits, NAPL removal via pumping and absorbents, and installation / sampling of additional shallow and intermediate monitoring wells.
- *Cell 4 Semi-Annual Groundwater Sampling Report, 2nd and 3rd Quarter 2024* (ARM, 2024k): Quarterly groundwater gauging and sampling to monitor downgradient groundwater impacts following the Cell 4 source excavation activities.
- *Parcel B18 Lead Excavation Completion Report, Revision 2* (ARM, 2023a); *Parcel B18 Lead Excavation Letter* (ARM, 2024g); *Parcel B18 Lead Excavation Stockpile Letter* (ARM, 2024l); *Parcel B18 Lead Excavation Stockpile Treatment Letter* (ARM, 2024o): Summarizes lead excavation activities (conducted in stages) in the vicinity of B18-043-SB, The final extent of the B18 lead excavation area is approximately 1,618 square feet, with a maximum depth of 8 feet bgs and a total excavated volume of approximately 412 CY. Portions of the excavated soil were treated with TerraBond® due to the elevated TCLP Lead concentrations prior to disposal at Greys Landfill.
- *B10 West Phase II Investigation Report* (ARM, 2024m): May and August 2024 Phase II field work included 22 soil borings and 53 soil samples from within the western portion of Parcel B10).
- *Coke Point Landfill Semi-Annual Groundwater Monitoring Report Fall 2024* (ARM, 2025a): Provides results from the Fall 2024 semi-annual groundwater monitoring

conducted at the CPLF. Groundwater samples are analyzed for VOCs, metals and general chemistry parameters. Samples from 13 groundwater monitoring wells are also analyzed for SVOCs based on recommendations from a previous compliance report for CPLF published in 2011.

- *Coke Oven Area Annual Interim Measures Progress Report 2024* (ARM, 2025d): Presents operational information for the groundwater remediation IM systems and a review of groundwater monitoring results collected from monitoring wells associated with the respective remediation systems through 2024.

3.0 CORRECTIVE ACTION OBJECTIVES

USEPA prepared a groundwater use determination memorandum dated April 13, 2018 (**Appendix A**) in which it indicated that the USEPA expects corrective actions/final remedies to return usable groundwater to its maximum beneficial use, where practicable, within a reasonable timeframe. For groundwater in the shallow and intermediate aquifers at Sparrows Point, the USEPA determined that drinking water use can be excluded from consideration when developing groundwater cleanup levels based on excess TDS, both low and high pH, the occurrence of the groundwater in non-natural slag fill which contributes cobalt, iron, manganese, and vanadium, and saltwater intrusion resulting in elevated chloride. The memorandum indicated that the maximum beneficial use of shallow and intermediate groundwater at Sparrows Point is industrial, commercial or dewatering and that groundwater cleanup levels should be developed based on State surface water quality criteria. The memorandum also indicated that more stringent groundwater cleanup levels may be appropriate in specific areas of the Sparrows Point Site, based on potential exposures or pathways not associated with groundwater use (e.g., vapor intrusion or direct contact during excavation).

3.1 CORRECTIVE ACTION OBJECTIVES

The Corrective Action Objectives (CAOs) for the CPA groundwater are defined as follows:

1) Control any releases of COPCs to the groundwater to the extent practicable;
2) Control human exposure to the COPCs remaining in the groundwater;
3) Ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors or adjacent surface water and pore water quality; and
4) Achieve cleanup levels for groundwater based on its maximum beneficial use, to the extent practicable.

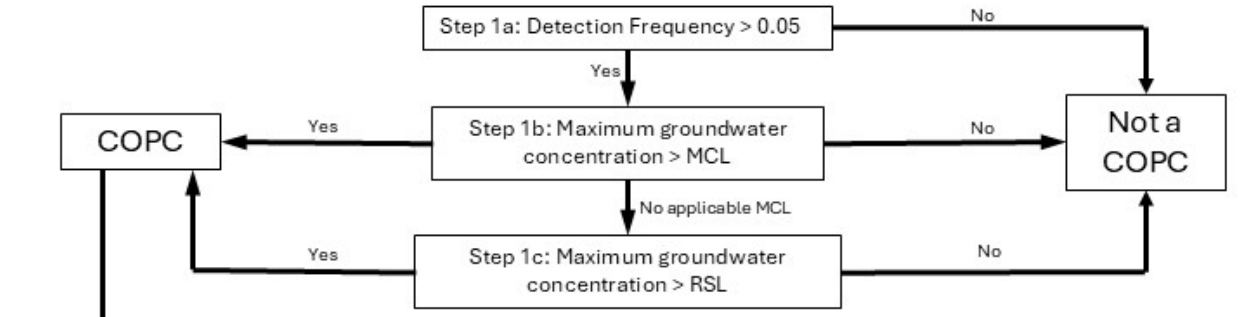
3.2 IDENTIFICATION OF CONSTITUENTS OF POTENTIAL CONCERN

The groundwater data set for the CMS COPC screening included the most recent sampling results for each monitoring well within the CPA, through August 2023 for regularly conducted (quarterly) sampling locations. Refer to **Figure 14** for the locations and IDs for all sampled monitoring wells, and to **Figure 15** for the location and IDs for all shoreline monitoring wells. Monitoring well construction details for all wells included in the groundwater database is included in **Appendix B-1**. This table also includes groundwater zone (perched, shallow, intermediate), current well status (existing, lost / destroyed, abandoned), and whether or not it is included within the shoreline groundwater monitoring network. **Appendix B-1** also includes the date for the most recent sampling event by parameter for each monitoring wells, and **Appendix B-2** includes dates and parameters (by monitoring well) for all sampling rounds included in the groundwater database (**E-Attachment #1A and 1B**).

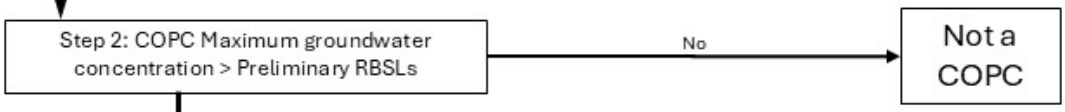
The COPC groundwater data set was screened to identify COPCs (see **Exhibit 1, below,** and **Appendix C**).

Step 1: GW COPC Identification:

Screen groundwater COPC database based on the following:



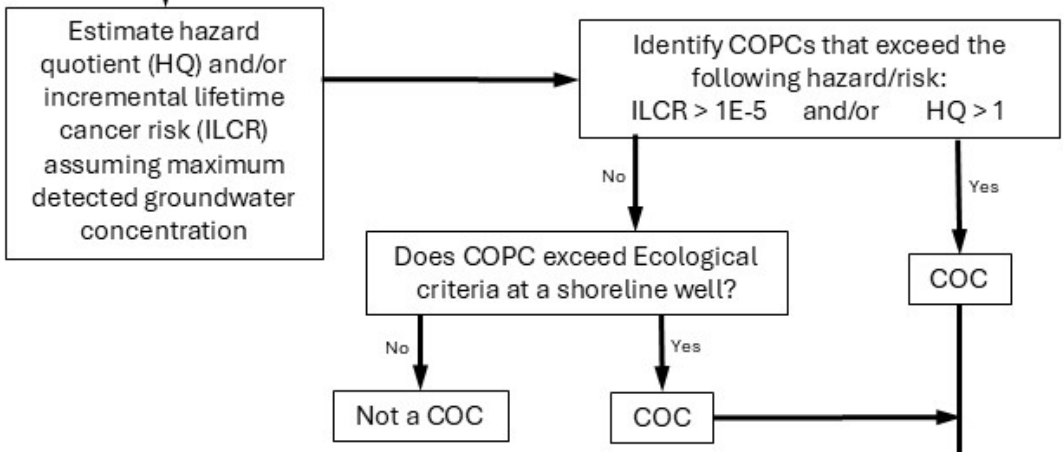
Step 2: Define Site-specific COPCs



Yes

Step 3: GW COC Identification

Screen COPC list based on the following:



Step 4: Calculate Final Remedial Goals

Determine Final RGs by reducing COC concentrations to a level that achieves the following hazard/risk (where IW = industrial worker, RR = resource restoration, UW = utility worker):

- Single chemical ILCR < 1E-5
- Cumulative ILCR for IW+RR and IW+UW receptor scenarios < 1E-4
- Single chemical HQ < 1
- Cumulative HI by target organ for IW+RR and IW+UW receptor scenarios < 1

AND

Meets applicable Ecological standards

The screening process was conducted in a step-wise fashion and COPCs were identified if they met the following criteria:

- Step 1a: The compound was detected in groundwater at a frequency of more than 5%;
- Step 1b: The maximum detection exceeded the Maximum Contaminant Level (MCL) for drinking water;
- Step 1c: If there is no applicable MCL, the maximum detection exceeds the USEPA Regional Screening Level (RSL) for tap water, assuming a Target Risk (TR) of 10^{-6} and Target Hazard Quotient (THQ) of 0.1.

Steps 2 through 4 in the flow chart are discussed in **Section 3.6.** Maximum detected concentrations that exceed the RSL but not the MCL were not identified as a COPC. For metals, if both total and dissolved concentrations are available, then the dissolved concentrations were utilized in the COPC screening. Based on this analysis, a total of 41 parameters were identified as COPCs. This includes eight VOCs, 22 SVOCs, nine inorganic parameters, cyanide, and polychlorinated biphenyl (PCBs) (total).

VOCs	SVOCs	Metals	Other
4-Chloroaniline	1,1-Biphenyl	Antimony	Cyanide
Benzaldehyde	2,4-Dimethylphenol	Arsenic	PCBs
Benzene	2,6-Dinitrotoluene	Chromium VI	
Ethylbenzene	2-Butanone (MEK)	Cobalt	
Methylene Chloride	2-Methylnaphthalene	Iron	
Toluene	2-Methylphenol	Manganese	
Xylenes	Acenaphthene	Nickel	
1,4-Dioxane	Benz[a]anthracene	Thallium	
	Benzo[a]pyrene	Vanadium	
	Benzo[b]fluoranthene		
	Benzo[k]fluoranthene		
	bis(2-Ethylhexyl)phthalate		
	Chrysene		
	Dibenz[a,h]anthracene		
	Fluoranthene		
	Fluorene		
	Indeno[1,2,3-c,d]pyrene		
	Naphthalene		
	Pentachlorophenol		
	Pyrene		
	Pyridine		
	Styrene		

For cyanide, initial groundwater sampling in several areas indicated elevated levels of total cyanide in shallow groundwater samples. However, cleanup levels (including the MCL, the Vapor

Intrusion Screening Level [VISL], and ambient water quality criteria [AWQC]) are based on free or available cyanide. Therefore, a supplemental cyanide investigation was conducted (ARM, 2017), with samples collected from 13 locations with high total cyanide across the entire TPA Property. Based on the results, a very small fraction of the total cyanide in groundwater is present in the form of available cyanide. While all available cyanide data will be compared to the calculated groundwater screening levels, additional discussion on free or available cyanide vs total cyanide will be included in **Section 3.6.1**.

3.3 Potential Receptors and Exposure Pathways

3.3.1 Human Health – Non-Residential

The TPA Property is zoned Industrial, and the Site use is expected to be limited to non-residential uses in the future. Therefore, no residential receptor scenarios need to be considered. Currently, groundwater is extracted only for construction purposes, remedial purposes, or dewatering of the Graving Dock. There are no other groundwater uses onsite, and there is currently no direct exposure to groundwater for human receptors, except during subsurface construction activities for site redevelopment. The current and reasonably anticipated on-site human health receptor exposure pathways considered are therefore:

- On-Site Industrial Workers: may have a potential to be exposed to vapors through vapor intrusion to indoor air; and
- On-Site Utility Workers: may have a potential for short-term exposure to shallow groundwater during ground intrusive work.

Potential off-site exposure pathways are based on the potential migration of impacted groundwater with subsequent impact to surface water and sediments. The offshore areas near Sparrows Point (and particularly offshore from the CPA) are not considered a high use area for swimming or other water activities. Potential exposure of boaters (including kayakers or canoers) bypassing the TPA Property are not readily anticipated based on the nature of the Patapsco River and are expected to be brief if they do occur; therefore, this potential exposure pathway is anticipated to pose insignificant exposures. The Patapsco River does support the use of recreational fishing and crabbing; therefore, exposure to COPCs through the consumption of fish and crabs impacted by migration of impacted groundwater from the CPA to surface water and sediments in the River is considered an unlikely but potentially complete pathway.

The following off-site human health receptor scenario is included:

- Off-Site Recreational User: may have potential for exposure due to ingestion of fish and/or crab impacted by the migration of impacted groundwater to surface water and/or sediments.

3.3.2 Ecological Receptors

Several offshore investigations focused on the collection of sediment, pore water, and/or surface water samples to assess the conditions of the offshore environment and to support delineation of

offshore impacts. These studies were reviewed to evaluate whether current groundwater discharges within the CPA groundwater CMS contain COPCs at concentrations that may contribute to any identified offshore issues. Refer to **Appendix D** for figures and tables of recent sediment, surface water, and pore water sampling.

3.3.2.1 Sediment

As part of the *Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area* (ARM, October 12, 2018), groundwater results were screened against the surface water impact screening criteria (10x the Final Chronic Values [FCV] / Secondary Chronic Values [SCV]) to determine if there was a potential for impact to sediment quality in the Patapsco River. The constituents exhibiting concentrations exceeding 10x the FCV or SCV values in shoreline groundwater are limited to VOCs and SVOCs, including benzene, toluene, ethylbenzene, xylenes and naphthalene, and were limited to three localized areas within the CPA (refer to **Appendix D-1** for figures showing the groundwater results) with a potential for impacts to sediment quality:

- Area 1 is located on the northwestern shore of the CPA adjacent to the former coal dock (Coal Pier Channel), and includes wells CO27-PZM046, CO36-PZM043, and CO28-PZM048 (Cell 2 area).
- Area 2 is located along the north shore of the cove area on the western shoreline of the CPA, around well CO30-PZM015 (Cell 3 area).
- Area 3 is located on the eastern shoreline of the CPA and includes wells CO26-PZM007 and CO58-PZM001 (Cell 5 area).

The toxic unit (TU) approach was utilized to evaluate the toxicity of sediment for different organisms. Sediment TUs were defined as the ratio of the pore water concentration of a contaminant and the Toxicity Reference Value (TRV) for *that contaminant.* The total risk of the sediment to aquatic life was assessed by summing the TUs for all of the contaminants detected in the sample, to obtain the total toxic unit (TTU). Metals and organic chemicals were considered separately. TTU values greater than 1 indicate a potential for adverse effects to benthic aquatic life. The three areas identified in the 10x FCV / SCV approach had TTU values ranging from 10.1 to 73.0. Outside these three areas, the maximum TTU value for groundwater was 2.78. As noted, pore water concentrations in shallow sediment would be expected to be significantly lower than groundwater concentrations due to attenuation associated with interaction with surface water and sorption to sediment due to high carbon content. Therefore, outside specific shoreline areas (as included in the above bullets), the 2018 groundwater quality shows no significant potential to cause narcosis effects to aquatic organisms through exposure to shallow offshore sediments.

The *Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area* (ARM, October 12, 2018) then evaluated parameters identified in available sediment data with those same parameters in groundwater (refer to **Appendix D-1** for a figure showing TTU values in sediment based on the 2009 EA sampling). At most locations, naphthalene was the only COC present in groundwater at TU values that exceeded the corresponding TU values in sediment.

Sediment samples were collected within the Turning Basin in April and May 2024 as part of the proposed dredging activities, with environmental testing conducted at seven locations within Dredge Unit areas DU26, DU27, and DU28. Refer to **Appendix D-1** for the Dredge Unit locations and for the specific locations of the sediment sample. Sediment samples collected from within Dredge Units DU26, DU27, and DU28 are offshore from Cell 5; the discrete sediment samples were collected from the -50 to -52 ft mean lower low water (MLLW) elevation (proposed final bottom of the channel is -50 ft MLLW) in conjunction with the dredging related sampling. A total of seven sediment samples were analyzed for VOCs, SVOCs, and polycyclic aromatic hydrocarbons (PAHs). Refer to **Appendix D-1, Table A1** for the analytical results from the 2024 collected sediment samples. The deep sediment samples (the -50 to -52 ft MLLW elevation) were compared to applicable ecological criteria, as this depth represents the shallow sediment conditions once the dredging is complete. Results were compared to the USEPA Region 4 Sediment Screening Values for Hazardous Waste Sites, Table 2A for Non-Narcotic Modes of Action (marine) and Table 2B for Narcotic Modes of Action (marine) (Ecological Risk Assessment Supplemental Guidance, March 2018) and the USEPA Region III Biological Assistance Technical Group (BTAG) Marine Screening Benchmarks (July 2006). There were no exceedances of the applicable ecological criteria in the deep sediment samples. In addition, naphthalene was not detected above the quantitation limit in any of the sediment samples from the -50 to -52 ft MLLW elevation.

Additional sediment sampling was conducted in 2025 (refer to **Appendix D-1** and **Table A2**), and is discussed in **Section 4.6**.

3.3.2.2 Surface Water

In May 2018, 39 surface water samples were collected from 13 locations offshore from the CPA as part of the *Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area* (ARM, 2018). Groundwater samples were also collected from the monitoring wells located in closest proximity to the surface water sampling locations. All surface water samples were analyzed for VOCs, cyanide, and PAHs.

Between March and July 2019, additional surface water sampling was conducted offshore of Cell 2, Cell 3, and Cell 5 (*Former Coke Oven Area Interim Measures Supplemental Investigation Report,* ARM, 2019b). Analytical methods varied (based on the main groundwater COCs within each Cell), with surface water samples from Cell 2 and Cell 3 analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and naphthalene, and surface water samples from Cell 5 analyzed for naphthalene only.

For the purpose of the CPA CMS, all surface water results have been tabulated and compared to applicable surface water screening levels for ecological receptors (this is discussed further in **Section 3.4.2**). Below is a hierarchy of the screening levels utilized. Surface water screening levels for marine or saltwater aquatic life, and for chronic exposure, were selected. If no marine or

saltwater screening level was available, then freshwater screening levels were utilized as a conservative option.

1. USEPA National Recommended Water Quality Criteria (NRWQCs) (USEPA 2014a) for ecological risk (Saltwater Aquatic Life Continuous Criterion Concentration).
2. Code of Maryland Regulations, 26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Salt Water – Chronic (updated May 2024).
3. USEPA Region 4 Ecological Risk Assessment Supplemental Guidance. Table 1a for Region 4 Surface Water Screening Levels for Hazardous Waste Sites, saltwater, chronic (March 2018).
4. NOAA Screening Quick Reference Tables (SQuiRTs), Marine Surface Water – Chronic (2008).
5. USEPA Region III BTAG Marine Screening Benchmarks (July 2006).
6. NOAA SQuiRTs, Fresh Surface Water – Chronic (2008).
7. USEPA Region III BTAG Freshwater Screening Benchmarks (July 2006).
8. USEPA, Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic Contaminants. Table 3-1 for Conventional and narcosis chronic toxicity values for marine water (October 2017).

Refer to **Appendix D-2** for a comparison of the 2018 and 2019 surface water sampling results with the applicable screening levels for ecological receptors. **Appendix D-2, Table A1** includes May 2018 surface water sampling results throughout the CPA; **Appendix D-2, Table A2** includes July 2019 surface water sampling results for Cell 2; **Appendix D-2, Table A3** includes March 2019 surface water sampling results for Cell 3; and **Appendix D-2, Table A4** includes July 2019 surface water sampling results for Cell 5. Sampling location figures are also included in **Appendix D-2**. There were exceedances at two locations in 2018: SW-08 (benzene, benzo[a]pyrene, benzo[g,h,i]perylene, and naphthalene) and SW-10 (benzo[a]pyrene, benzo[g,h,i]perylene, fluoranthene, indeno[1,2,3-c,d]pyrene, and pyrene). SW-08 is located within the Cell 3 cove, and SW-10 is located offshore from Cell 5.

In 2019, there were multiple surface water exceedances for benzene within the Cell 3 area. The maximum concentration was 736 micrograms per liter (µg/L) vs the USEPA Region 4 saltwater / chronic screening level of 110 µg/L. There was one exceedance for naphthalene within Cell 2 (1.5 µg/L vs the USEPA Region 3 BTAG Marine screening level of 1.4 µg/L), and multiple exceedances for naphthalene within Cell 3 (maximum concentration of 18.5 µg/L vs the USEPA Region 3 BTAG Marine screening level of 1.4 µg/L).

Additional surface water sampling was conducted in 2025 (refer to **Appendix D-2** and **Table A5**), and is discussed in **Section 4.6**.

3.3.2.3 Pore Water

The *Former Coke Oven Area Interim Measures Supplemental Investigation Report* (ARM, 2019b) included pore water sampling conducted offshore of Cell 2, Cell 3, and Cell 5. Where possible, samples were collected from depths of 9-inches and 3-feet below the sediment-water interface. All pore water samples were analyzed for BTEX, naphthalene, total petroleum hydrocarbons (TPH) – diesel range organics (DRO), and TPH – gasoline range organics (GRO). The *Supplemental Investigation Report* compared the results to the human health AWQC for consumption of organisms.

For this CPA CMS, the pore water results have been compared to pore water screening levels for ecological receptors (marine or saltwater aquatic life, chronic exposure) (refer to **Appendix D-3** for figures with sample locations and tables with results). For the sampled parameters, all results were compared to the USEPA guidance on "Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic Contaminants" (USEPA, October 2017).

Appendix D-3, Table A1 includes April / May 2019 pore water sampling results for Cell 2; **Appendix D-3, Table A2** includes April 2019 pore water sampling results for Cell 3; and **Appendix D-3, Table A3** includes April 2019 pore water sampling results for Cell 5. There were exceedances of BTEX and naphthalene in Cells 2 and 3 and for naphthalene in Cell 5. Maximum pore water concentrations were identified to the west of Cell 2, with concentrations of 19,100 µg/L (benzene), 127 µg/L (ethylbenzene), 1,910 µg/L (toluene), 511 µg/L (xylenes), and 72,000 µg/L (naphthalene).

3.3.2.4 Summary

Based on the review of the offshore investigations, there are exceedances of applicable criteria in sediment (BTEX, PAHs including naphthalene), surface water (benzene, naphthalene, PAHs), and pore water (BTEX and naphthalene) offshore from the CPA Peninsula. Offshore impacts from a variety of potential sources pre-date TPA's use and ownership of the TPA Property. TPA will address potential current and future migration of impacted groundwater to environmental media that could present unacceptable hazard and/or risk to offshore receptors.

3.3.3 **Resource Restoration**

USEPA expects final remedies to return usable groundwater to its maximum beneficial use, where practicable, within a timeframe that is reasonable. As previously discussed, USEPA has concluded that the maximum beneficial use of groundwater at Sparrows Point is industrial, commercial, or dewatering. Therefore, Resource Restoration groundwater screening levels are based on:

- Industrial Non-Potable Water User: may have the potential to be exposed through dermal contact and vapor inhalation. The Industrial Non-Potable Water User is intended to be a

worst-case scenario receptor and assumes groundwater exposure during truck washing or similar activities.

As discussed in **Section 2.1.4**, there is no ongoing use of groundwater beneath the site, extraction occurs only for construction or remedial purposes. All other onsite groundwater uses will be prohibited under an Environmental Covenant, which will be recorded as part of the Final Comprehensive No Further Action letter from the MDE.

3.4 Development of Preliminary Single-Chemical Risk-Based Screening Levels

Preliminary single-chemical Risk Based Screening Levels (RBSLs) were developed to address the proposed CAOs for all COPCs, based on the protection of human health (**Section 3.4.1**), the environment (**Section 3.4.2**), and groundwater resource restoration (**Section 3.4.3**). The purpose of the preliminary RBSLs is to identify the COCs in groundwater, to provide a basis for delineation of groundwater impacts, and identify those COCs which present the most significant contribution to hazard and/or risk to each of the potentially complete exposure pathways to support the development of Final Remedial Goals (RGs) for groundwater. The process for calculating the Final RGs is outlined in **Exhibit** 1.

These preliminary RBSLs were developed for each COPC and potentially complete exposure pathway outlined above using standard default exposure parameter values and USEPA toxicity criteria for each COPC with a cancer and/or non-cancer endpoint, as necessary. **Table 1** summarizes the exposure parameter values, and **Table 2** includes the chemical-specific toxicological criteria and physiochemical parameter values utilized for all pathways and receptors. **Table 3** includes the applicable Toxicity Reference Values for pore water and surface water, as well as the calculated groundwater screening levels that are protective of ecological receptors.

For human health exposure pathways, COPCs with a non-cancer endpoint were separated by target organ. The target non-cancer Hazard Index (HI) of 1 was divided by the number of COPCs contributing to that target organ HI in order to obtain a THQ per COPC. This THQ (per target organ per COPC) was used to calculate preliminary RBSLs for each COPC. Refer to **Appendix E-1** for a summary of target organs by COPC.

The cumulative carcinogenic risk for groundwater must not exceed the upper limit of USEPA's acceptable risk range (1E-04). A target cancer risk of 1E-06 was initially used to calculate the preliminary RBSLs for those COPCs with a carcinogenic endpoint to ensure that any compound that would significantly contribute to carcinogenic risk would be identified for quantitative analysis of cumulative risk. For each COPC and exposure scenario, the lowest of the carcinogenic (based on a target cancer risk of 1E-06) and non-carcinogenic screening levels was selected as the preliminary RBSLs (refer to **Table 4**). The preliminary RBSLs were then compared to the CPA groundwater database (refer to **Table 5** and **E-Attachment #1A**).

Refer to **E-Attachment #1A** for the complete groundwater database used for the CSM evaluation for comparison with the Preliminary RBSLs. Monitoring well construction details for all wells

included in the groundwater database is included in **Appendix B-1**. **Appendix B-1** also includes the date for the most recent sampling event by parameter for each monitoring wells, and **Appendix B-2** includes dates and parameters (by monitoring well) for all sampling rounds included in the groundwater database (**E-Attachment #1A and 1B**). For metals, if both total and dissolved concentrations are available, then the dissolved concentrations were utilized in the groundwater database.

3.4.1 Human Health – Non-Residential

As discussed in **Section 3.3.1**, the current and reasonably anticipated future receptor scenarios considered are:

- On-Site Industrial Workers: may have a potential to be exposed to vapors through vapor intrusion to indoor air;
- On-Site Utility Workers: may have a potential for short-term exposure (via dermal contact and vapor inhalation) to shallow groundwater during intrusive work;
- Off-Site Recreational User: may have a potential risk due to fish and crab ingestion.

Therefore, with respect to potential human exposure, preliminary RBSLs will be derived for each of the COPCs for the above receptors/exposure pathways.

3.4.1.1 On-Site Industrial Workers

On-Site industrial workers may have the potential to be exposed to groundwater COPCs through vapor intrusion to indoor air. USEPA's commercial scenario sub-slab vapor VISLs were selected as the appropriate preliminary RBSLs for this scenario (using a TR of 1E-06) and are presented in **Table 4**. The point of compliance would be across the entire CPA Area.

3.4.1.2 On-Site Utility Workers

On-site Utility Workers may have the potential for short-term exposure to shallow groundwater during intrusive work (excavations or trenches) in areas of the CPA where groundwater is within 15 feet of the ground surface. These receptors could come into direct contact with groundwater in excavations and trenches and could also be exposed to COPC vapors arising from groundwater both at and below the trench base for short periods of time.

The COPC list identified in **Section 3.2** includes multiple cancer and non-cancer COPCs. The cumulative carcinogenic risk for groundwater must not exceed the upper limit of USEPA's acceptable risk range (1E-04). In order to account for cumulative risks, a target cancer risk of 1E-06 was utilized in the below equations to ensure that cumulative carcinogenic risk for groundwater remains below acceptable risk levels (1E-04). For non-cancer COPCs, they were separated by target organ. The target non-cancer HQ (1.0) was divided by the number of COPCs contributing to that target organ HQ, in order to obtain a target HQ per target organ per COPC. This target HQ (per target organ per COPC) was used in the below equations to calculate preliminary RBSLs for

on-site utility workers to ensure that cumulative non-cancer risk by target organ remains below acceptable risk levels. Refer to **Appendix E-2, Tables A1 through A4** for groundwater calculations for the On-Site Utility Worker.

Dermal Contact

For inorganic COPCs, the Utility Worker dermal contact RBSL ($RBSL_{inorg_derm_uw}$) for dermal contact with groundwater in the trench is calculated based on the USEPA RSL equations for resident/ dermal contact with groundwater/tap water. These equations have been conservatively used to calculate the Utility Worker dermal contact RBSL as follows:

$$RBSL_{inorg_derm_uw}\left[\frac{\mu g}{L}\right] = \frac{DA_{event_uw} x\ 1{,}000\ cm^3/L}{K_p\ x\ ET_{uw}}$$

For organic COPCs for which exposure time (ET_{uw}) is less than or equal to the chemical-specific time to reach steady state (t^*), the Utility Worker dermal contact RBSL ($RBSL_{org_derm_uw}$) is calculated as:

$$RBSL_{org_derm_uw}\left[\frac{\mu g}{L}\right] = \frac{DA_{event_{uw}} x\ 1{,}000\frac{cm^3}{L}}{2\ x\ FA\ x\ K_p\ x\sqrt{\frac{6\ x\ \tau_{event} x\ ET_{uw}}{\pi}}}$$

For organic COPCs for which exposure time (ET_{rec}) is greater than the chemical-specific time to reach steady state (t^*_{rec}), the Utility Worker dermal contact RBSL ($RBSL_{org_derm_uw}$) is calculated as:

$$RBSL_{org_derm_uw}\left[\frac{\mu g}{L}\right] = \frac{DA_{event_uw}\ x\ 1{,}000\frac{cm^3}{L}}{FA\ x\ K_p\ x\left[\frac{ET_{uw}}{1+B} + 2\ x\ \tau_{event_uw}\ x\left[\frac{1+3B+\ 3B^2}{(1+B)^2}\right]\right]}$$

Where:

DA_{event_uw} = Absorbed dose per event for Utility Workers(µg/cm^2-event). Calculated.

K_p = Dermal permeability coefficient of COPC in water (cm/hour). Chemical specific, refer to **Table 1**.

τ_{event} = lag time per event (hour/event). Chemical specific, refer to **Table 1**.

t^* = time to reach steady state (hours). Chemical specific, refer to **Table 1**.

FA = fraction absorbed from water (unitless). Chemical specific, refer to **Table 1**.

ET_{uw} = exposure time (hours/event), 8 hours/event. Refer to **Table 1**.

B = ratio of permeability coefficient through the stratum corneum to permeability coefficient across the viable epidermis (unitless). Chemical specific, refer to **Table 1**.

The absorbed dose per event ($DA_{event_uw(c)}$) for carcinogenic effects for all COPCs is calculated as:

$$DA_{event_uw(c)}\left[\frac{\mu g}{cm^2 - event}\right] = \frac{TR\ x\ AT_c\ x\ BW_{uw}\ x\ GIABS\ x\ 1000\ \mu g/mg}{ED_{uw}\ x\ EF_{uw}\ x\ SA_{uw}\ x\ SF_o}$$

and $DA_{event_uw(nc)}$ for non-carcinogenic effects of all COPC types is calculated as:

$$DA_{event_uw(nc)}\left[\frac{\mu g}{cm^2 - event}\right] = \frac{THQ\ x\ AT_{nc}\ x\ BW_{uw}\ x\ RfD\ x\ GIABS\ x\ 1000\ \mu g/mg}{ED_{uw}\ x\ EF_{uw}\ x\ SA_{uw}}$$

Where:
TR = Target Risk (unitless), TR = 1E-6 for screening. Refer to **Table 1**.
THQ = Target Hazard Quotient (unitless) per COPC per target organ. Refer to **Appendix E-2, Table A3**.
AT_c = averaging time for carcinogens (days), 365 days/yr x LT (yrs). Refer to **Table 1**.
AT_{nc} = averaging time for non-carcinogens (days), 365 days/yr x ED (years). Refer to **Table 1**.
LT = lifetime (yrs), 70 yrs. Refer to **Table 1**.
BW_{uw} = body weight (kg), 80 kg. Refer to **Table 1**.
SA_{uw} = exposed body surface area (cm^2), 2,550 cm^2 (assumes contact with hands and forearms only). Refer to **Table 1**.
EF_{uw} = exposure frequency (events/year), 20 events/yr (based on routine maintenance work at Sparrows Point). Refer to **Table 1**.
ED_{uw} = exposure duration (years), 1 yr. Refer to **Table 1**.
GIABS = gastrointestinal absorption fraction (unitless). Chemical specific, refer to **Table 2**.
SF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$. Chemical specific, refer to **Table 2**.
RfD = reference dose (mg/kg-day). Chemical specific, refer to **Table 2**.

Vapor Inhalation

Before calculating vapor inhalation risks to the Utility Worker, each COPC must first meet the criteria for volatility where the Henry's Law Constant must be greater than 1×10^{-5} atm-m^3/mol. If it does not, then the chemical is not volatile enough to be assessed for vapor inhalation risks.

For carcinogenic effects, the Utility Worker direct contact inhalation RBSLs ($RBSL_{dir_inhal_uw(c)}$) are calculated in accordance with the Virginia Department of Environmental Quality (VDEQ) equations for a construction/utility worker in a trench:

$$RBSL_{dir_inhal_uw(c)}\left[\frac{\mu g}{L}\right] = \frac{TR\ x\ AT_c}{EF_{uw}\ x\ ED_{uw}\ xET_{uw}\ x\ \frac{1\ day}{24\ hours}\ x\ IUR\ x\ VF_{\leq 15_{uw}}}$$

For non-carcinogenic effects, the Utility Worker direct contact inhalation RBSLs ($RBSL_{dir_inhal_uw(nc)}$) are calculated as:

$$RBSL_{dir_inhal_uw(nc)}\left[\frac{\mu g}{L}\right] = \frac{THQ\ x\ AT_{nc}\ x\ RfC\ x\ 1{,}000\ \mu g/mg}{EF_{uw}\ x\ ED_{uw}\ x\ ET_{uw}\ x\ \frac{1\ day}{24\ hours}\ x\ VF_{\leq 15_{uw}}}$$

Where:
TR = Target Risk (unitless), TR = 1E-6 for screening. Refer to **Table 1**.
THQ = Target Hazard Quotient (unitless) per COPC per target organ. Refer to **Appendix E-2, Table A3**.
AT_c = averaging time for carcinogens (days), 365 days/yr x LT (yrs). Refer to **Table 1**.
AT_{nc} = averaging time for non-carcinogens (days), 365 days/yr x ED (years). Refer to **Table 1**.
EF_{uw} = exposure frequency (days/year), 20 days/yr (based on routine maintenance work at Sparrows Point). Refer to **Table 1**.
ED_{uw} = exposure duration (years), 1 yr. Refer to **Table 1.**
ET_{uw} = exposure time (hours/day), 4 hrs/day. Refer to **Table 1**.
IUR = inhalation unit risk $(\mu g/m^3)^{-1}$. Chemical specific, refer to **Table 2**.
RfC = reference concentration (mg/m^3). Chemical specific, refer to **Table 2**.
$VF_{\leq 15}$ = volatilization factor where depth to groundwater is ≤ 15 ft below ground surface (bgs) (L/m^3). Chemical specific, refer to **Table 2**.

For groundwater within 15 feet of the ground surface, volatilization factors and overall mass transfer coefficients (K) are calculated in accordance with the VDEQ equations for a construction/utility worker in a trench. A 2017 Battelle Study identified average air exchange rates of 46 per hour in a trench, when relatively low wind speeds (between 3.5 and 7 mph) were present. The study suggested that use of these empirically derived air exchange rates would be applicable at any site with comparable meteorological conditions and would be conservative for sites with higher average ambient wind speeds. Therefore, this CMS will assume 46 air changes per hour (ACH) for Utility Workers.

$$VF_{<15_uw}\left[\frac{L}{m^3}\right] = \frac{K\ x\ A\ x\ F\ x\ 10^{-3}\frac{L}{cm^3}\ x\ 10^4\frac{cm^2}{m^2}\ x\ 3600\ sec/hr}{[ACH_{uw}]\ x\ V}$$

Where:

$$K = \frac{1}{\frac{1}{k_L} + \frac{R\ x\ T}{H\ \ x\ k_G}}$$

$$k_L = \left(\frac{MW_{O_2}}{MW_i}\right)^{0.5}\ x\ \frac{T}{298}\ x\ k_L, O_2$$

$$k_G = \left(\frac{MW_{H_2O}}{MW_i}\right)^{0.335}\ x\ \left(\frac{T}{298}\right)^{1.005}\ x\ k_G, H_2O$$

Where:
K = overall mass transfer coefficient (cm/sec). Chemical specific, refer to **Table 2**.
k_L = liquid-phase mass transfer coefficient (cm/sec). Chemical specific, refer to **Table 2**.

R = ideal gas constant (atm-m^3/mole-°K). Assumption of 8.2 x 10^{-5}.
T = groundwater temperature (°K). Assumption of 11°C or 284°K, refer to **Table 1**.
H_i = Henry's Law constant of component i (atm-m^3/mole). Chemical specific, refer to **Table 2**.
k_G = gas-phase mass transfer coefficient (cm/sec). Chemical specific, refer to **Table 2**.
MW_i = molecular weight of component i (g/mol). Chemical specific, refer to **Table 2**.
A = Area of Trench (m^2). Assumption of 2.44 m^2, refer to **Table 1**.
F = fraction of floor through which contaminant can enter (unitless). Assumption of 1, refer to **Table 1**.
ACH_{uw} = air changes per hour (utility trench) (h^{-1}). Assumption of 46 per hour, refer to **Table 1**.
V = volume of trench (m^3). Assumption of 5.95 m^3, refer to **Table 1**.
MW_{O2} = molecular weight of O_2. 32 g/mol.
k_L, O_2 = liquid-phase mass transfer coefficient of oxygen at 25°C. 0.002 cm/sec, refer to **Table 1**.
MW_{H2O} = molecular weight of water. 18 g/mol.
k_G,H_2O = gas-phase mass transfer coefficient of water at 25°C. 0.833 cm/sec, refer to **Table 1**.

Combined Exposure Routes

For volatile COPCs, combined dermal and inhalation RBSLs are calculated. For carcinogenic effects, the Utility Worker direct contact inhalation RBSLs ($RBSL_{comb_uw(c)}$) are calculated as:

$$RBSL_{comb_uw(c)}\left[\frac{\mu g}{L}\right] = \frac{1}{\frac{1}{RBSL_{org_derm(c)}} + \frac{1}{RBSL_{dir_inhal_uw(c)}}}$$

For non-carcinogenic effects, the Utility Worker direct contact inhalation RBSLs ($RBSL_{comb_uw(nc)}$) are calculated as:

$$RBSL_{comb_uw(nc)}\left[\frac{\mu g}{L}\right] = \frac{1}{\frac{1}{RBSL_{org_derm(nc)}} + \frac{1}{RBSL_{dir_inhal_uw(nc)}}}$$

Refer to **Appendix E-2, Table A1** for exposure assumptions, **Appendix E-2, Table A2** for carcinogenic calculations, **Appendix E-2, Table A3** for non-carcinogenic calculations, and to **Appendix E-2, Table A4** for a summary of the calculated preliminary RBSLs for the On-Site Utility Worker.

The lowest of the carcinogenic (based on a target cancer risk of 1E-6) and non-carcinogenic combined direct contact screening levels was selected for the Utility Worker scenario and compared to the CPA groundwater database. Refer to **Table 4** for the preliminary RBSLs for the Utility Worker scenario. The point of compliance for the Preliminary RBSLs would be across the entire CPA Area.

3.4.1.3 Off-Site Recreational User

To be conservative, potential risk to an Off-Site Recreational User via fish and crab ingestion has been evaluated.

The COPC list identified in **Section 3.2** includes multiple cancer and non-cancer COPCs. In order to account for cumulative risks, a target cancer risk of 1E-06 was initially utilized in the equations below to ensure that cumulative carcinogenic risk for groundwater remains below acceptable risk levels. For non-cancer COPCs, they were separated by target organ. The target non-cancer HQ (1.0) was divided by the number of COPCs contributing to that target organ HQ, in order to obtain a target HQ per target organ per COPC. This target HQ (per target organ per COPC) was used in the below equations to calculate preliminary RBSLs for Off-Site Recreational Users to ensure that cumulative non-cancer risk by target organ remain below acceptable risk levels. Refer to **Appendix E-2, Tables B1 through B6** for groundwater calculations for the Off-Site Recreational User.

As a starting point, the Code of Maryland Regulations, 26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Human Health for Consumption of Organism Only (updated February 24, 2021) was utilized.

For COPCs where there was no MDE screening level for Human Health for Consumption of Organism Only, the USEPA RSL equations for fish ingestion were utilized to obtain a screening level for the concentration in the fish tissue that can be consumed.

For carcinogenic effects, the Fish Tissue Concentration ($C_{FT(c)}$) is calculated as:

$$C_{FT(c)}\left[\frac{mg}{kg}\right] = \frac{TR\ x\ AT_c\ x\ BW_{rec_fish}}{EF_{rec_fish}\ x\ ED_{rec_fish}\ x\ SF_o\ x\ IRF\ x\ \frac{10^{-6}kg}{1\ mg}}$$

For non-carcinogenic effects, the Fish Tissue Concentration ($C_{FT(nc)}$) is calculated as:

$$C_{FT(nc)}\left[\frac{mg}{kg}\right] = \frac{THQ\ x\ BW_{rec_fish}\ x\ AT_{nc}\ x\ RfD_o}{EF_{rec_fish}\ x\ ED_{rec_fish}\ x\ IRF\ x\ \frac{10^{-6}kg}{1\ mg}}$$

Where:
TR = Target Risk (unitless), TR = 1E-6 for screening. Refer to **Table 1**.
THQ = Target Hazard Quotient (unitless) per COPC per target organ. Refer to **Appendix E-2, Table B3**.
AT_c = averaging time for carcinogens (days), 365 days/yr x LT (yrs). Refer to **Table 1**.
AT_{nc} = averaging time for non-carcinogens (days), 365 days/yr x ED (years). Refer to **Table 1**.
LT = lifetime (yrs), 70 yrs. Refer to **Table 1**.
BW_{rec_fish} = body weight (kg), 80 kg. Refer to **Table 1**.
EF_{rec_fish} = exposure frequency (days/year), 32 days/yr. Refer to **Table 1**.
ED_{rec_fish} = exposure duration (years), 26 yrs. Refer to **Table 1**.

IRF = fish ingestion rate (mg/day), 230,000 mg/day. Refer to **Table 1**.
SF_o = oral cancer slope factor ((mg/kg-day)$^{-1}$). Chemical specific, refer to **Table 2.**
RfD = reference dose (mg/kg-day). Chemical specific, refer to **Table 2**.

The corresponding surface water screening level was calculated based on the fish tissue concentration and the fish bioconcentration factor.

$$RBSL_{rec_fish}\left[\frac{\mu g}{L}\right] = \frac{C_{FT}\left[\frac{mg}{kg}\right] x \frac{1000\ \mu g}{1\ mg}}{BCF\left[\frac{L}{kg}\right]}$$

Where:
BCF = Fish bioconcentration factor (L/kg). Chemical specific, refer to **Table 1**.

The lowest of the carcinogenic (using a target cancer risk of 1E-6) and non-carcinogenic screening levels was selected as the screening level for the concentration in the crab and fish tissue that can be consumed. In order to develop preliminary RBSLs to be protective of Off-Site Recreational Users via fish and crab ingestion, a groundwater to surface water mixing / attenuation factor was developed.

Groundwater that may contain COPCs and that flows into surface water along the shoreline will mix with the surface water in the water body. Groundwater and surface water data collected from several areas of the CPA have been evaluated to derive an empirical groundwater to surface water mixing/attenuation factor: Cell 2 (located along the southern portion of the inlet associated with the graving dock, also has a seawall), Cell 3 (located along the northern portion of a cove along the western shore of the CPA), and Cell 5 (located along the western portion of the Turning Basin). For each cell and the overall CPA, geometric means were calculated for surface water samples and for shoreline monitoring well locations based on benzene and naphthalene concentrations (refer to **Appendix E-3**). Based on the calculated geometric means, groundwater to surface water mixing/ attenuation factors were calculated (refer to **Appendix E-3**). A conservative surface water mixing/ attenuation factor of **121**, which was the factor from Cell 3 for benzene, was selected for use in this CPA CMS. This factor was selected for several reasons: 1) the Cell 3 cove is small and would have less mixing than other areas surrounding the entire Sparrows Point peninsula; 2) Cell 3 included 31 surface water samples, which was more than for the other Cells and is a robust data set; and 3) the Cell 3 factor was the lowest factor calculated based on the CPA data, and therefore will be conservative for use Sitewide.

The surface water mixing/attenuation factor of **121** will be used throughout the CPA and applied to the surface water screening levels for the Recreational User ($RBSL_{sw}$) to obtain preliminary RBSLs for the protection of the Recreational User ($RBSL_{gw}$) based on ingestion of fish and crabs:

$$RBSL_{GW} = RBSL_{SW}\ x\ Mixing\ Factor$$

Refer to **Appendix E-2, Table B1** for exposure assumptions, **Appendix E-2, Table B2** for carcinogenic calculations, **Appendix E-2, Table B3** for non-carcinogenic calculations, **Appendix E-2, Table B4** for a summary of the calculated surface water screening levels, **Appendix E-2, Table B5** for applicable surface water screening levels, and to **Appendix E-2, Table B6** for preliminary RBSLs for the Off-Site Recreational User.

The preliminary RBSLs for all COPCs (based on a target cancer risk of 1E-6) are presented in **Table 4**. The point of compliance would be groundwater at the CPA shoreline/property boundary.

3.4.2 Ecological Receptors

As discussed in **Section 3.3.2**, to be conservative, groundwater cleanup levels for ecological receptor protection will be developed to ensure protection of surface water, pore water, and sediment. Specifically, the cleanup levels will ensure that any discharge of groundwater that may contain COPCs will not result in surface water concentrations (after mixing and attenuation) or pore water concentrations (after attenuation) that may pose an unacceptable risk to ecological receptors inhabiting the surface water, pore water, or sediment surrounding the Site due to any complete on-shore groundwater to offshore porewater pathway that may exist. Whether ecological risk could occur as a result of past discharges or other sources is outside the scope of this report. Preliminary RBSLs were derived with a point of compliance at the CPA shoreline/property boundary.

In order to obtain appropriate preliminary RBSLs, various sources were identified for the selection of surface water screening levels. Below is a hierarchy of the screening levels utilized. Surface water screening levels for marine or saltwater aquatic life, and for chronic exposure, were selected. If no marine or saltwater screening level was available, then freshwater screening levels were utilized as a conservative option.

1. USEPA National Recommended Water Quality Criteria (NRWQCs) (USEPA 2014a) for ecological risk (Saltwater Aquatic Life Continuous Criterion Concentration).
2. Code of Maryland Regulations, 26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Salt Water – Chronic (updated May 2024).
3. USEPA Region 4 Ecological Risk Assessment Supplemental Guidance. Table 1a for Region 4 Surface Water Screening Levels for Hazardous Waste Sites, saltwater, chronic (March 2018).
4. NOAA Screening Quick Reference Tables (SQuiRTs), Marine Surface Water – Chronic (2008).
5. USEPA Region III BTAG Marine Screening Benchmarks (July 2006).
6. NOAA SQuiRTs, Fresh Surface Water – Chronic (2008).
7. USEPA Region III BTAG Freshwater Screening Benchmarks (July 2006).
8. USEPA, Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic

Contaminants. Table 3-1 for Conventional and narcosis chronic toxicity values for marine water (October 2017).

The hierarchy utilized for the pore water screening levels (as per USEPA Guidance, surface water screening levels are also utilized for pore water screening) differed slightly:

1. USEPA NRWQCs (USEPA 2014a) for ecological risk (Saltwater Aquatic Life Continuous Criterion Concentration).
2. USEPA, Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic Contaminants. Table 3-1 for Conventional and narcosis chronic toxicity values for marine water (October 2017).
3. Code of Maryland Regulations, 26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Salt Water – Chronic (updated May 2024).
4. USEPA Region 4 Ecological Risk Assessment Supplemental Guidance. Table 1a for Region 4 Surface Water Screening Levels for Hazardous Waste Sites, saltwater, chronic (March 2018).
5. NOAA SQuiRTs, Marine Surface Water – Chronic (2008).
6. USEPA Region III BTAG Marine Screening Benchmarks (July 2006).
7. NOAA SQuiRTs, Fresh Surface Water – Chronic (2008).
8. USEPA Region III BTAG Freshwater Screening Benchmarks (July 2006).

If no ecological screening level was identified based on the above hierarchy, then the Risk Assessment Information System was utilized to review other available ecological screening levels. Refer to **Table 3** for all of the selected Toxicity Reference Values (TRV) for pore water and surface water. The selected screening levels represent surface water concentrations (or pore water concentrations) that would be protective of ecological receptors. To determine applicable target screening levels for groundwater and in the absence of site-specific empirical data, mixing and/or attenuation factors have been considered. It is understood that there is significant dilution between the groundwater and surface water interface, particularly when dealing with a tidally influenced river. For example, one study found that under tidal pumping, high velocities coupled with hydrodynamic dispersion resulted in considerable mixing of groundwater and river water, creating a 1-m deep mixing interval within the hyporheic zone. Conservative solutes in groundwater discharging to the river were diluted significantly, on the order of 99.9% and 84% during flooding and ebbing tide conditions, respectively (Bianchin, 2010).

3.4.2.1 Surface Water

To determine Preliminary RBSLs that are protective of ecological receptors with respect to surface water, a surface water mixing / attenuation factor of **121** was calculated based on CPA empirical data. Refer to **Appendix E-3** for datasets and calculations. This surface water mixing factor has been applied as described in **Section 3.4.1.3**. The resulting preliminary RBSLs (based on groundwater to surface water) for the protection of ecological receptors are presented in **Table 3**.

3.4.2.2 Pore Water

To determine Preliminary RBSLs that are protective of ecological receptors with respect to pore water, pore water attenuation factors have been developed based on empirical data indicating the relationship between paired groundwater and pore water samples in several coves of the CPA: Cell 2 (located along the southern portion of the inlet associated with the graving dock, also has a seawall), Cell 3 (located along the northern portion of a cove along the western shore of the CPA), and Cell 5 (located along the western portion of the Turning Basin). For each cell and the overall CPA, geometric means were calculated for shallow pore water samples and for shoreline monitoring well locations based on benzene and naphthalene concentrations (refer to **Appendix E-3**). Based on the calculated geometric means, groundwater to shallow pore water attenuation factors were calculated (refer to **Appendix E-3**). ARM has selected the shallow pore water attenuation factor of **75** for use in this CPA CMS, which was the factor from Cell 5 for naphthalene. This factor was selected for several reasons: 1) the Turning Basin (where Cell 5 is located) would have less mixing than other areas surrounding the CPA Area, while also being more representative than Cell 2 which has a seawall; 2) Cell 5 included 7 pore water samples; and 3) the Cell 5 factor was the lowest factor calculated based on the CPA data, and therefore will be conservative for use in this CPA CMS.

The shallow pore water attenuation factor of **75** will be used across the CPA Area and applied to the pore water screening levels for Ecological Receptors to obtain Preliminary RBSLs for the protection of the Ecological Receptors based on shallow pore water. The resulting Preliminary RBSLs (based on groundwater to pore water) for the protection of ecological receptors are presented in **Table 3**.

3.4.2.3 Combined

To determine Preliminary RBSLs that are protective of ecological receptors with respect to surface water, a surface water mixing/attenuation factor of **121** was applied to the surface water screening levels. In addition, the shallow pore water attenuation factor of **75** was applied to the pore water screening levels. Preliminary RBSLs based on surface water or pore water screening levels will also be protective of ecological receptors within sediment.

The lowest of the two calculated screening levels was selected as the Preliminary RBSLs for the protection of ecological receptors. These Preliminary RBSLs are presented in **Table 3** and in **Table 4**. The point of compliance would be groundwater at the CPA shoreline/property boundary.

3.4.3 **Resource Restoration**

USEPA expects corrective actions/final remedies to return usable groundwater to its maximum beneficial use, where practicable, within a timeframe that is reasonable. As previously discussed, USEPA has concluded that the maximum beneficial use of groundwater at Sparrows Point is industrial, commercial, or dewatering.

Preliminary single-chemical RBSLs were developed to be protective of an Industrial Non-Potable Water User. The Industrial Non-Potable Water User is intended to be a worst-case scenario receptor and assumes groundwater exposure during truck washing or similar activity. For this scenario, a groundwater extraction rate of five (5) gallons per minute has been assumed.

In order to account for potential cumulative risk posed by COPCs with a carcinogenic endpoint, a target cancer risk of 1E-06 was utilized in the below equations. COPCs with a non-cancer endpoint were evaluated by target organ. The target non-cancer HQ (1.0) was divided by the number of COPCs contributing to that target organ HQ, in order to obtain a target HQ per target organ per COPC. This target HQ (per target organ per COPC) was used in the below equations to calculate preliminary RBSLs for on-site composite workers to ensure that cumulative non-cancer risk by target organ remain below acceptable risk levels. Refer to **Appendix E-2, Tables C1 through C4** for groundwater calculations for the Resource Restoration / Industrial Non-Potable Water User.

Dermal Contact

Dermal exposures were assessed using the same equations as for the On-Site Utility Worker (refer to **Section 3.4.1.2**) and are based on the USEPA RSL equations for resident/dermal contact with groundwater/tapwater. These equations have been conservatively used to calculate the Industrial Non-Potable Water User dermal contact RBSL as follows:

$$RBSL_{inorg_derm_rr}\left[\frac{\mu g}{L}\right] = \frac{DA_{event_rr} x\ 1{,}000\ cm^3/L}{K_p\ x\ ET_{rr}}$$

For organic COPCs for which exposure time (ET_{rr}) is less than or equal to the chemical-specific time to reach steady state (t^*), the Industrial Non-Potable Water User dermal contact RBSL ($RBSL_{org_derm_rr}$) is calculated as:

$$RBSL_{org_derm_rr}\left[\frac{\mu g}{L}\right] = \frac{DA_{event_{rr}} x\ 1{,}000\frac{cm^3}{L}}{2\ x\ FA\ x\ K_p\ x\ \sqrt{\frac{6\ x\ \tau_{event} x\ ET_{rr}}{\pi}}}$$

For organic COPCs for which exposure time (ET_{rec}) is greater than the chemical-specific time to reach steady state (t^*_{rec}), the Industrial Non-Potable Water User dermal contact RBSL ($RBSL_{org_derm_rr}$) is calculated as:

$$RBSL_{org_derm_rr}\left[\frac{\mu g}{L}\right] = \frac{DA_{event_rr}\ x\ 1{,}000\frac{cm^3}{L}}{FA\ x\ K_p\ x\ \left[\frac{ET_{rr}}{1+B} + 2\ x\ \tau_{event}\quad x\ \left[\frac{1+3B+\ 3B^2}{(1+B)^2}\right]\right]}$$

Where:

DA_{event_rr} = Absorbed dose per event for Industrial Non-Potable Water User (µg/cm^2-event). Calculated.

K_p = Dermal permeability coefficient of COPC in water (cm/hour). Chemical specific, refer to **Table 2**.
τ_{event} = lag time per event (hour/event). Chemical specific, refer to **Table 2**.
t^* = time to reach steady state (hours). Chemical specific, refer to **Table 2**.
FA = fraction absorbed from water (unitless). Chemical specific, refer to **Table 2**.
ET_{rr} = exposure time (hours/event), 4 hrs/event. Refer to **Table 1**.
B = ratio of permeability coefficient through the stratum corneum to permeability coefficient across the viable epidermis (unitless). Chemical specific, refer to **Table 2**.

The absorbed dose per event ($DA_{event_rr(c)}$) for carcinogenic effects for all COPCs is calculated as:

$$DA_{event_rr(c)}\left[\frac{\mu g}{cm^2 - event}\right] = \frac{TR\ x\ AT_c\ x\ BW_{rr}\ x\ GIABS\ x\ 1000\ \mu g/mg}{ED_{rr}\ x\ EF_{rr}\ x\ SA_{rr}\ x\ SF_o}$$

and $DA_{event_rr(nc)}$ for non-carcinogenic effects of all COPC types is calculated as:

$$DA_{event_rr(nc)}\left[\frac{\mu g}{cm^2 - event}\right] = \frac{THQ\ x\ AT_{nc,rr}xBW_{rr}xRfDxGIABSx1000\ \mu g/mg}{ED_{rr}\ x\ EF_{rr}\ x\ SA_{rr}}$$

Where:
TR = Target Risk (unitless), TR = 1E-6 for screening. Refer to **Table 1**.
THQ = Target Hazard Quotient (unitless) per COPC per target organ. Refer to **Appendix E-2, Table C3**.
AT_c = averaging time for carcinogens (days), 365 days/yr x LT (yrs). Refer to **Table 1**.
AT_{nc} = averaging time for non-carcinogens (days), 365 days/yr x ED (years). Refer to **Table 1**.
LT = lifetime (yrs), 70 yrs. Refer to **Table 1**.
BW_{rr} = body weight (kg), 80 kg. Refer to **Table 1**.
SA_{rr} = exposed body surface area (cm^2), 2,550 cm^2 (assumes contact with hands and forearms only). Refer to **Table 1**.
EF_{rr} = exposure frequency (events/year), 150 events/year (accounting for the average number of rain days per year). Refer to **Table 1**.
ED_{rr} = exposure duration (years), 25 years. Refer to **Table 1**.
GIABS = gastrointestinal absorption fraction (unitless). Chemical specific, refer to **Table 2**.
SF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$. Chemical specific, refer to **Table 2**.
RfD = reference dose (mg/kg-day). Chemical specific, refer to **Table 2**.

<u>Vapor Inhalation</u>

Before calculating vapor inhalation risks to the Industrial Non-Potable Water User, each COPC must first meet the criteria for volatility where the Henry's Law Constant must be greater than 1×10^{-5} atm-m^3/mol. If it does not, then the chemical is not volatile enough to be assessed for vapor inhalation risks.

In order to calculate the vapor inhalation risks for the Industrial Non-Potable Water User scenario, the USEPA RSL equation for composite worker air was utilized to calculate an outdoor air concentration for carcinogenic effects:

$$C_{rr-air(c)}\left[\frac{\mu g}{m^3}\right] = \frac{TR\ x\ AT_c}{ED_{rr}\ x\ EF_{rr}\ x\ ET_{rr}\ x\ \frac{1\ day}{24\ hrs}\ x\ IUR}$$

and for non-carcinogenic effects:

$$C_{rr-air(nc)}\left[\frac{\mu g}{m^3}\right] = \frac{THQ\ x\ AT_{nc}\ x\ RfC\ x\ 1000\ \mu g/mg}{EF_{rr}\ x\ ED_{rr}\ x\ ET_{rr}\ x\ \frac{1\ day}{24\ hrs}}$$

Where:
TR = Target Risk (unitless), TR = 1E-6 for screening. Refer to **Table 1**.
THQ = Target Hazard Quotient (unitless) per COPC per target organ. Refer to **Appendix E-2, Table C3**.
AT_c = averaging time for carcinogens (days), 365 days/yr x LT (yrs). Refer to **Table 1**.
AT_{nc} = averaging time for non-carcinogens (days), 365 days/yr x ED (years). Refer to **Table 1**.
LT = lifetime (yrs), 70 yrs. Refer to **Table 1**.
EF_{rr} = exposure frequency (days/year), 150 days/year. Refer to **Table 1**.
ED_{rr} = exposure duration (years), 25 years. Refer to **Table 1**.
ET_{rr} = exposure time (hours/day), 4 hours/day. Refer to **Table 1**.
IUR = inhalation unit risk $(\mu g/m^3)^{-1}$. Chemical specific, refer to **Table 2**.
RfC = reference concentration (mg/m^3). Chemical specific, refer to **Table 2**.

Then, the calculated outdoor air concentration is converted to an applicable Preliminary RBSL using a mass balance approach. This scenario involves a worker being exposed to vapors coming from a point source (groundwater from a hose) rather than an area source. There are no equations in the American Society for Testing and Materials (ASTM) E1739-95 Risk Based Corrective Action that apply for this scenario. Therefore, we utilized a simple mass balance approach utilizing a conservative assumption of 100% volatilization. Refer to **Appendix E-4** for more details on the mass balance modifications and assumptions. The calculated acceptable outdoor air screening level concentration is converted to an applicable Preliminary RBSL via the following equation:

$$RBSL_{rr-gw}\left[\frac{\mu g}{L}\right] = \frac{SL_{rr-air}\ x\ U_w\ x\ H_m\ x\ W}{Q_w}$$

Where:
U_w = wind speed (m/s). Assumption of 4.69 m/s, refer to **Table 1**.
H_m = ambient air mixing zone height (m). Assumption of 2 m, refer to **Table 1**.
W = work area width perpendicular to wind direction (m). Assumption of 6.096m (20 ft), refer to **Table 1**.

Q_w = groundwater extraction rate (L/s). Assumption of 0.31542 L/s (5 gallons per minute), refer to **Table 1**.

Combined Exposure Routes

For volatile COPCs, combined dermal and inhalation RBSLs are calculated. For carcinogenic effects, the Industrial Non-Potable Water User RBSLs ($RBSL_{comb_rr(c)}$) are calculated as:

$$RBSL_{comb_rr(c)}\left[\frac{\mu g}{L}\right] = \frac{1}{\frac{1}{RBSL_{org_derm(c)}} + \frac{1}{RBSL_{dir_inhal_rr(c)}}}$$

For non-carcinogenic effects, the Industrial Non-Potable Water User RBSLs ($RBSL_{comb_rr(nc)}$) are calculated as:

$$RBSL_{comb_rr(nc)}\left[\frac{\mu g}{L}\right] = \frac{1}{\frac{1}{RBSL_{org_derm(nc)}} + \frac{1}{RBSL_{dir_inhal_rr(nc)}}}$$

Refer to **Appendix E-2, Table C1** for exposure assumptions, **Appendix E-2, Table C2** for carcinogenic calculations, **Appendix E-2, Table C3** for non-carcinogenic calculations, and to **Appendix E-2, Table C4** for a summary of the calculated preliminary RBSLs for the Resource Restoration / Industrial Non-Potable Water User.

The lowest of the carcinogenic (based on a target cancer risk of 1E-6) and non-carcinogenic combined direct contact screening levels was selected as the preliminary RBSLs for the Resource Restoration/Industrial Non-Potable Water User scenario (refer to **Table 4**). The point of compliance for these RBSLs is the entire CPA Area.

3.5 Exposure Pathways of Concern

The preliminary RBSLs (calculated based on a Target Risk of 1E-6 or a noncancer THQ of 1.0, refer to **Table 4**) were screened against the CPA groundwater database (**E-Attachment #1A**) to identify potential pathways and exposures of concern.

For the potential on-site receptors below, the possibility of exposure is sitewide (i.e., CPA). Therefore, the Point of Compliance is the entire Site, and the preliminary RBSLs apply to the entire study area.

- On-Site Industrial Worker: COPCs in shallow and intermediate groundwater across the TPA Property were compared to the preliminary RBSLs (VISLs).
- On-Site Utility Worker: COPCs in shallow and intermediate groundwater across the TPA Property were compared to the preliminary RBSLs.
- Resource Restoration: COPCs in shallow and intermediate groundwater across the TPA Property were compared to the preliminary RBSLs.

For the potential off-site receptors below, the Point of Compliance for the groundwater is at the shoreline.

- Off-Site Recreational User (Fish and Crab Ingestion): COPCs in shallow and intermediate groundwater from shoreline locations were compared to the preliminary RBSLs.
- Ecological Receptors: COPCs in shallow and intermediate groundwater from shoreline locations were compared to the preliminary RBSLs.

Based on the Points of Compliance, groundwater analytical results were screened against the Preliminary RBSLs for each of the groundwater COPCs (as identified in **Section 3.2**).

COPC exceedances of the preliminary RBSLs by receptor are included in **Table 5**.

3.6 Final Remedial Goals

As discussed in **Section 3.2**, groundwater COPCs were initially identified by comparing the maximum concentration (for compounds detected in groundwater at a frequency of more than 5%) to the drinking water MCLs (Steps 1a and 1b) or the USEPA Regional Screening Level (RSL) for tap water (Step 1c), assuming a Target Risk (TR) of 10^{-6} and Target Hazard Quotient (THQ) of 0.1.

In Step 2 of the screening process, all groundwater results for these COPCs were screened against the Preliminary RBSLs (as discussed in **Section 3.4**) in **E-Attachment #1A**. The following parameters exceeded the preliminary RBSLs and were retained as groundwater COPCs:

VOCs	SVOCs	Metals	Other
4-Chloroaniline	1,1-Biphenyl	Arsenic	Cyanide
Benzene	2-Methylnaphthalene	Chromium VI	
Ethylbenzene	Benz[a]anthracene	Iron	
Toluene	Benzo[a]pyrene	Manganese	
Xylenes	Benzo[b]fluoranthene	Vanadium	
	Benzo[k]fluoranthene		
	bis(2-Ethylhexyl)phthalate		
	Chrysene		
	Dibenz[a,h]anthracene		
	Indeno[1,2,3-c,d]pyrene		
	Naphthalene		
	Pentachlorophenol		
	Pyrene		

In order to focus the evaluation on those COPCs that contribute significantly to cancer risk or noncancer hazard under each receptor scenario, Final RGs were developed via a conservative cumulative risk evaluation. In Step 3, cumulative hazard and risk estimates were calculated for each receptor, using the Preliminary RBSLs and the maximum detected groundwater concentration of each COPC in the CPA. Refer to **Appendix E-5, Table A** for the maximum concentrations identified in groundwater. Noncancer hazard estimates were broken down by target organ. The hazard and risk estimates for the on-site receptors based on maximum groundwater concentrations are presented in **Table 6** and **Table 7**, respectively. The maximum concentrations were used to identify which COPCs significantly contribute to the noncancer hazard and/or cancer risk for each receptor. COPCs with a calculated incremental lifetime cancer risk (ILCR) of greater than 1E-5 or that contribute to a HI greater than 1 for any exposure pathway (based on maximum groundwater concentrations) were identified as the COCs driving hazard and/or risk at the Site.

- As shown on **Table 6**, there were several COPCs where maximum groundwater concentrations exceeded a single-chemical THQ of 1 or significantly contributed to an exceedance of a cumulative HI of 1, including VOCs (benzene, toluene, xylenes), SVOCs (benzo(a)pyrene, naphthalene, 2-methylnapthalene) and inorganics (cyanide).
- As shown on **Table 7**, there are two VOCs (benzene and ethylbenzene), six SVOCs (benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, bis(2-ethylhexyl)phthalate, dibenz[a,h]anthracene, and naphthalene) and two inorganic constituents (chromium VI and arsenic) that were detected in groundwater at concentrations exceeding a single-chemical ILCR of 1E-5 when rounded to one significant digit.

In Step 4, Final RGs were established for each of the COCs identified above by reducing the maximum groundwater concentration for each receptor scenario at the applicable point of compliance until the following conditions were met (Step 4):

1. The estimated ILCR associated with any individual COC (assuming groundwater concentrations are equal to the Final RGs) is at or below 1E-5 (rounded to one significant figure);
2. The estimated cumulative noncancer hazard to each receptor is within the USEPA acceptable range (i.e., a Hazard Index of 1 for each individual target organ); and
3. The estimated cumulative ILCR to each receptor falls within the USEPA acceptable risk range (i.e., a cumulative excess cancer risk of less than 1E-4).

Tables 6 and **7** also present the cumulative hazard and risk estimates for each on-site receptor scenario based on estimated groundwater concentrations equivalent to the Final RGs. These groundwater concentrations were set to not exceed cumulative acceptable cancer risk or hazard. Final RGs were not calculated for COPCs that do not significantly contribute to noncancer hazard and/or cancer risk.

The same process was utilized for the off-site exposure scenarios (i.e., recreational user and for protection of water quality and ecological receptors), where an additional set of Final RGs were developed that are applicable to groundwater conditions at perimeter well locations. Specifically, in Step 3 of the process, COPCs were screened against Ecological criteria at shoreline wells.

Cumulative hazard and risk estimates for the Off-Site Recreational receptor were calculated as discussed above using the maximum groundwater concentrations observed in the perimeter wells. These calculations are shown in **Tables 8 and 9**, respectively As shown on **Table 9**, there were four constituents with maximum groundwater concentrations in perimeter wells with the potential to impact the Off-Site Recreational User population at an estimated ILCR of 1E-5, including one VOC (benzene), two SVOCs (benzo(a)pyrene and naphthalene), and one inorganic constituent (arsenic).

The Ecological RBSLs were compared to the risk-based Final RGs for protection of the Off-Site Recreational User receptor. Where the Ecological RBSL was lower than the Final RG for the Off-Site Recreational User receptor, the lowest of the estimated groundwater concentrations required to achieve compliance with applicable potential exposures of Off-Site Recreational Users and Ecological receptors was selected as the proposed Final RG.

The Final Sitewide RGs and Shoreline RGs are included in **Table 10**. Refer to **Appendix E-5** for Final RG calculations, as follows:

- **Appendix E-5, Table B1** for the carcinogenic and non-carcinogenic VISLs for the On-Site Industrial Worker.
- **Appendix E-5, Table C1** for exposure assumptions, **Appendix E-5, Table C2** for carcinogenic calculations, and to **Appendix E-5, Table C3** for non-carcinogenic calculations for the On-Site Utility Worker.
- **Appendix E-5, Table D1** for exposure assumptions, **Appendix E-5, Table D2** for carcinogenic calculations, and to **Appendix E-5, Table D3** for non-carcinogenic calculations for the Off-Site Recreational User.

- **Appendix E-5, Table E1** for exposure assumptions, **Appendix E-5, Table E2** for carcinogenic calculations, and to **Appendix E-5, Table E3** for non-carcinogenic calculations for the Resource Restoration / Industrial Non-Potable Water User.

Refer to **E-Attachment #1B** for the complete groundwater database used for the CSM evaluation for comparison with the Final RGs.

3.6.1 Cyanide

As discussed in **Section 3.2**, groundwater cleanup levels (including the MCL, the VISL, and AWQC) are based on free or available cyanide. Historic groundwater sampling was conducted for total cyanide. In 2017, a supplemental cyanide investigation was conducted across the entire TPA property (although largely focused on wells outside of the CPA area); available cyanide was sampled in wells that had exhibited elevated total cyanide. The results indicated that a very small fraction of the total cyanide in groundwater is present in the form of available cyanide *Supplemental Cyanide Investigation* (ARM, 2017).

Refer to **Table 11** for all available cyanide results from the CPA. All exceedances of the Sitewide and / or Shoreline Final RGs are based on total cyanide results. For some wells, amenable cyanide results are also available based on additional sampling conducted in July 2020:

- CP22-MWS:
  - Total cyanide: 95.6 µg/L
  - Amenable cyanide: 10 U µg/L
- CP24-MWI:
  - Total cyanide: 87.1 µg/L
  - Amenable cyanide: 10 U µg/L

It also appears that only a very small fraction of the total cyanide in groundwater is present in the form of available cyanide for monitoring wells within the CPA as well. Based on the *Supplemental Cyanide Investigation* (ARM, 2017) and the 2020 CPA results, cyanide has not been retained as a COC.

3.6.2 Hexavalent Chromium

Historically, hexavalent chromium was often analyzed via USEPA Method 7196A, which uses a colorimetric process and is therefore biased high for cloudy or colored water samples. At other locations within the TPA Property, follow up analysis using USEPA Method 7199 has resulted in lower detections for hexavalent chromium. In addition, the 2016 results associated with Parcel B18 identified lab blank contamination in samples with exceedances, with a maximum concentration of 5,700 B µg/L in B18-070-PZ. During the 2024 Supplemental Investigation, a new monitoring well (B18-070R-MWS) was installed and resampled (refer to **Section 4.1**); hexavalent chromium was not detected above the laboratory reporting limit of 50 U µg/L (the method detection limit was 15 µg/L). When reviewing groundwater exceedances for hexavalent

chromium, all were from samples collected via USEPA Method 7196A or were identified with a 'B' lab blank contamination qualifier. Therefore, chromium VI has not been retained as a COC.

3.7 Potential Soil Sources

Soil screening levels (SSLs) were calculated for each of the groundwater COCs to identify soil impacts that could be a continuing source of cross-media transfer of contaminants to groundwater at concentrations that could exceed the groundwater target levels for each receptor. **Figure 16** presents the location of all soil sampling conducted across the CPA since 2016.

SSL calculations are included in **Section 7.2**.

4.0 2024 AND 2025 SUPPLEMENTAL INVESTIGATION

In 2024, additional wells were installed, and additional samples were collected, to fill data gaps and provide additional information in key locations. A discussion of the results from the 2024 Supplemental Investigation is included in **Section 4.1 through 4.4**. Refer to **Appendix F-1** for the well installation logs.

In December 2024, seven soil borings (B10-023-SB through B10-029-SB) were installed to further delineate a distinct intermediate clay layer in the vicinity of Cells 1, 2, and 6. Refer to **Appendix F-2** for the soil boring logs and to **Section 6.2.2** for a discussion of the soil boring observations.

In 2025, additional groundwater sampling was conducted for SVOCs and metals in accordance with the *CPA CMS – Data Gap Sampling Work Plan* (ARM, 2025c). Additional offshore sampling was also conducted by EA Engineering, Science, and Technology, Inc (EA) in accordance with the *Proposed Sampling Plan for Supplemental Sampling of Coke Point Area Sediment, Surface Water, and Pore Water* (EA, 2025a).

Refer to **E-Attachment #3** for the laboratory reports associated with the 2024 and 2025 sampling activities. Refer to **E-Attachment #4** for a summary of groundwater field parameters observed during groundwater sampling.

4.1 Additional Groundwater Sampling and Delineation (2024)

Additional samples were collected from multiple wells that had not been sampled in 4-5 years:

- CO02-PZM041, CO05A-PZM, CO08A-PZM, CO18-PZM006, CO19-PZM004, CO88-PZM, CO100-PZM, CO121-PZM, CO152-PZM, CO159-PZM, CO167-PZM, CO184-MWI, CO185-MWI, CO187-MWS, CO188-MWI, CO189-MWS, CO193-MWI, CO212-MWS, CO213-RW, CO214-RW, CO215-RW, and CP20-PZM011

Refer to **Table 12** for the full VOC and SVOC sampling results, **Table 13** for metals results, and **Table 14** for BTEX plus naphthalene results only. The results have been incorporated into the groundwater database (**E-Attachment #1A** and **#1B**) and into the tables referenced in **Section 6.0**.

Twelve additional wells were installed, including wells installed for additional delineation purposes and wells installed in key locations where wells no longer exist. The monitoring wells were installed in 2024 as follows:

- COA-MW-001: adjacent to historical location B18-082-PZ where LNAPL was previously observed in 2018 / 2019
- COA-MW-002: delineation between Cell 6 and Parcel B18 tank area
- COA-MW-003: delineation to the west / southwest of COA-MWS-004
- COA-MWS-004 / COA-MWI-004: delineation to the southwest of CO08-PZM005 / CO08-PZM036 well pair
- COA-MWI-006: delineate intermediate groundwater impacts between Cells 1, 2, and 6

- COA-MWI-007: delineate intermediate groundwater impacts to the east of Cell 2
- COA-MWI-009: delineate intermediate groundwater impacts between Cells 2 and 3
- COA-MWI-011: adjacent to historical results at CO127-WS
- COA-012-MWS: NAPL delineation to the northwest of Cell 6
- COA-013-MWS: NAPL delineation to the northwest of Cell 6
- B18-070R-MWS: reinstallation of B18-070-MWS which had an elevated hexavalent chromium result in 2016
- Wells planned at COA-MWI-005 and COA-MWI-008 were not installed due to thick clay layer identified (no sand zone identified for an intermediate well screen).

Refer to **Figure 17** for the locations of these new monitoring wells, to **Tables 12, 13, and 14** for the sampling results (where applicable), and to **Appendix F-1** for the well installation logs. Installation and sampling of COA-MW-001 indicated no observation of LNAPL (supporting the results of the previously completed test pit, COA-003-TP, in which LNAPL was not observed. Refer to **Figure 18**). In 2016, hexavalent chromium groundwater results associated with Parcel B18 identified lab blank contamination in samples with exceedances, with a maximum concentration of 5,700 B µg/L in B18-070-PZ. New monitoring well B18-070R-MWS was installed and resampled in 2024; hexavalent chromium was not detected above the laboratory reporting limit of 50 U µg/L (the method detection limit was 15 µg/L). Total chromium was detected at 9.062 µg/L. Hexavalent chromium is not a COC for this CPA CMS.

4.2 NAPL Summary

Regular NAPL gauging and removal (where possible) has been conducted in 2023 and 2024. In late 2024, the following locations consistently demonstrated NAPL thickness of more than one inch:

- Southeast of Cell 6: COA-007-TP, COA-015-TP, and COA-016-TP
- Northwest of Cell 6: CO173, CO174, COA-005-TP, COA-012-TP (although there has been a significant decrease in this location), COA-013-TP, COA-013-MWS
- Further northwest of Cell 6: B10-014-SB/PZ, COA-027-TP
- Other Locations: ‘Cell 6 east’ and B10-013-SB. NAPL is very viscous in both locations, and difficult to gauge and / or remove.

In 2024, NAPL samples were collected from locations to the southeast of Cell 6 (COA-007-TP, COA-015-TP, and COA-016-TP), to the northwest of Cell 6 (CO173, COA-013-TP, COA-013-MWS), and further north of Cell 6 (B10-014-SB/PZ, COA-027-TP, COA-028-TP). Samples were also collected in 2022 from COA-004-TP, COA-005-TP, COA-007-TP, and CO173:

- Southeast of Cell 6: naphthalene concentrations between 73,000 milligrams per kilogram (mg/kg) and 120,000 mg/kg (between 7.3 and 12% naphthalene), and lower concentrations of benzene (between 2,800 mg/kg and 28,000 mg/kg, or between 0.28 and 2.8% benzene)
- Northwest of Cell 6: benzene concentrations between 1,200 mg/kg and 82,000 mg/kg (between 0.12 and 8.2% benzene), and lower concentrations of naphthalene (between 4,100 mg/kg and 28,000 mg/kg, or between 0.41 and 2.8% naphthalene). The maximum benzene concentrations were at CO173 (between 5.3 and 7.5%) and COA-013-MWS (8.2%).
- Further northwest of Cell 6: lower concentrations of both benzene (between 430 mg/kg and 13,000 mg/kg, or between 0.04 and 1.3% benzene) and naphthalene (between 7,800 mg/kg and 13,000 mg/kg, or between 0.78 and 1.3% naphthalene).

Refer to **Figure 18** for test pit and monitoring well locations associated with the NAPL characterization activities. Refer to **Table 15** for NAPL characterization results.

In November 2024, enhanced fluid recovery (EFR) was conducted at COA-013-MWS. Initial NAPL thickness was 3.08 feet; approximately 120 gallons (estimated to be half NAPL) were removed from the well; the NAPL thickness after 24 hours was 3.11 feet.

NAPL transmissivity testing was initiated at locations COA-013-MWS and B10-014-SB/PZ in December 2024. During the initial NAPL removal (via bailer and submersible pump), NAPL recharge at COA-013-MWS was such that the NAPL thickness could not be reduced to less than 25% of the original measured thickness. For COA-013-MWS, the pre-NAPL removal thickness was 3.08 feet; after approximately 2 hours of NAPL removal via submersible pump, the NAPL thickness remained at approximately 2.5 feet. After 24 hours, the NAPL thickness at COA-013-MWS was 2.70 ft. At B10-014-PZ, the pre-NAPL removal thickness was 1.07 feet; approximately 5 gallons of NAPL were removed, and the NAPL thickness was 0.17 ft (approximately 15% of the original thickness). After 2 hours, the NAPL thickness was 1.07 ft (approximately 92% of the original thickness).

Based on these results and the historical recovery at CO173, NAPL at these three locations (CO173, COA-013-MWS, and B10-014-SB/PZ) is recoverable. Based on historical NAPL EFR events and recovery to the southeast of Cell 6 (COA-007-TP, COA-015-TP, and COA-016-TP), NAPL in this area is likely recoverable. Based on historical NAPL EFR events and recovery to the northwest of Cell 6 (COA-005-TP, COA-012-TP, COA-013-TP), NAPL in this area is recoverable.

4.3 MNA AND MICROBIAL SAMPLING (2024)

Groundwater samples were collected from select monitoring wells for monitored natural attenuation (MNA) parameters and / or microbial parameters to assess current conditions:

- MNA Parameters: CO02-PZM041, CO05A-PZM CO18-PZM006, CO152-PZM, CO188-MWI, CO194-MWS, CO206R-MWS, CO212-MWS, CP20-PZM011

- Microbial: CO02-PZM041, CO18-PZM006, CO152-PZM

Well locations were selected based on proximity to known and potential sources, interim measure systems, and NAPL removal locations. The microbial sampling analysis was conducted by SiREM and included targeted analyses of genes that are indictive of varying degradation pathways. Per recommendations by SiREM, groundwater samples were not submitted for microbial analysis if the observed pH was at or above 10 s.u.. The analyses included the following:

- Aerobic degradation processes for BTX and naphthalene
    - Test ID: Catechol Dioxygenase, Naphthalene Dioxygenase, Xylene Monooxygenase, Toluene Dioxygenase
- Anaerobic degradation processes for BTX and naphthalene
    - Test ID: Sulfate Reducing Bacteria, Candidatus Benzenivorax ORM2, Peptococcaceae, Benzene Carboxylase, Benzylsuccinate Synthase DGG-X, Total Prokaryotes

Refer to **Table 16** for the sampling results. The results are discussed in the respective GAA sections: GAA A (**Section 6.1.3.2**), GAA B (**Section 6.2.3.4**), GAA E (**Section 6.5.3.2**), and GAA F (**Section 6.6.3.2**).

4.4 Shoreline Groundwater Sampling (2024)

A review was conducted of shoreline groundwater monitoring results compared to the shoreline receptors (Off-Site Recreational User and ecological receptors). There were seven exceedances in locations outside of active remediation cells; groundwater results in these wells were generally limited to BTEX plus naphthalene only, and in five of the seven wells, were last sampled in 2020 or prior. Additional samples were collected from the following wells for VOCs, SVOCs, and MNA parameters:

- CO29-PZM010, CO209-MWS, CO209-MWI, CO210-MWS, CO210-MWI, CP22-MWS, CP23-MWS

Refer to **Table 16** for the MNA results and to **Table 17** for the VOC and SVOC sampling results. The results have been incorporated into the groundwater database (**E-Attachment #1A** and **#1B**) and into the tables referenced in **Section 6.0**.

4.5 Groundwater Sampling (2025)

A review of historical sampling was conducted as part of the CPA CMS. It was noted that minimal metals data was available from within the Parcel B11 portion of the CPA. In addition, while extensive SVOC sampling has been conducted, a portion of that sampling (largely within Parcel B11) was conducted in 2015. Additional sampling was conducted in accordance with the *CPA CMS – Data Gap Sampling Work Plan* (ARM, 2025c).

Metals sampling was conducted from 43 existing monitoring wells, and SVOC sampling was conducted from eight existing monitoring wells. Two wells were unable to be sampled in accordance with the Work Plan: CO07-PZM050 was damaged and CO37-PZM038 was buried by fill. Refer to **Table 18** for the 2025 SVOC results and to **Table 19** for the 2025 metals results. All results have been incorporated into the groundwater database (**E-Attachment #1A** and **#1B**), and the SVOC results have been added into the tables and figures referenced in **Section 6.0**. The metals results are discussed further in **Section 6.7**.

4.6 OFFSHORE SAMPLING (2025)

As part of the *CPA CMS – Southern Shoreline Risk* (ARM, 2025b), groundwater results from along the southern and southwestern perimeter wells were evaluated (specifically for PAHs) to determine if additional pore water, surface water, and sediment samples will be required in these areas.

There were no exceedances for the southern and southwestern shoreline monitoring wells of the Preliminary RBSLs for Ecological Receptors; therefore the focus was on the Off-Site Recreational User scenario. Cumulative cancer risk was calculated for each of the perimeter wells based on the most recent sampling results. Each well represents a segment of the shoreline to identify if any segment might present a risk greater than 1e-5 to the Off-Site Recreational User. None of the individual wells presents a cumulative risk greater than 1e-5. Based on a well-by-well evaluation, there are no unacceptable risks to the recreational user or ecological receptor based on the current perimeter well concentrations.

As a secondary assessment, 95% upper confidence limits (UCLs) were considered as the UCLs may be more representative of the perimeter wells as a group, since the fish and the recreational user are mobile and may move along the shoreline. The cumulative cancer risk for southern shoreline wells was 7E-6, below the Target Risk of 1E-5. Based on evaluation of the southern shoreline as a whole, there are no unacceptable risks to the recreational user or ecological receptor based on the current perimeter well concentrations.

As the current perimeter well concentrations do not present an unacceptable risk to the recreational user or ecological receptor, offshore sampling along the southern and southwestern shore of the CPA is not warranted. Refer to **Appendix D-4** for the complete report.

Offshore sampling along the western CPA shoreline was proposed in the *Proposed Sampling Plan for Supplemental Sampling of Coke Point Area Sediment, Surface Water, and Pore Water* (EA, 2025a). A discussion of the field work and the associated results is included in the *Supplemental Sampling of Coke Point Area Sediment, Surface Water, and Pore Water Results* (EA, 2025b); the report is included in **E-Attachment #7**. Based on field conditions and in accordance with the approved Sampling Plan, sediment and pore water samples were not collected at multiple locations due to identified sheen and evidence of NAPL. Attempts to collect pore water samples in areas with no sheen were unsuccessful due to the composition of the sediment (organic clay and fine silt). Overall, two sediment samples and 11 surface water samples were collected in February 2025 off the western CPA shoreline.

2025 sediment results are included in **Appendix D-1, Table A2**, and were compared to the USEPA Region 4 Sediment Screening Values for Hazardous Waste Sites, Table 2A for Non-Narcotic Modes of Action (marine) and Table 2B for Narcotic Modes of Action (marine) (Ecological Risk Assessment Supplemental Guidance, March 2018) and the USEPA Region III BTAG Marine Screening Benchmarks (July 2006). There were no VOC exceedances. There were multiple PAH exceedances in both sediment samples (CP-2025-04-SD and CP-2025-07-SD), although the PAH results in CP-2025-04-SD were generally one to two orders of magnitude above the PAH results in CP-2025-07-SD. In addition, sediment samples were not collected in multiple locations due to observed sheen and evidence of NAPL. CP-2025-04-SD was collected offshore from the southern shoreline of the Cell 3 cove, closest to the CP23-MWS/MWI well pair. CP-2025-04-SD was collected from the western shoreline, between well pairs CO209-MWS/MWI and CO29-PZM010/CO29-PZM051. In December 2024, SVOC samples were collected from shoreline monitoring wells CO209-MWS, CO209-MWI, CO29-PZM010, and CP23-MWS. NAPL or sheen was not identified in any of the wells. With the exception of naphthalene, there were no PAH exceedances of the Preliminary RBSLs for the Off-site Recreational User or for Ecological Receptors (refer to **Table 17**). The majority of PAH compounds were not detected above the laboratory reporting limits. The sheen and elevated PAH concentrations identified in sediment samples are consistent with historic direct deposition from offshore sources, and not with groundwater concentrations along the western CPA shoreline.

2025 surface water results are included in **Appendix D-2, Table A5**, and were compared to applicable surface water screening levels for ecological receptors. There were no VOC exceedances. There were three PAH exceedances in CP2025-03-SW-A (located off the western CPA shoreline, to the west of Cell 3), including benzo[a]pyrene (0.03 J µg/L), benzo[b]fluoranthene (0.17 µg/L), and indeno[1,2,3-cd)pyrene (0.09 J µg/L). The exceedances were only slightly above the applicable surface water screening levels. CP2025-03-SW-A is located offshore from well pair CO210-MWS/MWI. In December 2024, SVOC samples were collected from shoreline monitoring wells CO210-MWS and CO210-MWI. With the exception of naphthalene, there were no PAH exceedances of the Preliminary RBSLs for the Off-site Recreational User or for Ecological Receptors (refer to **Table 17**). Benzo[a]pyrene, benzo[b]fluoranthene, and indeno[1,2,3-cd)pyrene were not detected above the laboratory reporting limits (although SIM PAH was unable to be analyzed at CO210-MWS due to the elevated naphthalene concentration). If the surface water mixing / attenuation factor of 121 identified in **Section 3.4.2.1** was applied, the surface water exceedances would equate to shoreline groundwater concentrations as follows: benzo[a]pyrene (3.63 µg/L), benzo[b]fluoranthene (20.57 µg/L), and indeno[1,2,3-cd)pyrene (10.89 J µg/L). PAH concentrations were not detected above these values in shoreline monitoring wells along the western shoreline, indicating that surface water impacts are not due to groundwater concentrations along the western CPA shoreline.

5.0 HISTORICAL INTERIM MEASURES ACROSS COKE POINT AREA

5.1 CELL 1

Cell 1 is located immediately west of Cell 6 and includes the use of an air sparging/soil vapor extraction (AS/SVE) system for the removal of VOCs from shallow zone groundwater in the Former Benzol Processing Area. Approximately 16,735 lbs of VOCs have been removed through 2024, although recovery rates have declined since the IM was implemented in 2010 (with 76 lbs of VOCs removed in 2024). Refer to **Table 20** for a summary of removal volumes.

5.2 CELL 2

Cell 2 is located in the former Coal Dock Basin Area, to the northwest of Cells 1 and 6. The Cell 2 IMs historically included the use of an AS/SVE system designed to address shallow groundwater impacts and a groundwater pump and treat (GWPT) system designed for hydraulic control and the removal of VOCs from intermediate zone groundwater. The AS/SVE system ceased operation in early 2019 when groundwater elevations rose above the vapor extraction trench level. Between system startup in 2014 and 2019, the AS/SVE system removed 282 lbs of VOCs.

The GWPT system removed approximately 38,232 lbs of VOCs from the Cell 2 area between 2014 and 2024. The GWPT system did not operate in 2023, while an assessment of the system's effectiveness and necessity was undertaken. System restart was delayed due to the Key bridge emergency recovery operations performed over the Cell 2 area. Based on Agency request, the Cell 2 GWPT system was restarted in 2024 as soon as the recovery work was completed. Refer to **Table 20** for a summary of VOC removal volumes.

5.3 CELL 3

Cell 3 is located southwest of the former Benzol Processing area and north of a cove on the western shore of the COA. Cell 3 IMs include the operation of an AS/SVE system for the removal of VOCs from shallow zone groundwater. The AS/SVE system removed approximately 26 lbs of VOCs in 2023, and an estimated 2,346 lbs of VOCs have been removed between 2012 and 2024. Refer to **Table 20** for a summary of removal volumes. Modifications to the system to optimize mass removal will be evaluated as part of this CPA CMS.

5.4 CELL 4

5.4.1 Cells 4 Historical IM

The remediation approach at Cell 4 included the use of pneumatic pumps to recover high-naphthalene dense non-aqueous phase liquid (DNAPL) from the shallow zone groundwater. The DNAPL recovery pumps removed approximately 1,586 gallons of DNAPL between 2015 and January 2023. DNAPL is contributing to the downgradient groundwater impacts that are being addressed by Cell 5. Refer to **Table 20** for removal volumes.

5.4.2 Cell 4 Source Remediation

In 2023, excavation activities were conducted at Cell 4 to maximize source (mass) removal and toxicity reduction and reduce impacts on the downgradient groundwater quality. Excavation activities were undertaken between January and June 2023, with backfilling performed in October and November 2023. The excavation was advanced to approximately 22 ft bgs, and 18,165 tons of impacted material (approximately 336,000 lbs of naphthalene) were removed and disposed at Greys Landfill (*Cell 4 DNAPL Excavation Report*, ARM, 2024d). Refer to **Figure 29G** for excavation extents. As the excavation progressed, samples were collected from the groundwater within the excavation between March and June 2023. Benzene results decreased from a maximum of 56 µg/L to 6.6 µg/L, while naphthalene results decreased from a maximum of 450 g/L µg/L to non-detect at 1.0 µg/L. These results indicate source removal in the immediate Cell 4 area.

Quarterly groundwater gauging and sampling is ongoing, with results most recently reported in the *Cell 4 Semi-Annual Groundwater Sampling Report, 2nd and 3rd Quarter 2024* (ARM, 2024k).

5.5 Cell 5

The Cell 5 remediation system (located southeast of Cell 4) includes the use of a dual-phase extraction (DPE) system to extract VOC-impacted groundwater and soil vapor from the shallow zone groundwater. Concurrent with the Cell 4 excavation, the system was upgraded with the intent to enhance final operations prior to system shutdown. In March 2023, eight of the original DPE wells were replaced with new extraction wells constructed with deeper screen intervals to more effectively target the removal of naphthalene-impacted groundwater. Approximately 2,545 lbs of VOCs have been removed since system startup in 2014 through the end of 2024 (system remains operational through 2025). Refer to **Table 20** for removal volumes.

5.6 Cell 6

5.6.1 Cell 6 Historical IMs

Cell 6 is located in the former Benzol Processing Area, approximately 500 feet east of Cell 1 and 1,000 feet southeast of Cell 2. The originally designed IMs for Cell 6 included the use of a light non-aqueous phase liquid (LNAPL) MPE system with catalytic oxidizer (CatOx) and/or carbon off-gas treatment units. The MPE system removed 7,643 gallons of LNAPL between startup and 2023 (in addition to 16,162 gallons removed between 2010 and 2019 via manual skimming and bailing). However, manual LNAPL recovery continued at location CO173, with 8,819 gallons removed between 2020 and 2024. Refer to **Table 20** for a summary of LNAPL removal volumes. Source remediation conducted at Cell 6 in 2023 and 2024 is discussed in **Section 5.2**.

5.6.2 Cell 6 Source Remediation

The *COA Cell 6 Hotspot Excavation Work Plan* (ARM, 2022b) and the *COA Cell 6 Pilot Test Work Plan, Revision 1* (ARM, 2023a), and respective comment response letters were submitted to the Agencies, proposing "hotspot" excavation and treatment for the remaining areas with more than 1-

foot of LNAPL within the Cell 6 MPE system recovery field, in order to maximize and expedite source mass removal. A pilot test was performed in November 2023 to assess the use of sodium persulfate and hydrogen peroxide to reduce the benzene concentrations in LNAPL impacted soils, with results presented in the *COA Cell 6 Pilot Test Status Update – Revision 1* (ARM, 2024b). An expanded pilot test was conducted in February 2024 to further evaluate hotspot removal/treatment for the residual NAPL within the Cell 6 MPE system recovery field (*Cell 6 Expanded Pilot Test Report (Revision 1),* ARM, 2024f). Full scale removal and treatment was conducted in May 2024, with results presented in the *Cell 6 Hotspot Removal / Treatment Final Report* (ARM, 2024i). A total of 628 CY of LNAPL impacted material was excavated, treated where necessary, and transported to Greys Landfill for disposal. The remaining levels of NAPL within the Cell 6 MPE area are all less than 1-foot and in most cases are less than 0.08 feet.

Approximately 4,965 gallons of LNAPL were recovered from the multiple test pits in the vicinity of Cell 6 between 2022 and 2024, including:

- Cell 6 Northwest Area test pits (COA-005-TP, COA-012-TP, COA-013-TP, COA-027-TP)
- Cel 6 Southeast Area test pits (COA-007-TP, COA-015-TP, COA-016-TP, COA-026-TP)
- Cell 6 excavation areas

Refer to **Table 20** for a summary of removal volumes.

5.7 Other Remedial Activities

5.7.1 Parcel B18

In accordance with the *Parcel B18 Lead Excavation Work Plan* (ARM, dated January 20, 2022a), excavation activities were performed to address known areas of lead impacted soil in the vicinity of B18-043-SB, specifically soil with lead results above 10,000 milligrams per kilogram (mg/kg), the Adult Lead Model (ALM) value threshold of 2,517 mg/kg or Toxicity Characteristic Leaching Procedure (TCLP) lead results above 5 milligrams per liter (mg/L). The excavation was conducted in various phases between May 2022 and March 2024, with updates and results provided in the *Parcel B18 Lead Excavation Completion Report* (Revision 2 dated August 1, 2023), the *Parcel B18 Lead Excavation Letter* (Revision 0 dated April 18, 2024), and the *Parcel B18 Lead Excavation Stockpile Letter* (Revision 0 dated August 28, 2024). The final extent of the B18 lead excavation area is approximately 1,618 square feet, with a maximum depth of 8 feet bgs and a total excavated volume of approximately 412 CY. Portions of the excavated soil were treated with TerraBond® due to the elevated TCLP Lead concentrations prior to disposal at Greys Landfill (*Parcel B18 Lead Excavation Stockpile Treatment Letter* (Revision 0 dated November 6, 2024)).

5.7.2 Northern Container Terminal

Following the Container Terminal Phase II field work, additional remedial activities were conducted along the northern Container Terminal footprint. In November 2023, test pit CT-006-

TP was completed (adjacent to CO05D-PZM with known NAPL impacts) to a depth of 12 ft bgs, with NAPL observed at 10 ft bgs. In September 2024, additional material was excavated along the north and west sides of this test pit; approximately 50 CY of impacted soil was excavated from CT-006-TP. In addition, hot spot excavations were conducted at CT-004 (10 ft by 10 ft by 13 ft deep, approximately 48 CY) and CT-007 (10 ft by 10 ft by 5 ft deep, approximately 20 CY).

Approximately 118 CY of impacted soil was transported to Greys Landfill for disposal from the three hot spot excavations. In 2023 and 2024, approximately 33.5 gallons of LNAPL were removed from the Northern Container Terminal Area test pits (CT-006-TP, COA-019-TP, COA-021-TP, COA-022-TP). Refer to **Section 6.4.1** for additional discussion on remedial activities in this area, and to **Table 20** for a summary of removal volumes.

6.0 CONCEPTUAL SITE MODEL

As discussed in **Section 2.1**, the Site was operational from the late 1800s until 2012 for iron and steel production. The Coke Point Area (CPA) is an approximately 344.8-acre man-made peninsula in the southwestern portion of the Tradepoint Atlantic (TPA) Property that was the location of the former coking operations from the 1940s to the early 1980s. The CPA was formed through the use of slag (a byproduct of iron and steelmaking) to expand the area beginning in the late 1930s through the operational history of the coking operations. The steelmaking operations at the facility ceased in Fall 2012, and the vast majority of the above-grade structures in the CPA have been demolished / removed / scrapped. All historical infrastructure with the potential to be a continuing source of contamination (buildings, tanks, etc.) has been removed.

Previous sampling conducted at the Site has identified the presence of VOCs, SVOCs, metals, cyanide, PCBs, and NAPL in the shallow and/or intermediate groundwater zones underlying the CPA. The groundwater data set initially used to identify the COPCs for the CPA (as discussed in **Section 3.2**) included the most recent sampling results for all wells within the CPA (both existing and abandoned wells) through August 2023.

As discussed in **Section 2.1.3.4**, cobalt, iron, manganese, and vanadium detections in groundwater are believed to be associated with the presence of extensive slag fill material at the Site. For the purpose of this CMS, these constituents will be discussed separately from the other COPCs. The nature and extent of these constituents are described in **Section 9** (Technical Impracticability).

For purposes of developing the Conceptual Site Model (CSM), the COPC groundwater database was revised/updated as follows:

- For wells that were last sampled prior to 2017 and have since been abandoned / destroyed, the well locations were reviewed to determine if the results should be retained as part of the CPA CMS groundwater database. Refer to **Appendix E-6** for a list of applicable wells and below for the rationale for retaining or excluding those results:
    - Locations within active remediation cells, or with more current results available for adjacent wells, were removed from the CPA CMS groundwater database;
    - Locations outside of active remediation areas and without more recent results in the vicinity were retained within the groundwater database; and
    - Refer to the figure in **Appendix E-6** for locations with historic results that were retained or excluded.
- 2015 VOC and SVOC data from the *Coke Point Pre-Design Investigation Summary Report, Former Coke Oven Area* (Key Environmental, 2015) were included if the monitoring wells were located in areas without more recent sampling results available; refer to **Appendix E-6** for a list of wells and the rationale for retaining or excluding those results, and to the figure in **Appendix E-6** for locations with 2015 results that were retained or excluded.

- Results from all groundwater sampling conducted between August 2023 and the end of 2024 were retained, including:
    - regular COA quarterly groundwater sampling;
    - regular CPLF semi-annual groundwater sampling;
    - 2024 supplemental sampling conducted as part of this CPA CMS.
- Results from all February 2025 supplemental sampling were included.

Refer to **Figure 14** for the locations and sample identifications (IDs) for Sitewide monitoring wells, and to **Figure 15** for the Shoreline monitoring wells. Refer to **E-Attachment #1A** and **#1B** for the complete groundwater database used for the CSM evaluation. **E-Attachment #1A** includes comparison with the Preliminary RBSLs, and **E-Attachment #1B** includes a comparison with the Final RGs. **Figure 19** summarizes the analytes constituents for each location, and the most recent date that each location was sampled. **Appendix B-1** also includes the date for the most recent sampling event by parameter for each monitoring wells, and **Appendix B-2** includes dates and parameters (by monitoring well) for all sampling rounds included in the groundwater database (**E-Attachment #1A and 1B**).

Benzene and naphthalene results from newly installed wells, and historical wells sampled in 2024, were added to the results from the CPA CMS groundwater database to generate shallow and intermediate groundwater zone isocontours. Refer to **Figures 20-23**. The following observations are noted:

- Shallow Benzene Isocontours (**Figure 20**): The shallow benzene isocontours are based on the lowest applicable Preliminary RBSL, which is the On-Site Industrial Worker value (based on VISLs) of 6.93 µg/L. The main shallow benzene plume (with concentrations more than 10,000 times the target value) is located primarily under Cell 1, just to the west of Cell 6. Impacts more than 1,000 times the target value extend northwest to Cell 2 and southwest to Cell 3 and are also present to the southeast of Cell 6 (CO08-PZM005 and COA-MWS-004). There are also several areas with benzene concentrations in shallow groundwater more than 100 times the target value: within Parcel B18 (B18-082-PZ and COA-MW-001), the northeast portion of Parcel B10 (CO05-PZM006, CO05A-PZM, CO05B-PZM)), adjacent to Cell 4 (CO25-PZM008), and in the eastern portion of Parcel B12 (CP08R-PZM008 and CP19R-PZM008).
- Intermediate Benzene Isocontours (**Figure 21**): The intermediate benzene isocontours are based on the lowest applicable Preliminary RBSL, which is the On-Site Industrial Worker value (based on VISLs) of 6.93 µg/L. The main intermediate benzene plume (with concentrations more than 10,000 times the target value) has shifted to the northwest, and is located primarily under Cell 2, and between Cells 1 and 2. Impacts more than 1,000 times the target value extend laterally in all directions, and are also present to the southeast

of Cell 6 (CO08-PZM036 and COA-MWI-004). The impacts south of Cell 6 do not appear to be connected to the main benzene plume near Cell 2.

- Shallow Naphthalene Isocontours (**Figure 22**): The shallow naphthalene isocontours are based on the lowest applicable Preliminary RBSL, which is the Resource Restoration value of 7.86 µg/L. Naphthalene is present at concentrations more than 1,000 times the target value in several isolated locations: within Parcel B18 (B18-082-PZ and COA-MW-001), the northeast portion of Parcel B10 (CO05A-PZM and CO05B-PZM)), adjacent to Cell 4 (CO25-PZM008), and at Cell 3 (CO199-MWS). Naphthalene is present in shallow groundwater at concentrations more than 100 times the target value throughout Parcel B10 and within the western portion of Parcel B18.
- Intermediate Naphthalene Isocontours (**Figure 23**): The intermediate naphthalene isocontours are based on the lowest applicable Preliminary RBSL, which is the Resource Restoration value of 7.86 µg/L. Naphthalene is present at concentrations more than 1,000 times the target value in two isolated locations: CO184-MWI / CO185-MWI and CO209-MWI, both within the northwestern portion of Parcel B10. Naphthalene is present in intermediate groundwater at concentrations more than 100 times the target value throughout the northwest portion of Parcel B10, to the south of Cell 6 (CO08-PZM036 and COA-MWI-004), and at one location along the Turning Basin (CT-037-GW-41).

Groundwater analytical results from wells across the entire Site (**Figure 14**) were compared to the Preliminary RBSLs for the applicable Sitewide receptors (On-Site Industrial Worker, On-Site Utility Worker, and Resource Restoration). Analytical results from Shoreline monitoring wells (**Figure 15**) were compared to the Preliminary RBSLs for the applicable shoreline receptors (Off-Site Recreational User and Ecological Receptors). Refer to **E-Attachment #1A**, as well as in the following tables:

- **Table 21A**: Compares groundwater results for Groundwater Assessment Area (GAA) A to Sitewide Preliminary RBSLs
- **Table 21B**: Compares groundwater results for GAA A to Shoreline Preliminary RBSLs
- **Table 22A**: Compares groundwater results for GAA B to Sitewide Preliminary RBSLs
- **Table 22B**: Compares groundwater results for GAA B to Shoreline Preliminary RBSLs
- **Table 23A**: Compares groundwater results for GAA C to Sitewide Preliminary RBSLs
- **Table 23B**: Compares groundwater results for GAA C to Shoreline Preliminary RBSLs
- **Table 24A**: Compares groundwater results for GAA D to Sitewide Preliminary RBSLs
- **Table 24B**: Compares groundwater results for GAA D to Shoreline Preliminary RBSLs
- **Table 25A**: Compares groundwater results for GAA E to Sitewide Preliminary RBSLs
- **Table 25B**: Compares groundwater results for GAA E to Shoreline Preliminary RBSLs
- **Table 26A**: Compares groundwater results for GAA F to Sitewide Preliminary RBSLs
- **Table 26B**: Compares groundwater results for GAA F to Shoreline Preliminary RBSLs

Metals are excluded from these groundwater tables. Refer to **Table 27A** for a comparison of groundwater results for metals for all wells, compared to the Preliminary RBSLs for Sitewide receptors (On-Site Industrial Worker, On-Site Utility Worker, and Resource Restoration). Refer to **Table 27B** for a summary of groundwater results for metals for shoreline wells, compared to the Preliminary RBSLs for shoreline receptors (Off-Site Recreational User and Ecological Receptors). As discussed in **Section 3.6.2**, chromium VI has not been retained as a groundwater COC.

For the purpose of analyzing data and identifying potentially applicable corrective measures, the CPA was subdivided into six GAAs. These GAAs were identified on the basis of known and potential sources and/or the presence of similar COCs (via benzene and naphthalene isocontours, and the Preliminary RBSL exceedances), inclusive of downgradient impacts. The GAA boundaries should not be interpreted as the discrete delineation of Areas of Concern and should be considered as areas over which a given corrective measure may be capable of achieving CAOs for a given source and associated environmental media contamination.

The GAAs presented here have been identified as:

- GAA A – CPLF Area
- GAA B – Former Benzol Processing Area (Cell 6 NAPL)
- GAA C – Parcel B18
- GAA D – Northeast B10 Area
- GAA E – IM Cells 4 and 5 and Container Terminal
- GAA F – Parcels B11 and B12

Refer to **Figure 24** for the general boundaries for each above GAA. Parameters exceeding the preliminary RBSLs were retained as groundwater COPCs. In **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for those groundwater COPCs. The groundwater database is compared to the Final RGs in **E-Attachment #1B**. Exceedances of the Final RGs were then identified as groundwater COCs.

Additional details and discussion on current conditions for each GAA are included below.

6.1 Groundwater Assessment Area A – Coke Point Landfill Area

6.1.1 Known and Potential Source Identification

GAA A encompasses the western portions of Parcels B11 and B12 (refer to **Figure 25A**). The land associated with the CPLF and the DMCF was reclaimed between 1971 and 1982. The CPLF, located in the western portion of Parcel B12, was historically used for the disposal of non-hazardous industrial waste materials generated during steel production activities. The DMCF, also partially within GAA A, was constructed to store dredged material from maintenance dredging operations. The circular shape of the CPLF is first visible in the 1994 aerial photograph. The groundwater within GAA A is impacted by contaminants likely associated with these activities.

6.1.2 Geology / Hydrogeology in GAA A

Within GAA A, the shallow zone is characterized primarily by an overlying slag-fill unit. This slag-fill unit is fine to coarse, poorly sorted, non-plastic, and noncohesive slag with fill gravel, and has varying thickness across GAA A. Well pair CP25-MWS/MWI is located between the CPLF and the DMCF. The slag fill unit ranges from 27-30 feet thick where data are available within GAA A (based on the CP05 well group, the CP15 well pair, and the CP24 well pair located along the western and southwestern shoreline, and the CP25 well pair located between the CPLF and the DMCF). In the central area of GAA A, a low-permeability clay unit occurs within the slag-fill unit at depths of 11-13.6 ft bgs (CP25-MWS), and 6-12 ft bgs (CP25-MWI) within the slag-fill unit. This clay unit is likely discrete and localized, as it is not observed within the slag-fill unit in other wells of GAA A.

Within GAA A, the intermediate zone is characterized by interbedded marine sand, silt and clay units. Semi-confining clay units are present within the intermediate zone, and have varying thickness and depths across GAA A. In the central area, a semi-confining clay unit extend from 28.5-35 ft bgs (CP25-MWI). This clay unit is thin and eventually pinches out to the west, with no semi-confining clay units observed in well CP24-MWI or CP05 well group (CP05-PZM boring log utilized for review). The intermediate zone at CP24 and CP05 is instead characterized by interbedded sands and silts, with a silt layer observed at CP24-MWI from 40-60 feet bgs (base of borehole), and clayey silt and silty clay at CP05 from 47-70 feet bgs and clay from 70-131 feet bgs. Along the southern shoreline a semi-confining clay unit is observed at greater depths, extending from 86-95 ft bgs (CP15-PZM042). The overall geology of GAA A is characterized by a southward dip of intermediate zone strata, and variable extent of semi-confining clay layers.

Groundwater surface elevations within both the shallow and intermediate zones are relatively flat, characterized by a very shallow hydraulic gradient. As discussed in the *Coke Point Landfill Semi-Annual Groundwater Monitoring Report Fall 2024* (ARM, 2025a), shallow groundwater flows radially out towards the shoreline; within GAA A this corresponds to a very slight western and southward groundwater flow direction towards the shoreline. Groundwater flow direction and the potentiometric surface within GAA A are influenced by tidal changes, especially within shoreline wells (average tidal influence throughout the entire Sparrows Point peninsula of 285 feet, refer to **Section 2.1.3.3**). Within the central area of GAA A, the shallow zone aquifer is unconfined, while the intermediate zone aquifer is semi-confined due to the presence of semi-confining clay units. The extent of semi-confining clay layers appears to be variable, with the southern area intermediate zone aquifer varying between semi-confined and unconfined.

6.1.3 Nature and Extent of Contamination in GAA A

In **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for groundwater COPCs. The groundwater database was compared to the Final RGs in **E-Attachment #1B**. Exceedances of the Final RGs were then identified as GAA A groundwater COCs. For GAA A, bis(2-Ethylhexyl)phthalate and naphthalene were identified as groundwater

COCs based on the Sitewide Final RGs. No groundwater COCs were identified based on the Shoreline Final RGs.

Refer to **Table 28A** for a summary of groundwater results for GAA A for all wells, compared to the Sitewide Final RGs. Refer to **Table 28B** for a summary of groundwater results for GAA A for shoreline wells, compared to the Shoreline Final RGs. **Tables 28A and 28B** include results from the Spring 2023 sampling event through the end of 2024, for CPLF monitoring wells. For wells not regularly sampled, the most recent available results are included. The Current COC Distribution discussion in the following section will focus on the most recent available results for each monitoring well.

Refer to **Table 28C**, where statistical analysis includes the detected concentration range, the Exceedance Frequency (EF), and the Detection Frequency (DF) for each identified COC.

6.1.3.1 Current COC Distribution

Based on the most recent results available for each well, the maximum naphthalene concentration in the shallow groundwater zone is contained within the footprint of the CPLF at CP10-PZM008 (391 µg/L in October 2021, this well has since been abandoned); refer to **Figure 25B** and **Table 28A**. Shallow naphthalene concentrations decrease in all directions, with minimal observed naphthalene concentrations to the north and shoreline naphthalene concentrations ranging from 0.19 µg/L to 48.3 µg/L (based on the most recent sampling, refer to **Table 28B**).

Based on the most recent results available for each well, the maximum naphthalene concentration in the intermediate groundwater zone is centered within the central portion of GAA A at CP25-MWI (564 µg/L in March 2020, the most recent available data for this well); refer to **Figure 25B** and **Table 28A.** Intermediate naphthalene concentrations decrease in all directions towards the shoreline, with shoreline naphthalene concentrations ranging from 0.15 µg/L to 41.6 µg/L (based on the most recent sampling, refer to **Table 28B**). When the most recent results are compared to the Final RGs, there is one naphthalene exceedance in the shallow zone (CP10-PZM008) and one in the intermediate zone (CP25-MWI). There are no shallow or intermediate zone naphthalene exceedances of the Shoreline Final RGs (refer to **Figure 25C**).

Benzene impacts within GAA A appear to be minimal and not directly related to a single source. There are no shallow or intermediate zone benzene exceedances of the Sitewide Final RGs; benzene is not a groundwater COC for shoreline receptors in GAA A. Within GAA A, there was also one groundwater exceedance for bis(2-ethylhexyl)phthalate. Refer to **Table 28C** for statistical analysis. Based on the entire GAA A groundwater dataset, the maximum bis(2-Ethylhexyl)phthalate and naphthalene detected concentrations were less than one order of magnitude above the applicable Final RG. In addition, exceedances were not widespread, with an exceedance frequency of 2.7% for bis(2-Ethylhexyl)phthalate and 5.4% for naphthalene, both when compared with Sitewide Final RGs. There were no exceedances of the Shoreline Final RGs.

Mann Kendall statistical analysis was used to identify increasing or decreasing trends at a 95% confidence factor based on all historical data results. Trend analysis was conducted for the GAA A COCs (bis(2-Ethylhexyl)phthalate and naphthalene) for wells with a sufficient number of sampling results. Benzene and benzo[a]pyrene (to be representative of PAHs) were also included in the trend analysis as these, along with naphthalene, are the main groundwater COCs within the CPA Site as a whole. Refer to **Appendix G** for a complete summary of trends within GAA A monitoring wells and to **E-Attachment #5** for the ChemStat trend analysis export files. Within GAA A, all statistically significant trends were associated with results below the Final RGs. The two wells with naphthalene exceedances of the Sitewide Final RGs (CP10-PZM008 and CP25-MWI) did not have enough sampling results for trend analysis. Among those trends with results below the Final RGs (but not non-detect concentrations), statistically significant decreasing trends were identified for CP05-PZM008 (benzene), CP09-PZM010 (naphthalene), CP11-PZM010 (benzene and naphthalene), CP15-PZM020 (benzene and naphthalene), and CP09-PZM047 (naphthalene). A statistically significant upward trend was identified for benzene in CP15-PZM042; however the most recent benzene result is 4.2 µg/L, well below the Final RG of 100 µg/L. Refer to **Appendix G** for a figure showing the locations of the identified trends (as well as where there was insufficient data for trend testing, or where no trends were identified).

6.1.3.2 Potential Migration and Summary of COCs

Refer to **Tables 28A and 28B** for a summary of groundwater results within GAA A versus the applicable Sitewide and Shoreline Final RGs, respectively. Refer to **Figure 25B** for exceedances of the Sitewide Final RGs within GAA A. There are no exceedances of the Shoreline Final RGs in GAA A (refer to **Figure 25C**). The main COC in GAA A is naphthalene.

In GAA A, the gradient and direction of groundwater flow is a major influence on the transport of the identified COCs. The maximum concentrations for benzene and naphthalene generally occur at the interior of GAA A (CPLF). The relatively flat gradient in the shallow groundwater zone across GAA A allows for significant attenuation of groundwater concentrations towards the shoreline wells. Statistical trend analysis using a Mann-Kendall method was completed for shoreline wells within GAA A using data since 2011. There are no benzene or naphthalene exceedances of the Sitewide Final RGs in any shoreline monitoring wells. Geochemical conditions within GAA A include a reducing aquifer (depressed ORP) with depressed dissolved oxygen. The pH tends to be elevated; however, variation between sampling events is noted with occasional pH observations within the 9-10 s.u. range. Wells surrounding GAA A are observed to be depleted in ferric iron and nitrate, with available sulfate pointing towards potential anaerobic oxidation occurring. Attenuation mechanisms for naphthalene and benzene are likely to include anaerobic biodegradation, volatilization (benzene), and dispersion. Geochemical data trending should be considered for long-term monitoring to identify decay rates, biodegradation by products, and increased biological oxygen demand.

A summary of Sitewide and Shoreline exceedances is included in **Table 28C**. Shallow naphthalene exceeds the Sitewide Final RGs in one shallow well and one intermediate well. Based on the most recent sampling event for each well, there are no benzene exceedances for any Final RGs.

As shown in **Table 28C** and discussed in **Section 6.1.3.1**, the PAH exceedances in GAA A are minor (in terms of number, magnitude, and distribution) and, considering the relatively flat groundwater gradient and nature of PAHs to adsorb to soils, do not appear to be mobile in groundwater.

The trend analysis and geochemical conditions within GAA A discussed above, along with the lower COC concentrations, support the use of MNA as a corrective measure within GAA A.

6.2 Groundwater Assessment Area B – Former Benzol Processing Area (Cell 6 NAPL)

6.2.1 Known and Potential Source Identification

GAA B encompasses the western portion of Parcel B10 and includes four remedial cells (Cells 1, 2, 3, and 6, refer to **Figure 26A**). Historically, the Coke Point Peninsula at Sparrows Point was home to coke production facilities, including 13 coke oven batteries, which operated from the 1930s until 1991 (EA, 2009; EA, 2011). As part of steelmaking operations, the Coke Point Peninsula housed the Coal Tar Storage Area and the Benzol Processing Area. The Benzol Plant (primarily within the Cell 6 footprint) and the Litol Plant (located between Cells 1 and 6) operated from the late 1940s through 1986, distilling and cracking light oil to produce benzene, toluene, and xylene. These plants contained numerous tanks (containing substances like benzol, light oil, toluol, and motor fuel), along with coolers, absorbers, and scrubbers. Additionally, two large oil tanks were located immediately to the northwest of the Benzol Processing Area (and Cell 6).

Known and potential sources of contamination at the Site are linked to the historical operations at the Benzol Processing Area and its associated infrastructure. Contaminants include NAPL, VOCs, and byproducts from coke production and benzol processing, such as benzene and toluene. Discharge from these operations likely occurred at multiple locations, including the former Benzol Processing Area.

The former Coal Storage Yard was located within the footprint of Cell 2. The former ‘B’ Coal Handling System and coal bedding was located to the west of Cell 1. No historical processes were identified within the western portion of Parcel B10 or within the footprint of Cell 3. Refer to **Appendix H-1** for historical figures.

6.2.2 Geology / Hydrogeology in GAA B

Within GAA B, the shallow zone is characterized primarily by an overlying slag-fill unit. This slag-fill unit is fine to coarse, poorly sorted, non-plastic, and noncohesive slag with fill gravel, and

has varying thickness across GAA B. Within GAA B, the intermediate zone is characterized by sand and clay units.

Seven soil borings (B10-023-SB through B10-029-SB) were installed in December 2024 in GAA B to further delineate a distinct intermediate clay layer in the vicinity of Cells 1, 2, and 6. Refer to **Figure 26B** for the soil boring locations, and to **Appendix F-2** for the soil boring logs. Multiple cross sections were also completed, including information from the new soil borings. Refer to **Figure 26C** for the cross-section locations and to **Figures 26D through 26H** for the cross sections. Historical well installation and soil boring logs utilized for the cross sections are included in **E-Attachment #6**. These cross sections showcase the significant variability in thickness for the overlying slag-fill unit. The cross sections are summarized below:

- **Figure 26D**: Cross Section A-A' (west to east cross section through Cell 2)
    - A clay layer is present along the eastern portion of the transect (B10-013-SB, COA-MWI-008) which thins out towards the middle of the transect (B10-026-SB, B10-029-SB, and CO182-MWI). This clay layer is not present within the western portion of the transect.
- **Figure 26E**: Cross Section B-B' (western-most north to south cross section through Cell 2 and Cell 3)
    - A thin, discontinuous clay lens is present in several locations across the transect.
- **Figure 26F**: Cross Section C-C' (central north to south cross section through Cell 2 and Cell 3)
    - A clay layer is present at the southern end of the transect (CO33-PZM141, CO32-PZM041), thins out towards the middle of the transect (CO188-MWI, B10-026-SB, B10-027-SB), and is not observed along the northern portion of the transect (CO47-PZM046).
- **Figure 26G**: Cross Section D-D' (eastern-most north to south cross section through Cell 2, Cell 1, and Cell 3)
    - A clay layer is present across the entire transect, although it is thicker along the central portion of the transect. The clay layer is thinnest along the norther portion of the transect (B10-028-SB, B10-029-SB).
- **Figure 26H**: Cross Section E-E' (west to east cross section through Cell 3, Cell 4, and Cell 5)
    - A clay layer is present across the entire transect; increasing in thickness from the western (Cell 2) portion of the transect and is thickest in the center (CO32-PZM041, CO211-MWS) of the transect.

The extent and distribution of the semi-confining clay layer observed within a large portion of GAA B suggests a confined intermediate zone within the eastern and southern portions of the Coke Point Area. As groundwater flows towards the west, this confining layer eventually terminates and results in an unconfined intermediate zone. Most of the lithology in this northwestern portion of GAA B consists of interbedded sand and slag, with some mixed gravels observed to a depth of 50

feet bgs. This connectivity between the shallow and intermediate zones in the northwestern portion of GAA B, coupled with Graving Dock Area dewatering, increases downward percolation of groundwater from the shallow zone into the intermediate zone. Shallow zone groundwater impacts are greatest around Cells 1 and 6 (above this semi-confining clay layer). Moving north and west towards Cell 2, the semi-confining clay layer becomes thinner and then non-existent. Groundwater impacts then move to the intermediate zone (also influenced by the Graving Dock system pumping at approximately 750 gallons per minute).

Along the northern Cell 2 shoreline (at the Coal Pier Channel) there is a sheet pile Quay wall with a length of approximately 1,575 feet (ft) running west to east along the Coal Pier Channel southern bank. The eastern 1,125-foot section of the Quay wall was constructed earlier, using rigid concrete sheet piles with tiebacks, and was advanced into the confining clay layer. The western 450-foot extension of the Quay wall was constructed using steel sheet piles with tiebacks, and was installed from the top of fill at +5 ft AMSL to -52 ft AMSL (as shown in as-built diagram from the former Bethlehem Steel Corporation's archives). The sheet pile wall also continues approximately 75 feet from the western end of the Coal Pier Channel to the south, acting as a return that provides partial containment along the western shoreline. Refer to **Figure 26A** for the approximate location of the sheet pile Quay wall.

In February 2024, synoptic groundwater gauging was conducted for both shallow and intermediate groundwater within the Coke Point Peninsula. In the shallow groundwater zone, the groundwater flows towards the CPA Peninsula from the main Sparrows Point area and then flows radially towards surrounding shorelines (similar to the 2001 observations). Within GAA B, shallow groundwater flows to the west from Cell 6 to Cell 1, and then flows radially northwest towards Cell 2, west towards the Patapsco River, and southwest towards Cell 3. Refer to **Figure 3** for shallow groundwater contours. Key Environmental completed groundwater modeling in the Cell 2 vicinity in 2016 and 2023. The Key Environmental model indicated that prior to the completion / operation of the Graving Dock pumping system, the groundwater from the Cell 6 area likely flowed west and southwest towards Cell 3. The Graving Dock now has a significant influence on groundwater flow in the Coke Point Peninsula, with the intermediate groundwater flowing north towards the Graving Dock. Refer to **Figure 4** for intermediate groundwater contours. Approximately 1,080,000 gallons per day (750 gallons per minute) of water is pumped from the Graving Dock underdrain system and then treated and discharged to Patapsco River in accordance with the NPDES permit. The modeling results also indicated that pumping has likely induced migration of impacted groundwater from Cell 6 downward from the shallow to intermediate groundwater zone as it flows to the northwest. This downward migration is observed where the semi-confining clay layer is absent between the shallow and intermediate groundwater zones. There is also a slight groundwater high at CO180-MWI; this is at the western corner of the sheet pile wall and may be due to slight mounding of groundwater behind the sheet pile wall.

6.2.3 Nature and Extent of Contamination at GAA B

The groundwater within GAA B is impacted by contaminants mostly tied to the Former Benzol Processing Area previously located in the Cell 6 area. In **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for groundwater COPCs. The groundwater database was compared to the Final RGs in **E-Attachment #1B**. Exceedances of the Final RGs were then identified as GAA B groundwater COCs. For GAA B, 1,1-biphenyl, arsenic, benz(a)anthracene, benzene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, ethylbenzene, indeno(1,2,3-c,d)pyrene, naphthalene, toluene, and xylenes were identified as groundwater COCs based on the Sitewide Final RGs. Iron and toluene were identified as groundwater COCs based on the Shoreline Final RGs. Benzene and naphthalene isocontours for the shallow and intermediate groundwater zones are included in **Figures 20-23**, and a NAPL location map is included as **Figure 18**.

Refer to **Table 29A** for a summary of groundwater results for GAA B for all wells, compared to the Sitewide Final RGs. Refer to **Table 29B** for a summary of groundwater results for GAA B for shoreline wells, compared to the shoreline Final RGs. **Tables 29A and 29B** include results from the 3rd Quarter 2023 sampling event through the end of 2024 for COA monitoring wells. For wells not regularly sampled, the most recent available results are included. The COC Distribution discussion in the following section will focus on the most recent available results for each monitoring well.

Refer to **Table 29C**, where statistical analysis includes the detected concentration range, the EF, and the DF for each identified COC.

6.2.3.1 Current NAPL Characterization

LNAPL is observed in the area of Cell 6 and to the northwest towards Cell 2 but does not extend west into Cell 1. Some LNAPL is also observed directly southeast of Cell 6 (COA-007-TP, COA-015-TP, COA-016-TP, COA-026-TP). The LNAPL thickness, viscosity, composition, and apparent mobility vary significantly across the impacted area (refer to **Section 4.2**). There appears to be discrete areas in which LNAPL recovery is significant and areas where recovery is limited.

Based on the results of recent LNAPL testing, LNAPL at three locations (CO173, COA-013-MWS, and B10-014-SB/PZ) to the northwest of Cell 6 is recoverable and likely constitutes the majority of the remaining NAPL source. NAPL also appears to be recoverable (although to a lesser extent) to the southeast of Cell 6 (COA-007-TP, COA-015-TP, and COA-016-TP), and further to the northwest of Cell 6 (COA-005-TP, COA-012-TP, COA-013-TP, COA-027-TP). These locations are all outside of the Cell 6 MPE system footprint. LNAPL currently observed within the MPE system footprint is minimal.

6.2.3.2 Current COC Distribution

Refer to **Tables 29A and 29B** for a summary of groundwater results within GAA B versus the applicable Sitewide and Shoreline Final RGs, respectively. Refer to **Figure 26I** for exceedances of the Sitewide Final RGs within GAA B, and to **Figure 26J** for exceedances of the Shoreline Final RGs within GAA B. The main COC in GAA B is benzene. The shallow benzene plume originates at Cell 6, where the Benzol Processing Area previously operated, and moves to the west.

The shallow benzene isocontours (refer to **Figure 20**) are based on the lowest applicable Preliminary RBSL, which is the On-Site Industrial Worker value (based on VISL) of 6.93 µg/L. The highest observed benzene concentration of 710,000 µg/L was measured at CO187-MWS (September 2024), located just north of Cell 1. The main shallow benzene plume extends west to CO189-MWS (290,000 µg/L, September 2024), south to CO16-PZM006 (78,000 µg/L, October 2019), and east to CO93-PZM (130,000 µg/L, December 2024), all located in the Cell 1 vicinity. The benzene plume then splits to the southwest towards Cell 3 (historical groundwater flow direction) and to the northwest towards Cell 2 and the Coal Pier Channel (Graving Dock influence), with maximum benzene concentrations of 21,000 µg/L (CO181-MWS, May 2023) along the Coal Pier Channel and 38,000 µg/L along the Cell 3 cove (CO30-PZM015, November 2024). Lower-level benzene impacts in the shallow groundwater zone extend towards the shoreline to the west and south under the Cell 3 cove area to the northern portion of the DMCF). The shallow benzene plume attenuates relatively quickly with concentrations of benzene decreasing below the eastern portion of Cell 6 and along the western shoreline, respectively. Towards the eastern portion of GAA B, there is a separate impacted area with peak benzene concentrations up to 15,000 µg/L (CO08-PZM005, June 2015) and 16,000 µg/L (COA-MWS-004, June 2024). Historically there were COA activities in the vicinity of the CO-08 and COA-MWS/MWI-004 well pairs, but no specific source has been identified. Surrounding delineation wells indicate significant attenuation in all directions.

The intermediate benzene isocontours (refer to **Figure 21**) are based on the lowest applicable Preliminary RBSL, which is the On-Site Industrial Worker value (based on VISLs) of 6.93 µg/L. The main intermediate benzene plume (with concentrations more than 10,000 times the target value) has shifted to the northwest, and is located primarily between Cells 1 and 2. Elevated benzene concentrations in the intermediate groundwater zone extend north to the Graving Dock under-drain system, west to the property boundary, south to Cell 3. Concentrations of benzene in the Graving Dock under-drain system are observed up to 150,000 µg/L (GD02-MWI, November 2023). Benzene extending to the west is observed at concentrations up to 2,000 µg/L at intermediate groundwater zone shoreline wells (CO209-MWI, December 2024). Within the Cell 3 area, the plume appears to have significantly attenuated with concentrations of benzene within intermediate groundwater zone wells observed to be up to 680 µg/L (COA-MWI-011, November 2024). Towards the eastern portion of GAA B, the benzene impacts in the vicinity of the CO-08 and COA-MWS/MWI-004 well pairs extend into the intermediate zone, with peak concentrations

up to 35,300 µg/L (CO08-PZM036, June 2015). Surrounding delineation wells indicate significant attenuation in all directions.

Unlike benzene, naphthalene concentrations observed within the shallow groundwater zone of the former Benzol Processing Area do not appear to have a clear source area. Naphthalene is present in shallow groundwater at concentrations more than 100 times the target value throughout Parcel B10, including to the northwest and Cell 2, to the western shoreline, and to the southwest and Cell 3.

The intermediate naphthalene isocontours (refer to **Figure 23**) are based on the lowest applicable Preliminary RBSL, which is the Resource Restoration value of 7.86 µg/L. Naphthalene is present at concentrations more than 1,000 times the target value in three locations: CO184-MWI (9,200 µg/L, November 2024), CO185-MWI (8,900 µg/L, November 2024) and CO209-MWI (18,000 µg/L, December 2024, along the western shoreline). Naphthalene is present in intermediate groundwater at concentrations more than 100 times the target value throughout the northwest portion of Parcel B10, and to the south of Cell 6 (CO08-PZM036 [2,170 µg/L, June 2015] and COA-MWI-004 [2,900 µg/L, June 2024]).

Within GAA B (and excluding benzene and naphthalene), there were also groundwater exceedances for three VOCs (ethylbenzene, toluene, and xylenes) and eight SVOCs (1,1-biphenyl, 2-methylnaphthalene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and pentachlorophenol). The VOCs follow a similar pattern to the benzene plume, with peak concentrations generally just west of Cell 1 in both the shallow and intermediate groundwater zones. Maximum concentrations within GAA B based on the most recent sampling data are 1,200 µg/L for ethylbenzene (CO93-PZM, December 2024), 90,000 µg/L for toluene (CO41-PZM036, December 2024), and 17,000 µg/L for xylenes (CO41-PZM036, December 2024).

Refer to **Table 29C** for statistical analysis. Based on the entire GAA B groundwater dataset, the maximum EFs were 76% for benzene and 67% for naphthalene. EFs for the other VOCs ranged from 16% (toluene) to 32% (ethylbenzene). SVOC exceedances were not widespread; the maximum exceedance frequency was 3.6% (excluding naphthalene). Maximum concentrations for all SVOCs (excluding naphthalene and with the exception of benzo[a]pyrene) were less than one order of magnitude above the applicable Final RGs. For benzo[a]pyrene, the maximum concentration (across all sampling rounds) was 2.4 µg/L (CO08B-PZM, May 2021) versus the Sitewide Final RG of 0.16 µg/L.

Mann Kendall statistical analysis was used to identify increasing or decreasing trends at a 95% confidence factor based on all historical data results, focusing on wells within the Cell 1 vicinity. Trend analysis was conducted for benzene (the main COC in Cell 1) and naphthalene for the following wells: CO93-PZM (upgradient of Cell 1 and downgradient of Cell 6), CO190-MWS (central Cell 1), CO191-MWS and CO02-PZM006 (downgradient of Cell 1), and CO18-PZM006 (upgradient of Cell 1). Refer to **Appendix G** for a complete summary of trends within GAA B (Cell 1) monitoring wells and to **E-Attachment #5** for the ChemStat trend analysis export files.

Statistically significant benzene trends were identified as follows: downward trends for CO93-PZM, CO191-MWS, and CO02-PZM006; and an increasing trend for CO18-PZM006. CO18-PZM006 is located just upgradient of Cell 1. Benzene results were also reviewed to determine the percent reduction between initial and current sampling (based on the average concentration for each year, where quarterly results were available) (refer to **Appendix G**). CO18-PZM006 showed a 55% reduction in average benzene concentrations from 2010 to the November 2024 result; this location was not sampled between December 2020 and November 2024. The other Cell 1 wells exhibit benzene reductions between 18% and 72% since the original sampling was conducted. Statistically significant naphthalene trends were identified as follows: downward trend for CO02-PZM006 and an increasing trend for CO190-MWS. For CO190-MWS, the most recent naphthalene result was 160 µg/L (versus the Final RG of 115 µg/L), although results have fluctuated in recent sampling events. CO190-MWS also showed a 41% reduction in average naphthalene concentrations from 2019 to 2024. The other Cell 1 wells exhibit naphthalene reductions between 48% and 82% since the original sampling was conducted.

6.2.3.3 Offshore Impacts Characterization

In May 2018, 24 surface water samples were collected from eight locations offshore from the northwest portion of the CPA as part of the *Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area* (ARM, 2018). Between March and July 2019, additional surface water sampling was conducted offshore of Cell 2 and Cell 3 (*Former Coke Oven Area Interim Measures Supplemental Investigation Report,* ARM, 2019b).

For this CPA CMS, all surface water results have been tabulated and compared to applicable surface water screening levels for ecological receptors (refer to the discussion in **Section 3.3.2** and to the results in **Appendix D-2**), detailed below:

- 2018 surface water sampling results: there were exceedances at one location located within the Cell 3 cove: SW-08 (benzene, benzo[a]pyrene, benzo(g,h,i)perylene, and naphthalene);
- 2019 surface water sampling results: there were multiple benzene exceedances within the Cell 3 area. The maximum concentration was 736 µg/L versus the USEPA Region 4 saltwater / chronic screening level of 110 µg/L. There was one exceedance for naphthalene within Cell 2 (1.5 µg/L versus the USEPA Region 3 BTAG Marine screening level of 1.4 µg/L), and multiple exceedances for naphthalene within Cell 3 (maximum concentration of 18.5 µg/L versus the USEPA Region 3 BTAG Marine screening level of 1.4 µg/L).

The *Former Coke Oven Area Interim Measures Supplemental Investigation Report* (ARM, 2019b) included pore water sampling conducted offshore of Cell 2 and Cell 3. Where possible, samples were collected from depths of 9-inches and 3-feet below the sediment-water interface. For this CPA CMS, the pore water results have been compared to surface water screening levels for ecological receptors (marine or saltwater aquatic life, chronic exposure) (refer to the discussion in **Section 3.3.2** and to the results in **Appendix D-3**). There were exceedances of BTEX and naphthalene in Cell 2 (west shore outside the coal pier channel) and Cell 3 (sample probe

encountered NAPL) and for naphthalene in Cell 5. Maximum pore water concentrations were identified to the west of Cell 2, with concentrations of 19,100 µg/L (benzene), 127 µg/L (ethylbenzene), 1,910 µg/L (toluene), 511 µg/L (xylenes), and 72,000 µg/L (naphthalene).

Since the surface water and pore water samples were collected in 2018 and 2019, the Cell 2 and Cell 3 IM systems have continued to operate.

In February 2025, two sediment samples and 11 surface water samples were collected off the western CPA shoreline (refer to **Section 4.6** for additional details). Pore water samples were not collected due to identified sheen and evidence of NAPL at multiple locations, or due to the composition of the sediment (organic clay and fine silt), restricting the generation of pore water.

The two sediment samples were collected from the southern shoreline of the Cell 3 cove closest to the CP23-MWS/MWI well pair (CP-2025-04-SD), and from the western shoreline between well pairs CO209-MWS/MWI and CO29-PZM010/CO29-PZM051 (CP-2025-07-SD). There were no VOC exceedances and multiple PAH exceedances of the applicable screening levels (USEPA Region 4 Sediment Screening Values for Hazardous Waste Sites, Table 2A for Non-Narcotic Modes of Action (marine) and Table 2B for Narcotic Modes of Action (marine) (Ecological Risk Assessment Supplemental Guidance, March 2018); and the USEPA Region III BTAG Marine Screening Benchmarks (July 2006)). Sediment samples were not collected in multiple locations due to observed sheen and evidence of NAPL. Shoreline groundwater sampling has not identified NAPL or sheen in any wells. With the exception of naphthalene, there were no PAH exceedances of the Sitewide or Shoreline Final RGs (refer to **Table 17**). The sheen and elevated PAH concentrations identified in sediment samples are consistent with historic direct deposition from offshore sources, and not with groundwater concentrations along the western CPA shoreline.

Surface water samples were compared to applicable surface water screening levels for ecological receptors. There were no VOC exceedances. There were three PAH exceedances in CP2025-03-SW-A (located off the western CPA shoreline near well pair CO210-MWS/MWI). The exceedances were only slightly above the applicable surface water screening levels. SVOC samples collected from CO210-MWS and CO210-MWI had no PAH exceedances (other than naphthalene) of the Sitewide or Shoreline Final RGs (refer to **Table 17**). Comparison of the surface water and groundwater results indicate that surface water impacts are not due to groundwater concentrations along the western CPA shoreline.

6.2.3.4 Potential Migration and Summary of COCs

The localized geology and hydrology within Cells 1, 2, and 6 areas significantly influences the benzene plume fate and transport. Within GAA B, shallow groundwater flows to the west from Cell 6 to Cell 1, and then splits to flow primarily northwest towards Cell 2 and southwest towards Cell 3. Prior to the completion / operation of the Graving Dock pumping system, the shallow groundwater from the Cell 6 area likely flowed west and southwest towards Cell 3; currently it flows northwest towards the Graving Dock (based on the Key Environmental groundwater

modeling). The extent and distribution of the semi-confining clay layer observed within a large portion of GAA B suggests a semi-confined intermediate zone within the eastern and southern portions of the Coke Point Area. Moving north and west towards Cell 2, the semi-confining clay layer becomes thinner and then pinches out, resulting in an unconfined intermediate zone.

The combination of the western groundwater flow direction, the intermediate vertical gradient driven by the nearby Graving Dock under-drain system, and the pinching out of the semi-confining clay layer towards the western portion of Cell 2, all contribute to the LNAPL and benzene fate and transport. The main shallow benzene plume is located slightly west of Cell 6, in the vicinity of Cell 1. The shallow benzene plume then splits to the southwest towards Cell 3 (historical groundwater flow direction) and to the northwest towards Cell 2 and the Coal Pier Channel (Graving Dock influence). The main benzene plume shifts to the northwest (primarily between Cells 1 and 2) as a portion of the plume moves into the intermediate groundwater zone in this area, where the vertical downward gradient driven by the Graving Dock under-drain system is stronger due to the pinching out of the semi-confining clay layer. The portion of the plume that reaches the intermediate groundwater zone then migrates north under the Coal Pier Channel due to the Graving Dock under-drain system. However, implementation of the Cell 2 and Cell 6 IMs (GWPT and MPE) appears to have reduced the northern movement of the shallow benzene source area, likely through the location of reinjection wells placed between Cell 2 and Cell 6.

Microbial and geochemical data were collected within the GAA B source area to determine potential degradation mechanisms. Microbial sampling was completed at CO152-PZM, CO18-PZM006, and CO02-PZM041. The results of Gene-Trac testing completed by SiREM Laboratory included observations of healthy populations of both anaerobic and aerobic microbes and/or enzymes associated with biodegradation as follows:

- Sulfate reducing bacteria (SRB): typically associated with anaerobic degradation of hydrocarbons,
- Candidatus benzenivorax ORM2 (BNVX): typically associated with anaerobic degradation of benzene,
- Toluene dioxygenase (TDO): typically associated with aerobic degradation of toluene and benzene,
- Catechol dioxygenase (CDO): typically associated with aerobic degradation of BTX, phenol, and naphthalene, and
- Naphthalene dioxygenase (NDO): typically associated with aerobic degradation of naphthalene and other polycyclics.

The microbial laboratory sampling results are included in **E-Attachment #3,** geochemical parameters are presented in **Table 16**, and geochemical field parameters are included in **E-Attachment #4.** Microbial samples collected from CO152-PZM (Cell 6) include healthy populations of anaerobic microbes/enzymes SRB and BNVX, and aerobic microbes/enzymes

TDO and NDO. Geochemical parameters collected from this well indicate negative ORP (-361 to -300), depressed DO, depleted ferric iron, some available sulfate, and dissolved carbon dioxide. The combination of microbial and geochemical data indicate that CO152-PZM is likely in iron reducing conditions with potentially some sulfate reduction occurring. Microbial samples collected from CO18-PZM006 (Cell 1) include healthy populations of anaerobic BNVX and aerobic TDO and CDO. Geochemical parameters collected from this well include negative ORP (-102 to -72), no DO, depleted nitrate, available ferric iron, and large amounts of dissolved carbon dioxide. The depleted nitrate and DO indicate this well is likely in nitrogen reducing conditions. High amounts of dissolved carbon dioxide point towards current bioactivity. Microbial samples collected from CO02-PZM041 include observed healthy populations of anaerobic SRB and BNVX, and aerobic TDO. Geochemical parameters collected from this well include negative ORP (-173), depleted sulfate, depleted ferrous iron, and dissolved carbon dioxide. Field measured DO indicated approximately 2.5 mg/l; however, based on the available MNA parameters, it is likely this reading is artificially inflated due to field error. This well is likely in sulfate reducing conditions.

CO18-PZM006 is located very close to the Cell 1 sparge system. The total microbial population at this well is larger than observed in CO152-PZM (Cell 6) and CO02-PZM041 (downgradient of Cell 1), potentially indicating improved biodegradation due to the introduction of oxygen via operation of Cell 1. This is further supported by the higher redox potential observed at CO18-PZM006 in comparison to CO152-PZM and CO02-PZM041. Degradation mechanisms within the GAA B source area appear to be mostly associated with biodegradation, which is expected based on the operation of the air sparge system in Cell 1.

A summary of Sitewide and Shoreline exceedances is included in **Table 29C**. Benzene, ethylbenzene, toluene, xylenes, and naphthalene concentrations exceed the Sitewide Final RGs within GAA B for both shallow and intermediate groundwater zones. Higher molecular weight PAH exceedances were observed in multiple shallow wells; however these exceedances are strictly inland. The potential for these low-level exceedances to impact offshore receptors is minimal.

A potential opportunity to prevent future migration of the benzene and NAPL sources may include active remediation prior to migration into the intermediate groundwater zone.

6.3 Groundwater Assessment Area C – Parcel B18

6.3.1 Known and Potential Source Identification

GAA C encompasses the western portion of Parcel B18, with a slight extension into the southern part of Parcel B10 (refer to **Figure 27A**). Historically, the area supported operations at the Former COA, where above ground tar storage and oil tanks were used. The No. 10 and No. 11 Fuel Oil Storage Tanks, located along the western perimeter of Parcel B18, were former ASTs with capacities of approximately 2.3 million gallons each. The No. 10 tank was used for storing No. 6

fuel oil, while the No. 11 tank also stored fuel oil. The No. 10 tank was identified as a Recognized Environmental Condition (REC) due to historical releases (*Phase I ESA*, Weaver, 2014). In 1987, visible oil surfaced in the nearby coal dock basin, triggering an investigation into potential contamination. Remediation efforts were undertaken, and a cut-off wall (approximately 125 feet) was installed in 1989 to the west of the former No. 10 Tank footprint. Based on historic drawings (**Appendix H-1**), the sheet pile cut-off wall is located approximately 3-feet to the east of the existing relieving platform, and extends into a clay unit located at approximately 20 feet bgs. Refer to **Figure 27A** for the approximate location of the sheet pile cut-off wall. As documented in the *Parcel B18 No. 10 Tank Area Investigation Report* (ARM, 2020a), groundwater in the vicinity was found to be impacted by contaminants primarily associated with the historical storage and handling of petroleum products.

During the 2018 investigation activities, LNAPL and VOC impacts were identified at B18-082-PZ (a 1-inch piezometer), located to the east of the former AST locations. These impacts appear to be independent from the DNAPL and associated dissolved phase constituents in the No. 10 Tank Area. When reviewing the historical drawings (**Appendix H-1**), there were several railway spurs and an electrical substation in the vicinity of the B18-082-PZ location, but no historical tanks or fuel storage. LNAPL was not identified in any locations adjacent to B18-082-PZ, including B18-061-PZ to the southeast (towards the former mechanical maintenance yard), B18-017-PZ to the northeast (towards the former mechanical maintenance storage and repair shop), and soil borings advanced as part of the No. 10 Tank Investigation to the west. Historically, 1-inch piezometers tend to over-estimate the amount of LNAPL present. A test pit (COA-003-TP) and a 2-inch monitoring well (COA-MW-001) (refer to **Section 4.1**) were installed in 2024 adjacent to historic piezometer B18-082-PZ, and no LNAPL was identified. LNAPL presence (if any remains) is limited in extent.

As discussed in **Section 5.7.1**, elevated lead was detected in soil in the vicinity of B18-043-SB. Subsequent excavation activities resulted in the removal of approximately 412 CY of lead impacted soil. Portions of the excavated soil were treated with TerraBond® due to the elevated TCLP Lead concentrations prior to disposal at Greys Landfill (*Parcel B18 Lead Excavation Stockpile Treatment Letter* (Revision 0 dated November 6, 2024)).

6.3.2 Geology / Hydrogeology in GAA C

Within GAA C, the shallow zone is characterized by significant geological variability. During the Parcel B18 Phase II Investigation, the encountered shallow subsurface geology included non-native fill materials (silt, sand, gravel, brick, cinder ballast, coal, coke ash, concrete, slag, stockpiled materials, and wood fragments) and natural sediments, which included fine-grained sediments (clays and silts) and coarse-grained sediments (sands, gravels, and cobbles). Moving from east to west (towards the Coal Pier Channel), the uppermost unit shifts from coarse grained material (sands and gravels) to slightly finer-grained material (sands and silts). The shallow zone slag-fill varies in thickness.

Based on the field work conducted as part of the *Parcel B18 No. 10 Tank Area Investigation Report* (ARM, 2020a) and the supplemental 2022 soil borings, a clay unit was encountered between approximately 15 to 20 feet bgs. Directly on top of the clay unit was a dense fine-grained sand unit with a thickness ranging from 5 to 10 feet. DNAPL is present in the sand unit, sitting on top of the clay unit. Shallow groundwater was generally encountered between approximately 7 and 9 feet bgs across the delineation area. The shallow hydrogeologic zone appears to span from approximately 8 to 19 feet bgs and is an unconfined aquifer. The continuous, semi-confining clay unit throughout GAA C restricts vertical hydraulic connectivity between the shallow and intermediate zone, resulting in a semi-confined intermediate zone aquifer. Shallow groundwater flows west toward the former Coal Dock Basin across the western portion of Parcel B18, where the ASTs were located (refer to **Figure 27B** for the shallow groundwater contours based on the gauging included in the *No. 10 Tank Area Investigation Report* (ARM 2020a) (most of the wells used for this gauging and contours no longer exist).

In 2022, 21 soil borings were completed to further identify NAPL in the western portion of Parcel B18 (refer to **Section 6.3.3** for a discussion of the NAPL observations). Based on the completed soil borings and other historical investigation activities, cross sections were completed. Refer to **Figure 27C** for soil boring locations, as well as cross section locations, and to **Figures 27D and 27E** for the associated cross sections. The soil borings logs from the 2022 investigation are included in **Appendix H-2**, and all historical well installation and soil boring logs utilized for the cross sections are included in **E-Attachment #6**. The soil borings were advanced to a maximum depth of 20 to 30 feet bgs; however, multiple locations met refusal. Based on the deeper soil borings, the clay unit extends to between 20 ft bgs (CW21) and 22.5 ft bgs (CW6 CW22) and is underlain by native sands. The findings from the 2022 supplemental soil borings support the earlier conclusion that there is a sand layer on top of the clay unit across much of the investigation area, and that DNAPL is present in the sand layer on top of the clay unit. Intermediate groundwater similarly flows to the west but has a northwest component due to the Graving Dock pumping system (refer to **Figure 4** for intermediate groundwater contours).

6.3.3 Nature and Extent of Contamination in GAA C

In **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for groundwater COPCs. The groundwater database was compared to the Final RGs in **E-Attachment #1B**. Exceedances of the Final RGs were then identified as GAA C groundwater COCs. For GAA C, 2-methylnaphthalene, benz(a)anthracene, benzene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, ethylbenzene, indeno(1,2,3-c,d)pyrene, naphthalene, and xylenes were identified as groundwater COCs based on the Sitewide Final RGs. Benzo(a)pyrene, dibenz(a,h)anthracene, and pyrene were identified as groundwater COCs based on the Shoreline Final RGs. The main COCs for GAA C are benzene and naphthalene (in addition to LNAPL and DNAPL).

Refer to **Table 30A** for a summary of groundwater results for GAA C for all wells, compared to the Sitewide Final RGs. Refer to **Table 30B** for a summary of groundwater results for GAA C for shoreline wells, compared to the Shoreline Final RGs.

Refer to **Table 30C**, where statistical analysis includes the detected concentration range, the EF, and the DF for each identified COC.

6.3.3.1 NAPL Distribution

NAPL was identified during the Phase II Investigation (*Phase II Investigation Report for Area B: Parcel B18*. ARM, 2020b) and further delineated in the *No. 10 Tank Area Investigation Report for Area B: Parcel B18* (ARM, 2020a). Around the former No. 10 and No. 11 Fuel Oil Tanks, NAPL is most prevalent in the shallow soil in the immediate vicinity of the former AST footprints and appears to become more widespread deeper in the subsurface (as the DNAPL reaches the top of the clay unit). Refer to **Figures 27F, 27G,** and **27H**, which identify the presence of NAPL in discrete 4-foot-thick soil intervals ranging from the ground surface to 12 feet bgs (0 to 4, 4 to 8, and 8 to 12 feet bgs). The NAPL in the area of the tanks has largely been identified as DNAPL, with the thickness observed via gauging to be several feet in multiple wells (refer to **Figure 27A** for locations where DNAPL has been identified in monitoring wells).

However, during the 2022 soil boring investigation, NAPL was noted in soil boring cores (refer to **Figure 27C)** but was not clearly observed in the expected thickness during test pit construction. Based on the investigation activities completed within GAA C, the DNAPL is likely sitting on top of the dry to moist clay layer, in the fine-grained sand unit (refer to the cross sections in **Figures 27D and 27E**). Based on field observations, the DNAPL is thick and difficult to gauge, likely pointing to a DNAPL thickness less than that reported via gauging and more representative of what was observed during the soil boring investigation. Attempts to remove the DNAPL via bailer or pumping have also been unsuccessful, due to the viscosity of the DNAPL (it coats probes, bailers, pumps, etc.).

6.3.3.2 Current COC Distribution

Refer to **Tables 30A and 30B** for a summary of groundwater results within GAA C versus the applicable Sitewide and Shoreline Final RGs, respectively. Refer to **Figure 27I** for exceedances of the Sitewide Final RGs within GAA C, and to **Figure 27J** for exceedances of the Shoreline Final RGs within GAA C. The main COCs for GAA C are benzene and naphthalene (in addition to LNAPL and DNAPL). Within the shallow groundwater at GAA C, the maximum benzene and naphthalene concentrations are B18-082-PZ (benzene at 2,440 µg/L and naphthalene at µg/L 15,300 in November 2018) and COA-MW-001 (benzene at 3,500 µg/L and naphthalene at13,000 µg/L in June 2024). COA-MW-001 was installed in 2024 adjacent to the former B18-082-PZ location. There are COC exceedances in shallow groundwater throughout the tank footprints, although at significantly lower concentrations than at the B18-082-PZ / COA-MW-001 location.

The impacts at the B18-082-PZ / COA-MW-001 location are limited in extent, with significant attenuation of both benzene and naphthalene in all directions.

There is only one intermediate monitoring well (SW13-PZM035) located in the western portion of GAA C; there were no COC exceedances.

Within GAA C (excluding benzene and naphthalene), there were also groundwater exceedances for two VOCs (ethylbenzene and xylenes) and seven SVOCs (2-methylnaphthalene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene). Refer to **Table 30C** for statistical analysis. When compared to the Sitewide Final RGs, the maximum exceedance frequency observed was 25% for benzo(a)pyrene. For all SVOCs (excluding naphthalene and with the exception of benz(a)anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and dibenz(a,h)anthracene), the maximum concentration detected was less than one order of magnitude above the applicable Final RGs. For benz(a)anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and dibenz(a,h)anthracene, the maximum concentrations all occurred at B18-044-PZ during the 2018 sampling event: 41.8 µg/L versus the benz(a)anthracene Final RG of 1.0 µg/L, 24.2 µg/L versus the benzo[a]pyrene Final RG of 0.16 µg/L, 15.1 µg/L versus the benzo[b]fluoranthene Final RG of 1.0 µg/L,, and 2.9 J µg/L versus the dibenz(a,h)anthracene Final RG of 0.16 µg/L. Exceedance locations are co-located with benzene and naphthalene exceedances and / or NAPL observations.

6.3.3.3 Potential Migration and Summary of COCs

Historical releases from the ASTs have resulted in DNAPL in the shallow soil in the immediate vicinity of the former AST footprints; the DNAPL appears to become more widespread deeper in the subsurface. The DNAPL is primarily located in the sand layer above the semi-confining clay unit. The higher molecular weight PAH exceedances also seem to coincide with the former No. 10 Tank footprint and DNAPL locations. Migration of the NAPL has been generally restricted by the cut-off wall (the observed surface water sheen may be due to impacts north of the cut-off wall).

The maximum benzene and naphthalene concentrations in shallow groundwater are located in the B18-082-PZ / COA-MW-001 area; LNAPL has historically been identified in this location. No source area (historic tanks or fuel storage) has been identified in the vicinity, but the impacts are limited in extent, with significant attenuation of both benzene and naphthalene in all directions.

The main COCs for GAA C are benzene and naphthalene in the shallow groundwater zone (in addition to LNAPL and DNAPL). DNAPL and LNAPL would present a potential risk to all receptors. A summary of Sitewide and Shoreline exceedances is included in **Table 30C**.

6.4 GROUNDWATER ASSESSMENT AREA D – NORTHEAST B10 AREA

6.4.1 Known and Potential Source Identification

GAA D is located within the northeast portion of Parcel B10 (refer to **Figure 28A**). This portion of the Site was within the Coke Oven Battery Area, to the north of Battery ‘A’. However, no

SWMUs were identified within the GAA D source area as part of the DCC Report. Based on the historical drawings (refer to **Appendix H-1**), the area of impact is centered on the former Benzol Washers. As part of the *Former Coke Oven Area Northeast Delineation Letter Report* (ARM, 2021c), shallow zone monitoring wells were installed and sampled to delineate groundwater impacts in the vicinity of CO05-PZM006. NAPL was identified in April 2021 in delineation well CO05D-PZM. Transmissivity testing was conducted at CO05D-PZM in November and December 2021, and NAPL transmissivity was below the range where active recovery is practical (*CPA Combined Delineation Interim Report, Revision 1*, ARM, 2023b). Passive NAPL removal (bailing, absorbent socks) was conducted as needed at CO05D-PZM between 2022 and August 2024 (when the well was abandoned). As outlined in the *Well Abandonment Request Letter for Parcels B1, B10, and B12* (ARM, 2024h), an excavation to remove residual NAPL at CO05D-PZM was also proposed. This excavation was completed but no NAPL was identified.

During the Container Terminal Phase II field work in October 2023, NAPL was identified in CT-006-SB (installed adjacent to CO05D-PZM). Additional test pits were advanced in 2023 and 2024 in the vicinity of CT-006-SB and CO05D-PZM to further delineate impacts (*Container Terminal Phase II Report,* ARM, 2024c, and *Container Terminal RADWP,* ARM, 2024l). Trace or minor NAPL was identified in multiple test pits (CT-006-SB, COA-019-TP, COA-021-TP, and COA-022-TP). Subsequent delineation test pits did not identify NAPL (COA-023-TP, COA-024-TP, and COA-025-TP). In 2023 and 2024, approximately 33.5 gallons of LNAPL were removed from the Northern Container Terminal Area test pits (CT-006-TP, COA-019-TP, COA-021-TP, COA-022-TP). Refer to **Section 5.3** for more information on remedial activities conducted in GAA D, to **Figure 28B** for the NAPL removal and excavation locations, and to **Table 20** for a summary of removal volumes.

6.4.2 Geology / Hydrogeology in GAA D

Within GAA D, the shallow zone is characterized primarily by an overlying slag-fill unit. This slag-fill unit is fine to coarse, poorly sorted, non-plastic, and noncohesive slag with fill gravel, and has varying thickness across GAA D. Concrete, cement, and subsurface obstructions are also found within the shallow zone throughout GAA D due to residual foundations throughout the area, such as in wells CO212A-PZM, CO05B-PZM, CO216-MWS, and CO05C-PZM. In the western area of GAA D, this unit extends from 0-20 ft depth (CO04-PZM048). In the central area of GAA D, this unit extends to depths between 14 ft bgs (CO05B-PZM) to at least 19 ft bgs (CO05C-PZM, total boring depth was 19 ft). In the northeastern area of GAA D, this slag fill unit extends from 0-6 ft depth (SW14-PZM004, SW-030-MWS). Thus, the thickness of the overlying slag-fill unit generally thins towards the northeast (towards the main Sparrows Point peninsula).

There is only one intermediate monitoring well (CO04-PZM048) located in the western portion of GAA D. Therefore, limited data are available about the intermediate zone geology within GAA D. At CO04-PZM048, there is a semi-confining clay unit extending from 22-31 ft depth, underlain by silt and fine sand deposits from 31-44.5 ft depth. A second semi-confining clay unit was observed from 44.5-47.5 ft depth, underlain by fine sand to the maximum borehole depth of 55

feet bgs. The shallow semi-confining clay layer was also observed in the central portion of GAA D, at CO05B-PZM (from 14 ft to the base of the borehole at 20 ft bgs), CO05-PZM006 (from 15 ft to the base of the borehole at 17 ft bgs), and B18-076-PZ (from 14.6 ft to the base of the borehole at 16 ft bgs). As part of Container Terminal investigation, four soil borings were advanced along the shoreline within GAA D (refer to **Figure 29B**). Along the northern portion of the shoreline, the shallow semi-confining clay layer was identified at approximately 20 ft bgs (CT-030-SB and CT-032-SB, approximately -10 ft AMSL for both), and drops approximately 10-feet in elevation to the south (CT-034-SB, approximately 30 ft bgs or -20 ft AMSL).

Groundwater surface elevations within the shallow zone flow from the main Sparrows Point area towards the CPA, with the higher groundwater elevations extending south towards CO04-PZM004; shallow groundwater then flows radially out towards the surrounding shorelines. Within GAA D, shallow groundwater flow is generally to the southeast and east towards the shoreline, while groundwater to the west of well CO04-PZM004 flows west and southwest (refer to **Figure 3** for shallow groundwater contours). There is only one intermediate zone monitoring well within GAA D and therefore intermediate groundwater flow direction cannot be determined. However, the Graving Dock influence likely extends towards GAA D as well (refer to **Figure 4** for the intermediate groundwater contours).

Based on the subsurface geology of GAA D, the shallow zone aquifer is unconfined, and the intermediate zone aquifer is semi-confined due to the presence of fine-grained deposits and semi-confining clay units in the western, central, and eastern shoreline areas of GAA D.

6.4.3 Nature and Extent of Contamination in GAA D

In **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for groundwater COPCs. The groundwater database was compared to the Final RGs in **E-Attachment #1B**. Exceedances of the Final RGs were then identified as GAA D groundwater COCs. For GAA D, 2-methylnaphthalene, benzene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, ethylbenzene, indeno(1,2,3-c,d)pyrene, naphthalene, and xylenes were identified as groundwater COCs based on the Sitewide Final RGs. No groundwater COCs were identified based on the Shoreline Final RGs. The main COCs for GAA D are benzene and naphthalene in the shallow groundwater zone.

Refer to **Table 31A** for a summary of groundwater results for GAA D for all wells, compared to the Sitewide Final RGs. Refer to **Table 31B** for a summary of groundwater results for GAA D for shoreline wells, compared to the Shoreline Final RGs.

Refer to **Table 31C**, where statistical analysis includes the detected concentration range, the EF, and the DF for each identified COC.

6.4.3.1 Current COC Distribution

Refer to **Tables 31A and 31B** for a summary of groundwater results within GAA D versus the applicable Sitewide and Shoreline Final RGs, respectively. Refer to **Figure 28C** for exceedances of the Sitewide Final RGs within GAA D. There are no exceedances of the Shoreline Final RGs in GAA D (refer to **Figure 28D**).

Across GAA D, the majority of the groundwater exceedances, and the maximum benzene and naphthalene concentrations, are centered on CO05-PZM006, CO05A-PZM, CO05B-PZM.

Based on the most recent sampling results for each well, the maximum benzene concentrations in shallow groundwater of 2,550 µg/L (CO05B-PZM, May 2021), 1,850 µg/L (CO05-PZM006, June 2015), and 1,200 µg/L (CO05A-PZM, November 2024), and maximum naphthalene concentrations in shallow groundwater of 12,500 µg/L (CO05B-PZM, May 2021), and 8,700 µg/L (CO05A-PZM, November 2024) (refer to isocontours in **Figures 20 and 22**). Benzene and naphthalene concentrations decrease to the east and north to concentrations below all Final RGs. Attenuation of the benzene and naphthalene plumes to the south and west is reduced due to comingling with Cell 4, 5, and 6 plumes. Benzene and naphthalene concentrations in the northeastern corner of GAA D (B18-070-PZ, B18-071-PZ, B18-072-PZ, SW-030-MWS) are consistently below Final RGs. There are no benzene or naphthalene exceedances in shallow shoreline monitoring well CO10-PZM006.

Groundwater sampling of intermediate well CO04-PZM048 in March 2020 identified low benzene (4.3 J µg/L) and naphthalene (8.8 J µg/L) concentrations, below the Sitewide Final RGs.

At CO05A-PZM, concentrations decreased between 2021 and 2024 for benzene (1,330 µg/L to 1,200 µg/L), naphthalene (16,600 µg/L to 8,400 µg/L), and xylenes (1,080 µg/L to 600 µg/L).

Within GAA D (and excluding benzene and naphthalene), there were also groundwater exceedances for two VOCs (ethylbenzene and xylenes) and six SVOCs (2-methylnaphthalene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene). Refer to **Table 31C** for statistical analysis.

Ethylbenzene and xylene exceedances were limited to the three wells in the CO05 location (CO05-PZM006, CO05A-PZM, CO05B-PZM). Based on the entire GAA D groundwater data set, maximum concentrations for ethylbenzene and xylene were within one order of magnitude of the Final RGs: 163 µg/L for ethylbenzene (CO05B-PZM, May 2021) versus the Sitewide Final RG of 100 µg/L, and 1,080 µg/L for xylenes (CO05A-PZM, May 2021) versus the Sitewide Final RG of 1,000 µg/L.

For all SVOCs (excluding naphthalene and excluding benz(a)anthracene and benzo[a]pyrene), the maximum concentration detected was less than one order of magnitude above the applicable Final RG. For benz(a)anthracene and benzo[a]pyrene, the maximum concentrations in GAA D were 11 µg/L versus the benz(a)anthracene Final RG of 1.0 µg/L and 5.8 µg/L versus the benzo[a]pyrene

Final RG of 0.16 µg/L. SVOC exceedances (excluding naphthalene) were not widespread; the maximum exceedance frequency was 17% for benzo(a)pyrene.

There are no Shoreline Final RG exceedances in shoreline monitoring well CO10-PZM006.

6.4.3.2 Potential Migration and Summary of COCs

A summary of Sitewide exceedances is included in **Table 31C**. The plumes within GAA D appear to be mainly influenced by the relatively flat shallow groundwater gradient and the semi-confining clay layer. There were VOC and SVOC exceedances of the Sitewide Final RGs in multiple shallow zone monitoring wells (with maximum concentrations centered on CO05-PZM006, CO05A-PZM, and CO05B-PZM). Shallow groundwater flow direction appears to be mostly east to southeast; however, the plume appears to be limited in extent with rapid attenuation in all directions. There are no exceedances for Shoreline Final RGs in the one shoreline monitoring well within GAA D (CO10-PZM006). The semi-confining clay layer appears to prevent migration into the intermediate groundwater zone. There are no exceedances for Sitewide Final RGs in the one intermediate zone monitoring well within GAA D (CO04-PZM048). At this time, wells in GAA D do not have enough sampling rounds to complete trend analysis. Available water quality data near the area of Final RG exceedances indicate a reducing aquifer (depressed ORP), limited DO, and only slightly elevated pH. The pH from samples collected at wells with Final RG exceedances is between 9.11-9.65 s.u.. Continued sampling of COCs and geochemical parameters over time will be needed to confirm mechanisms that are driving the attenuation process.

6.5 GROUNDWATER ASSESSMENT AREA E – CELL 4 / 5 AND CONTAINER TERMINAL

6.5.1 Known and Potential Source Identification

GAA E encompasses the southeastern portion of Parcel B10 and the eastern portion of Parcel B11 and includes two remedial cells (Cells 4 and 5, refer to **Figure 29A**). As part of the steelmaking operations at Sparrows Point, the Coke Point Peninsula housed coke production facilities from the 1930's until 1991 (EA, 2009; EA, 2011). The B Coal Chemical Plant (B CCP) is located near the south-central portion of the Coke Oven Facility Area and performed the initial processing of the raw coke oven gas. This included the condensing out of the coal tars and water, and the absorption of ammonia and light oils from the raw coke oven gas.

The *Phase I ESA* (Weaver, 2014) identified the B Coal Chemicals Plant Process Area as AOC U, with 19 SWMUs related to historic operations (though it was not determined from which individual units the releases had occurred). Generally, these SWMUs include various aboveground tanks, bins, separators, decanters, coolers, clarifiers and other units used in the raw coke gas treatment processes. Based on the DCC Report, the main analytical suites of potential concern associated with the B Coal Chemical Plant Area include VOCs (specifically BTEX) and PAHs (including naphthalene). Refer to **Appendix H-1** for historical figures. Cell 4 is located within the Former Coal Tar Storage Area.

6.5.2 Geology / Hydrogeology in GAA E

Within GAA E, the encountered shallow subsurface geology includes non-native fill materials (silt, sand, gravel, brick, coke ash, concrete, slag, and wood fragments), and is referred to as the slag-fill unit. This uppermost unit is characterized by loose, non-plastic, noncohesive, silt to gravel sized fill material. This slag-fill unit varies in thickness across GAA E. Within the northwestern area of GAA E, the slag fill extends from 0-17 ft depth (CO34-PZM048) and to at least 18-19 ft depth at CO24-PZM007 and CO23-PZM008 (borehole total depths were between 18 and 19 ft bgs). Within the central area of GAA E (in the vicinity of the Cell 4 excavation, refer to **Figure 29B**), the slag fill extends to between 20 and 25 ft bgs. Moving from north to south along the eastern shoreline, the slag fill unit extends from 0-24 ft depth (CO203-MWS), 0-30 ft depth (CO26-PZM032, CO35-PZM056), 0-39 ft depth (CP17-MWI), and 0-57.5 ft depth (CP26-MWI). This is also reflected in the soil borings completed along the proposed Container Terminal wharf, where slag was encountered from the ground surface to between 25 feet bgs (northern end of GAA E at CT-037-SB) to 46 feet bgs (southern end at CT-048-SB). Thus, across GAA E the slag fill unit appears to thicken towards the southeast (refer to **Figure 29C** for H-H' cross section of GAA E). Historical well installation and soil boring logs utilized for the cross sections are included in **E-Attachment #6**.

Within GAA E, the intermediate zone is characterized by sand, silt, and clay deposits. Coarse-grained sand and fine-grained silt/clay deposits often interbed throughout the uppermost section of the intermediate zone and occur as discontinuous lenses (refer to **Figure 29C**). Semi-confining clay layers are present within the intermediate zone throughout GAA E. In the central area of GAA E (in the vicinity of the Cell 4 excavation), the semi confining clay layer is encountered between 20 and 25 feet bgs, and ranges between 3 and 6 feet thick (CO173-SB036, CO13-PZM030, CO171-SB031, refer to **Figures 26C and 26H**). The top of the clay layer drops to a depth of approximately 40 ft bgs adjacent to the Turning Basin (CO26-PZM032). The clay layer is underlain by silty sands, silty clays, and clayey sands. As noted above, the depth to the semi-confining clay layer also increases from north to south along the eastern shoreline. The extent and thickness of the semi-confining clay layer between the shallow and intermediate zones of GAA E are variable across the Site, yet it generally tends to increase in depth to the southeast. This semi-confining clay unit restricts vertical hydraulic connectivity between the shallow and intermediate zone, resulting in a semi-confined intermediate zone aquifer.

Groundwater surface elevations within the shallow zone showcase general groundwater flow direction to the southeast towards the shoreline (refer to **Figure 3** for shallow groundwater contours). The intermediate groundwater contours indicate a relatively flat groundwater gradient in the intermediate zone (refer to **Figure 4** for intermediate groundwater contours). Groundwater flow direction and the potentiometric surface within GAA E are likely influenced by tidal changes, especially within shoreline wells (average tidal influence throughout the entire Sparrows Point peninsula of 285 feet, refer to **Section 2.1.3.3**). Based on the subsurface geology of GAA E, the

shallow zone aquifer is unconfined, and the intermediate zone aquifer is semi-confined due to the presence of semi-confining clay units throughout GAA E.

6.5.3 Nature and Extent of Contamination in GAA E

In **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for groundwater COPCs. The groundwater database was compared to the Final RGs in **E-Attachment #1B**. Exceedances of the Final RGs were then identified as GAA E groundwater COCs. For GAA E, benz(a)anthracene, benzene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, and naphthalene were identified as groundwater COCs based on the Sitewide Final RGs. No groundwater COCs were identified based on the Shoreline Final RGs.

Refer to **Table 32A** for a summary of groundwater results for GAA E for all wells, compared to the Sitewide Final RGs. Refer to **Table 32B** for a summary of groundwater results for GAA E for shoreline wells, compared to the Shoreline Final RGs. **Tables 32A and 32B** include results from the 3rd Quarter 2023 sampling event through the end of 2024for COA monitoring wells. For wells not regularly sampled, the most recent available results are included. The Current COC Distribution discussion in the following section will focus on the most recent available results for each monitoring well.

Refer to **Table 32C**, where statistical analysis includes the detected concentration range, the EF, and the DF for each identified COC.

6.5.3.1 Current COC Distribution

Refer to **Tables 32A and 32B** for a summary of groundwater results within GAA E versus the applicable Sitewide and Shoreline Final RGs, respectively. Refer to **Figure 29D** for exceedances of the Sitewide Final RGs within GAA E. There are no exceedances of the Shoreline Final RGs in GAA E (refer to **Figure 29E**).

Based on the most recent sampling event (November 2024), the maximum benzene and naphthalene concentrations in shallow groundwater both occurred at CO25-PZM008 (benzene at 980 µg/L and naphthalene at 15,000 µg/L in November 2024); refer to **Figures 18 and 20** and **Table 32A**. CO25-PZM008 is located directly northeast of the Cell 4 excavation area; observed groundwater impacts are likely related to the historical source area which was removed in 2023. Maximum shallow groundwater concentrations of both benzene and naphthalene decrease to the south, west and north. Shallow groundwater impacts are present to the southeast (Cell 5 area) and east of CO25-PZM008 and Cell 4, although some attenuation occurs towards the shoreline. In shoreline wells directly east of CO25-PZM008, benzene concentrations range between 57.2 µg/L (CO60-PZP001) and 380 µg/L (CO203-MWS, CO205-MWS), while naphthalene concentrations range between 360 µg/L (CO60-PZP001) and 2,900 µg/L (CO203-MWS).

In the intermediate groundwater zone, the maximum benzene and naphthalene concentrations in shallow groundwater both occurred at CT-037-GW-41 (grab sample in February 2024, with

benzene at 320 µg/L and naphthalene at 2,600 µg/L); refer to **Figures 21 and 23** and **Table 32A**. However, based on the borelog, it is possible that this grab sample was actually collected from within the shallow groundwater zone. Results at other intermediate locations (CO26-PZM032, CO34-PZM048, CP17-MWI, SW18-PZM053) are generally non-detect or below applicable criteria, indicating that the intermediate zone groundwater has not been adversely impacted. With the exception of the CT-037-GW grab sample location, the concentrations in intermediate wells are significantly lower than the concentrations in the paired shallow wells.

Within GAA E (and excluding benzene and naphthalene), there were also groundwater exceedances for benz[a]anthracene, benzo(a)pyrene, benzo[b]fluoranthene, and bis(2-Ethylhexyl)phthalate. Refer to **Table 32C** for statistical analysis. Based on the entire GAA E groundwater dataset, the maximum exceedance frequency was 1.8% for bis(2-Ethylhexyl)phthalate. In addition, the maximum concentrations were within one order of magnitude of the Final RGs: 2.5 µg/L versus the Final RG of 1.0 µg/L for benz[a]anthracene; 2.0 µg/L versus the Final RG of 0.16 µg/L for benzo(a)pyrene; 3.8 µg/L versus the Final RG of 1.0 µg/L for benzo[b]fluoranthene, and 2.4 µg/L versus the Final RG of 1.0 µg/L for bis(2-Ethylhexyl)phthalate. The exceedance locations are co-located with benzene and naphthalene exceedances. There are no exceedances of Shoreline Final RGs.

The Mann Kendall statistical analysis was used to identify increasing or decreasing trends at a 95% confidence factor based on all historical data results within GAA E. Trend analysis was conducted for GAA E COCs and for wells with a sufficient number of sampling results. This includes benzene and naphthalene. Trend analysis was unable to be conducted for PAHs (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate) as there were insufficient rounds of results. Ethylbenzene and xylenes were added to the trend analysis to provide more information. Refer to **Appendix G** for a complete summary of trends within GAA E and to **E-Attachment #5** for the ChemStat trend analysis export files. No statistically significant increasing trends were identified within GAA E. Multiple statistically significant decreasing trends were identified for benzene, ethylbenzene, naphthalene, and xylenes (both for locations with results above the Sitewide Final RGs and below the Sitewide Final RGs). Within GAA E, statistically significant trends (with results above the Final RGs) were identified as follows: CO23-PZM008 (benzene), CO24-PZM007 (naphthalene), CO26-PZM007 (benzene), CO56-PZP001 (benzene and naphthalene), and CO58-PZM001 (naphthalene). No trends were identified for benzene or naphthalene in CO25-PZM008 (maximum concentrations within GAA E). Refer to **Appendix G** for a figure showing the locations of the identified trends (as well as where there was insufficient data for trend testing, or where no trends were identified). There are multiple wells with decreasing trends both downgradient of the Cell 4 excavation area and upgradient of Cell 5 (CO55-PZM000 and CO56-PZP001), as well as several wells downgradient of Cell 5 (CO26-PZM007 and CO58-PZM001). No increasing trends were identified within GAA E.

Surface water, pore water, and sediment sampling have been conducted within the Turning Basin, offshore from Cell 5 (refer to the discussion in **Section 3.3.2** and to the results in **Appendix D**).

While there were pore water and surface water sample exceedances (generally towards the northeast of Cell 5, not downgradient of Cell 5), those samples were collected prior to the removal of the DNAPL source area at Cell 4. In 2024, sediment sampling was conducted from the -50 to -52 ft mean lower low water (MLLW) elevation (proposed final bottom of the channel is -50 ft MLLW, refer to **Figure 29F** for the cross section showing the proposed wharf and offshore sample locations) in conjunction with the dredging related sampling. There were no exceedances of the applicable ecological criteria in the deep sediment samples. In addition, naphthalene was not detected above the quantitation limit in any of the co-located sediment samples from the -50 to -52 ft MLLW elevation. Sediment samples collected to characterize sediment within the proposed new channel confirm that impacted groundwater is not migrating to the -50 ft MLLW elevation.

6.5.3.2 Potential Migration and Summary of COCs

The general shallow groundwater flow direction within GAA E is towards the southeast, which influences the migration of contaminants, including the main COCs at GAA E (benzene and naphthalene). Maximum benzene and naphthalene concentrations in shallow groundwater occurred at CO25-PZM008 (northeast of the Cell 4 excavation area), with benzene and naphthalene exceedances continuing to the east and southeast. The historical source was removed in 2023 (Cell 4 DNAPL Excavation, refer to **Figure 29G**), and shallow groundwater impacts are expected to continue to attenuate towards the shoreline. Trend analysis via a Mann Kendall method identified no upward trends of COCs within GAA E. Geochemical data shows depleted ferric iron and nitrate, indicating ferric iron reduction during microbial degradation under iron reducing conditions and denitrification under nitrate reducing conditions. Sulfate concentrations remain elevated for ongoing biodegradation under sulfate reducing conditions. Biological oxygen demand measured over a 5-day period indicates some active biological processes. The reducing environment (depressed ORP) and minimal dissolved oxygen support the potential for an anaerobic pathway. Sampling of geochemical parameters over time will be needed to confirm mechanisms that are driving the attenuation process along with expected dispersion after implementation of source removal via excavation.

COC concentrations in intermediate wells are significantly lower than the concentrations in the paired shallow wells and intermediate results are below Final RGs (both with the exception of the CT-037-GW-41 grab sample). This indicates that the semi-confining clay layer appears to prevent migration into the intermediate groundwater zone, and intermediate zone groundwater has not been adversely impacted.

A summary of Sitewide and Shoreline exceedances is included in **Table 32C**. The main COCs at GAA E are benzene and naphthalene in shallow groundwater, with Sitewide Final RG exceedances in multiple wells. There are no exceedances of the Shoreline Final RGs. Trend analysis indicates decreasing trends in multiple wells located both upgradient and downgradient of the Cell 5 system, and along the downgradient shoreline. Offshore sampling has identified impacts in pore water and surface water (northeast of the Cell 5 area); however, these samples were collected prior to the

Cell 4 DNAPL source removal. Groundwater sampling is ongoing to determine impacts of the Cell 4 excavation on downgradient groundwater concentrations. However, the samples collected from the groundwater within the excavation showed decreasing benzene and naphthalene, with the August 29, 2023 results showing only slightly elevated benzene results (6.6 and 7.4 µg/L) and non-detect results for naphthalene. These results indicate source removal in the immediate Cell 4 area. Offshore deep sediment samples collected in 2024 (at the proposed final bottom of the channel) did not identify any exceedances of applicable criteria. These samples were taken at points corresponding to the toe of the future capped wharf revetment structure, which will be the future points of compliance.

6.6 Groundwater Assessment Area F – Parcels B11 and B12

6.6.1 Known and Potential Source Identification

GAA F encompasses the eastern portion of Parcel B12 and a central portion of Parcel B11 (refer to **Figure 30A**). The eastern portion of Parcel B12 (outside of the CPLF footprint) was utilized for materials processing, recovery, and storage (similar to Parcel B11). During the steel plant operations, Fritz Enterprises occupied a slag processing plant at the Site. The slag processing plant activities included the excavation of slag materials from the subsurface that were then processed through a portable screener to recover metal. No significant source area was identified on the historical 5500 drawings or historical aerial photographs. Refer to **Appendix H-1** for historical figures.

During the Parcel B11 Phase II field work in October 2020, NAPL was identified at B11-026-SB. B11-026-PZ was installed; subsequent gauging identified 1.85 feet of NAPL. Three additional delineation piezometers were installed (B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ) to delineate the extent of potentially mobile NAPL (*NAPL Delineation Completion Report, B11-026-PZ*, ARM, 2021b). B11-026-PZ was also replaced by B11-026-MWS. Refer to **Figure 30A** for the location of B11-026-MWS within GAA F, and to **Figure 30B** for the location of the delineation piezometers. Measurable NAPL has not been identified in the delineation piezometers. Monthly NAPL gauging and removal (where possible) was undertaken between 2021 and August 2024, when the locations were abandoned. B11-026-MWS consistently exhibited poor product recovery due to the fact that the product is very viscous; absorbent socks were typically utilized. As outlined in the *Well Abandonment Request Letter for Parcels B1, B10, and B12* (ARM, 2024h), an excavation to remove residual NAPL at B11-026-MWS was also proposed. This NAPL excavation has not yet been completed.

6.6.2 Geology / Hydrogeology in GAA F

Within GAA F, the shallow zone is characterized primarily by an overlying slag-fill unit. This slag-fill unit is fine to coarse, poorly sorted, non-plastic, and noncohesive slag with fill gravel, and has varying thickness across GAA F. In the northern area of GAA F, the slag fill unit extends from 0 to between 32 and 40 ft deep (CP02-PZM026) (or between -12 and -20 ft AMSL). In the central

area of GAA F, the slag fill unit extends from 0-20 ft deep (CP08R-PZM034), and 0-23 ft deep (CP19R-PZM008) (to approximately -15 ft AMSL). Along the southern shoreline, the slag fill unit extends from 0-51 ft bgs (CP16-PZM-035) (to approximately -36 ft AMSL). The overlying slag fill unit increases in depth from north to south, as would be expected based on the slag reclamation activities at the CPA.

Within GAA F, the intermediate zone is characterized by interbedded clay, sand, and silt deposits. Semi-confining clay layers are present within the intermediate zone in several locations. In well CP02-PZM026, a clay unit extends from between 32 and 40 feet (continuous boring data not available) to 42 ft deep (from -12 and -20 ft AMSL to -22 ft AMSL) and is underlain by a coarse-grained sand unit from 42-47 ft deep (base of borehole). In well CP08R-PZM034, two distinct clay units are documented, extending from 21.5-27 ft deep (approximately -11.5 to -17 ft AMSL), and 35-45 ft deep (approximately -25 to -35 ft AMSL), and interbedding with coarser grained sand units. Along the southern shoreline, the clay unit extends from 51-56 ft bgs (approximately -36 to -41 ft AMSL, CP16-PZM-035). While the semi-confining clay unit was documented in all locations where deeper geologic data was available for review, there appears to be significant variability in depth and thickness of semi-confining clay layers within the intermediate zone of GAA F.

Groundwater surface elevations within both the shallow and intermediate zones are relatively flat, characterized by a very shallow hydraulic gradient. In the shallow zone, the groundwater flows radially from the northern portion of GAA F to the southern shoreline (refer to **Figure 3** for shallow groundwater contours). The intermediate groundwater contours indicate a relatively flat groundwater gradient in the intermediate zone (refer to **Figure 4** for intermediate groundwater contours). Groundwater flow direction and the potentiometric surface within GAA F are likely influenced by tidal changes, especially within shoreline wells (average tidal influence throughout the entire Sparrows Point peninsula of 285 feet, refer to **Section 2.1.3.3**). Based on the subsurface geology of GAA F, the shallow zone aquifer is unconfined, and the intermediate zone aquifer is semi-confined due to the presence of semi-confining clay unit (although there is variability in the depth and thickness) throughout GAA F. This semi-confining clay unit restricts vertical hydraulic connectivity between the shallow and intermediate zones.

6.6.3 Nature and Extent of Contamination in GAA F

In **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for groundwater COPCs. The groundwater database was compared to the Final RGs in **E-Attachment #1B**. Exceedances of the Final RGs were then identified as GAA F groundwater COCs. For GAA F, benzene, bis(2-Ethylhexyl)phthalate, and naphthalene were identified as groundwater COCs based on the Sitewide Final RGs. No groundwater COCs were identified based on the Shoreline Final RGs. The main COC at GAA F is benzene.

Refer to **Table 33A** for a summary of groundwater results for GAA F for all wells, compared to the Sitewide Final RGs. Refer to **Table 33B** for a summary of groundwater results for GAA F for

shoreline wells, compared to the Shoreline Final RGs. **Tables 33A and 33B** include results from the Spring 2023 sampling event through the end of 2024, for CPLF monitoring wells. For wells not regularly sampled, the most recent available results are included. The Current COC Distribution discussion in the following section will focus on the most recent available results for each monitoring well.

Refer to **Table 33C**, where statistical analysis includes the detected concentration range, the EF, and the DF for each identified COC.

6.6.3.1 Current COC Distribution

Refer to **Tables 33A and 33B** for a summary of groundwater results within GAA F versus the applicable Sitewide and Shoreline Final RGs, respectively. Refer to **Figure 30C** for exceedances of the Sitewide Final RGs within GAA F. There are no exceedances of the Shoreline Final RGs in GAA F (refer to **Figure 30D**). There were Sitewide Final RG exceedances for benzene, naphthalene, and bis(2-Ethylhexyl)phthalate. There were no Shoreline Final RG exceedances in GAA F.

Based on the most recent sampling event (October 2024) the maximum benzene concentrations in shallow groundwater occurred at CP08R-PZM008 (1,000 µg/L) and CP19R-PZM008 (2,500 µg/L); refer to **Figure 30C** and **Table 33A**. The maximum naphthalene concentration in shallow groundwater occurred at CP19R-PZM008 (340 µg/L). Shallow benzene and naphthalene concentrations attenuate in all directions (refer to **Figures 20 and 22**). Benzene concentrations in shallow shoreline wells ranged from not detected (CP12-PZM012) to 82 µg/L (CP16-PZM008).

For the intermediate groundwater zone, the maximum benzene and naphthalene concentrations (based on the most recent sampling event) both occur at CP16-PZM035 (benzene at 110 µg/L [above the Sitewide Final RG] and naphthalene at 21 µg/L [below the Sitewide Final RG]); refer to **Figures 21 and 23** and **Table 33A**. At CP16-PZM035, benzene and naphthalene concentrations in the intermediate zone well are slightly higher than in the shallow zone well. However, based on the borelog, the slag fill unit is continuous down to 51 feet bgs; the shallow and intermediate monitoring wells have overlapping screened intervals. Refer to **Table 33C** for statistical analysis. Based on the entire GAA F groundwater dataset, naphthalene had an exceedance frequency of 4.9% and a maximum concentration of 400 µg/L (versus the Sitewide Final RG of 115 µg/L), and bis(2-ethylhextyl)phthalate had an exceedance frequency of 3.3% and a maximum concentration of 18 µg/L (versus the Sitewide Final RG of 1.0 µg/L). The statistical analysis indicates that groundwater exceedances (excluding benzene as the main GAA F COC) are minor (generally less than one order of magnitude above the Final RGs) and are limited in extent.

Mann Kendall statistical analysis was used to identify increasing or decreasing trends at a 95% confidence factor based on all historical data results. Trend analysis was conducted for GAA F COCs (benzene, bis(2-Ethylhexyl)phthalate and naphthalene) and for wells with a sufficient number of sampling results. Benzo[a]pyrene (to be representative of PAHs) was also included in

the trend analysis as this, along with benzene and naphthalene, are the main groundwater COCs within the CPA Site as a whole. Refer to **Appendix G** for a complete summary of trends within GAA F monitoring wells and to **E-Attachment #5** for the ChemStat trend analysis export files. Within GAA F, statistically significant trends (with results above the Final RGs) were identified as follows:

- CP07-PZM006 (benzene, downward trend): most recent result is 360 µg/L, versus the Sitewide Final RG of 100 µg/L.
- CP19R-PZM008 (bis(2-ethylhexyl)phthalate, upward trend): the April 2023 bis(2-ethylhexyl)phthalate result is 18 µg/L. However, the three more recent results for bis(2-ethylhexyl)phthalate are all non-detect at a reporting limit of 3.0 µg/L.
- CP16-PZM035 (benzene, downward trend): most recent result is 110 µg/L, versus the Sitewide Final RG of 100 µg/L.

Multiple trends were identified for other wells / COCs, but the results for those specific wells / COCs were below the Final RGs. Among those trends with results below the Final RGs (but not non-detect concentrations), statistically significant decreasing trends were identified for multiple wells: CP02-PZM007 (benzene, benzo[a]pyrene, naphthalene), CP12-PZM012 (benzene and naphthalene), CP14-PZM009 (benzene), CP20-PZM011 (benzene, benzo[a]pyrene, naphthalene), CP21-PZM004 (benzene), CP02-PZM026 (benzo[a]pyrene), CP12-PZM052 (naphthalene), and CP14-PZM062 (naphthalene). Among those trends with results below the Final RGs (but not non-detect concentrations), statistically significant increasing trends were identified in only two locations: CP16-PZM008 (naphthalene) and CP21-PZM004 (benzene). For CP16-PZM008, the October 2024 naphthalene result is 8.6 µg/L, below the Sitewide Final RG of 115 µg/L. For CP21-PZM004, the October 2024 benzene result is 9.4 µg/L, below the Sitewide Final RG of 100 µg/L.

No trends were identified for benzene or naphthalene in CP08R-PZM008 (maximum concentrations within GAA F). Refer to **Appendix G** for a figure showing the locations of the identified trends (as well as where there was insufficient data for trend testing, or where no trends were identified). There are multiple wells with decreasing trends (and results above ND) downgradient of the maximum impacted area (CP08R-PZM008 and CP19R-PZM008) and along the downgradient shoreline, including CP14-PZM009 (benzene), CP12-PZM052 (naphthalene), CP14-PZM062 (naphthalene), and CP16-PZM035 (benzene). While CP16-PZM008 had an increasing trend for naphthalene, the October 2024 naphthalene result is 8.6 µg/L, below the Sitewide Final RG of 115 µg/L.

6.6.3.2 Potential Migration and Summary of COCs

Groundwater COC fate and transport within GAA F appear to be limited by the relatively flat shallow groundwater gradient and the semi-confining clay layer. Benzene (more so) and naphthalene (less so) are the main COCs within GAA F. The relatively flat gradient within the area supports the fact that significant attenuation of the benzene plume is observed between source

wells (CP08R-PZM008 and CP19R-PZM008) and shoreline wells. The lack of impacts within the intermediate groundwater zone (no exceedances of Final RGs for CP08R-PZM034) is supported by the continuity of interbedded, semi-confining clay observed throughout GAA F. Trend analysis completed on COCs within GAA F via a Mann Kendall method indicates downward or no trends for naphthalene and benzene in most of the shoreline wells. One upward trend in benzene concentrations is observed in a well upgradient of the benzene source area (CP21-PZM004), although the most recent result is well below the Sitewide Final RG. Geochemical data collected within GAA F indicates a reducing aquifer (depressed ORP) with depressed dissolved oxygen. Additionally, the area appears to be depleted in ferrous iron, with minor amounts of nitrate available and more sulfate available, indicating a nitrogen/iron reducing environment and potential for continued sulfate reduction. Analysis shows there was no detected biological oxygen demand over a 5-day period and no carbon dioxide was observed in groundwater samples. The pH within GAA F varies between 8 and 13 s.u. with lower pHs observed upgradient of the main benzene plume. These data point to the potential for biodegradation within this area but geochemical trending would need to be completed to confirm active degradation conditions. Based on the available data, it is likely that attenuation mechanisms are occurring via dispersion and volatilization.

A summary of Sitewide and Shoreline exceedances is provided in **Table 33C**. In the shallow zone, there were Sitewide Final RG exceedances for benzene, naphthalene, and bis(2-Ethylhexyl)phthalate. Shallow benzene concentrations decrease in all directions from the source towards the shoreline, with no Shoreline Final RG exceedances for any groundwater COCs.

In the intermediate zone, there were Sitewide Final RG exceedances in intermediate well CP16-PZM035 only; there are no other exceedances within intermediate zone wells. There were no Shoreline Final RG exceedances in intermediate zone wells.

The low COC concentrations and the trend analysis within GAA F support the use of MNA.

6.7 METALS

Based on the cumulative risk analysis completed (refer to **Section 3.6**), final RGs were established for arsenic for Sitewide receptors and iron for Shoreline receptors. The groundwater database is compared to the Final RGs in **E-Attachment #1B**, and are included in **Tables 28-33**.

There were arsenic exceedances of the Sitewide Final RG (40 µg/L) in GAA B, with a maximum arsenic concentration was 537.6 µg/L at CO28-PZM048. There were iron exceedances of the Shoreline Final RG (22,500 µg/L) in GAA B, with a maximum iron concentration was 205,000 µg/L at CP22-MWI. Refer to the individual GAA exceedance figures for locations with all metals exceedances.

Iron, manganese, and vanadium are slag-related COCs. While arsenic is not a slag-related COC, the groundwater exceedances were limited in extent. No specific metals source areas have been identified related to the exceedance locations.

7.0 NATURE AND EXTENT OF CPA IMPACTS

As discussed in **Section 3.6**, a conservative cumulative risk analysis was prepared to identify and develop Final RGs for groundwater COPCs that contribute significantly to cancer risk or noncancer hazard under each potentially exposed receptor scenario and are considered groundwater COPCs. This section discusses exceedances of the groundwater Final RGs and the associated SSLs, across the entire CPA Site.

7.1 FINAL RGS - GROUNDWATER

The groundwater database is compared to the Final RGs in **E-Attachment #1B**, as well as in the following tables:

- **Table 28A**: Compares groundwater results for GAA A to Sitewide Final RGs
- **Table 28B**: Compares groundwater results for GAA A to Shoreline Final RGs
- **Table 29A**: Compares groundwater results for GAA B to Sitewide Final RGs
- **Table 29B**: Compares groundwater results for GAA B to Shoreline Final RGs
- **Table 30A**: Compares groundwater results for GAA C to Sitewide Final RGs
- **Table 30B**: Compares groundwater results for GAA C to Shoreline Final RGs
- **Table 31A**: Compares groundwater results for GAA D to Sitewide Final RGs
- **Table 31B**: Compares groundwater results for GAA D to Shoreline Final RGs
- **Table 32A**: Compares groundwater results for GAA E to Sitewide Final RGs
- **Table 32B**: Compares groundwater results for GAA E to Shoreline Final RGs
- **Table 33A**: Compares groundwater results for GAA F to Sitewide Final RGs
- **Table 33B**: Compares groundwater results for GAA F to Shoreline Final RGs

Groundwater exceedance locations are also depicted in the following figures:

- **Figure 31A**: Depicts Sitewide Final RG Groundwater Exceedances for Benzene in the Shallow Zone
- **Figure 31B**: Depicts Sitewide Final RG Groundwater Exceedances for Benzene in the Intermediate Zone
- **Figure 31C**: Depicts Shoreline Final RG Groundwater Exceedances for Naphthalene in the Shallow Zone
- **Figure 31D**: Depicts Shoreline Final RG Groundwater Exceedances for Naphthalene in the Intermediate Zone
- **Figure 31E**: Depicts Sitewide Final RG Groundwater Exceedances for PAHs
- **Figure 31F:** Depicts Shoreline Final RG Groundwater Exceedances for Toluene in the Shallow Zone
- **Figure 31G**: Depicts Shoreline Final RG Groundwater Exceedances for PAHs in the Shallow Zone

- **Figure 31H:** Depicts Shoreline Final RG Groundwater Exceedances for Toluene in the Intermediate Zone
- **Figure 31I:** Depicts Shoreline Final RG Groundwater Exceedances for Iron in the Intermediate Zone

A summary of groundwater exceedances of the Final RGs by GAA is shown in **Table 34**. These represent the groundwater COCs for each GAA. Based on a comparison with the Sitewide Final RGs, benzene is identified as a groundwater COC in five GAAs: GAA B, GAA C, GAA D, GAA E, and GAA F. Naphthalene is identified as a groundwater COC in all six GAAs. Other PAHs are identified as groundwater COCs in all six GAAs, with the most PAH exceedances in GAA B, GAA C, and GAA D. Arsenic is identified as a groundwater COC in GAA B only.

Based on a comparison with the Shoreline Final RGs, no groundwater COCs were identified for GAA A, GAA D, GAA E, or GAA F. Iron and toluene were identified as shoreline groundwater COCs for GAA B, while three PAHs were identified as shoreline groundwater COCs for GAA C.

7.2 Soil Screening Levels

Potential continuing sources to groundwater (including soil concentrations above the SSLs that could present a risk of cross-media transfer from soil to groundwater) were considered. Specifically, soil from the unsaturated zone (roughly 0-8 feet bgs across the Site) could present a potential continuing source to groundwater (soil results from within the saturated zone are better represented by the actual groundwater results).

SSLs were calculated for each of the groundwater COCs to identify soil impacts that could be a continuing source of cross-media transfer of contaminants to groundwater at concentrations that could exceed the groundwater target levels for each receptor. **Figure 16** presents the location of all soil sampling conducted across the CPA since 2016. As discussed in **Sections 3.6.1** and **3.6.2**, cyanide and hexavalent chromium were not retained as groundwater COCs; therefore no SSLs were calculated for cyanide or hexavalent chromium.

The SSLs were derived using the USEPA's partitioning equations from Section 4.8.3 of the USEPA RSL User's Guide (November 2020). The partitioning equations can be used to back calculate SSLs that are protective of groundwater, in order to address potential cross media transfer from soil to groundwater. The below USEPA equations are used to calculate the SSLs based on the previously calculated Final RGs for the Sitewide and Shoreline scenarios.

$$SSL\left(\frac{mg}{kg}\right) = C_{water} * \left[K_d + \frac{(\theta_w + \theta_a) * H'}{\rho_b}\right]$$

Where:

$$C_{water} = Groundwater\ Target\ Value * DAF$$

$$\theta_a = n - \theta_w$$

$$n = 1 - \left(\frac{\rho_b}{\rho_s}\right)$$

DAF = Dilution Attenuation Factor (unitless), assume 1.
K_d = Soil-water partition coefficient (L/kg)
contaminant specific for inorganics, refer to **Appendix E-7**.
$K_d = K_{oc} * f_{oc}$ for organics
K_{oc} = Soil organic carbon-water partition coefficient (L/kg), contaminant specific, refer to **Appendix E-7**.
f_{oc} = fraction organic carbon in soil (g/g), assume 0.002.
θ_w = water-filled soil porosity (L_{water}/L_{soil}), assume 0.3.
θ_{air} = air-filled soil porosity (L_{air}/L_{soil}), calculated, refer to **Appendix E-7**.
H' = Dimensionless Henry Law Constant (unitless), contaminant specific, refer to **Appendix E-7**.
n = total soil porosity (L_{pore}/L_{soil}), calculated, refer to **Appendix E-7**.
ρ_b = dry soil bulk density (kg/L), 1.5 kg/L
ρ_s = soil particle density (kg/L), 2.65 kg/L

Refer to **Appendix E-7** for SSL calculations. The calculated SSLs to prevent cross-media transfer from soil to groundwater under each receptor scenario are included in **Table 35A**.

Within each GAA, parameters identified as groundwater COCs based on exceedances of the Final RGs (refer to **Table 34**) were evaluated as a soil COPC. If a soil COPC did not exceed SSLs within a certain GAA, then that parameter is not a soil COC for that GAA. Locations with exceedances of the SSLs for inorganic COCs and of 10x the SSLs for organic COCs indicate a potential risk of cross-media transfer from soil to groundwater. Refer to **Table 35A** for soil COPCs identified for the sitewide and shoreline scenarios; the 10x SSLs for Sitewide soil COPCs are also included. These SSLs were used to identify potential soil COCs.

The CPA soil database (refer to **E-Attachment #2**) was evaluated to identify exceedances of the applicable SSLs. Refer to **Table 35B** for a summary of soil exceedances by GAA and point of compliance (sitewide vs shoreline). These represent the soil COCs for each GAA.

Soil exceedance locations are also depicted in the following figures:

- **Figure 32A**: Depicts Sitewide SSL Exceedances for Benzene
- **Figure 32B**: Depicts Sitewide SSL Exceedances for Naphthalene
- **Figure 32C**: Depicts Sitewide SSL Exceedances for other PAHs
- **Figure 32D**: Depicts Shoreline SSL Exceedances for all parameters

No soil COCs were identified for GAA A. Naphthalene was identified as a sitewide soil COC for the remaining five GAAs: GAA B, GAA C, GAA D, GAA E, and GAA F. Naphthalene was the only soil COC identified for GAA F. Based on a comparison with the Sitewide SSLs, benzene is identified as a soil COC in three GAAs: GAA B, GAA C, and GAA D. Other PAHs are identified as soil COCs in four GAAs, with the most PAH exceedances in GAA B, GAA C, and GAA D.

There were no shoreline groundwater COCs for GAA A, GAA D, GAA E, or GAA F; therefore, no shoreline SSLs were required. Iron was identified as a shoreline soil COC for GAA B, while three PAHs were identified as shoreline soil COCs for GAA C.

8.0 DEVELOPMENT AND EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES

8.1 PROCESS DESCRIPTION

8.1.1 Overall Process

The development of corrective action alternatives for each of the GAAs followed a standard methodology, outlined below:

- Identify General Response Actions (GRAs), remedial technologies, and applicable process options to address impacted media at each of the GAAs. The results of this applicability screening are outlined for GAA A through GAA F in **Tables 36A, 37A, 38A, 39A, 40A,** and **41A.**

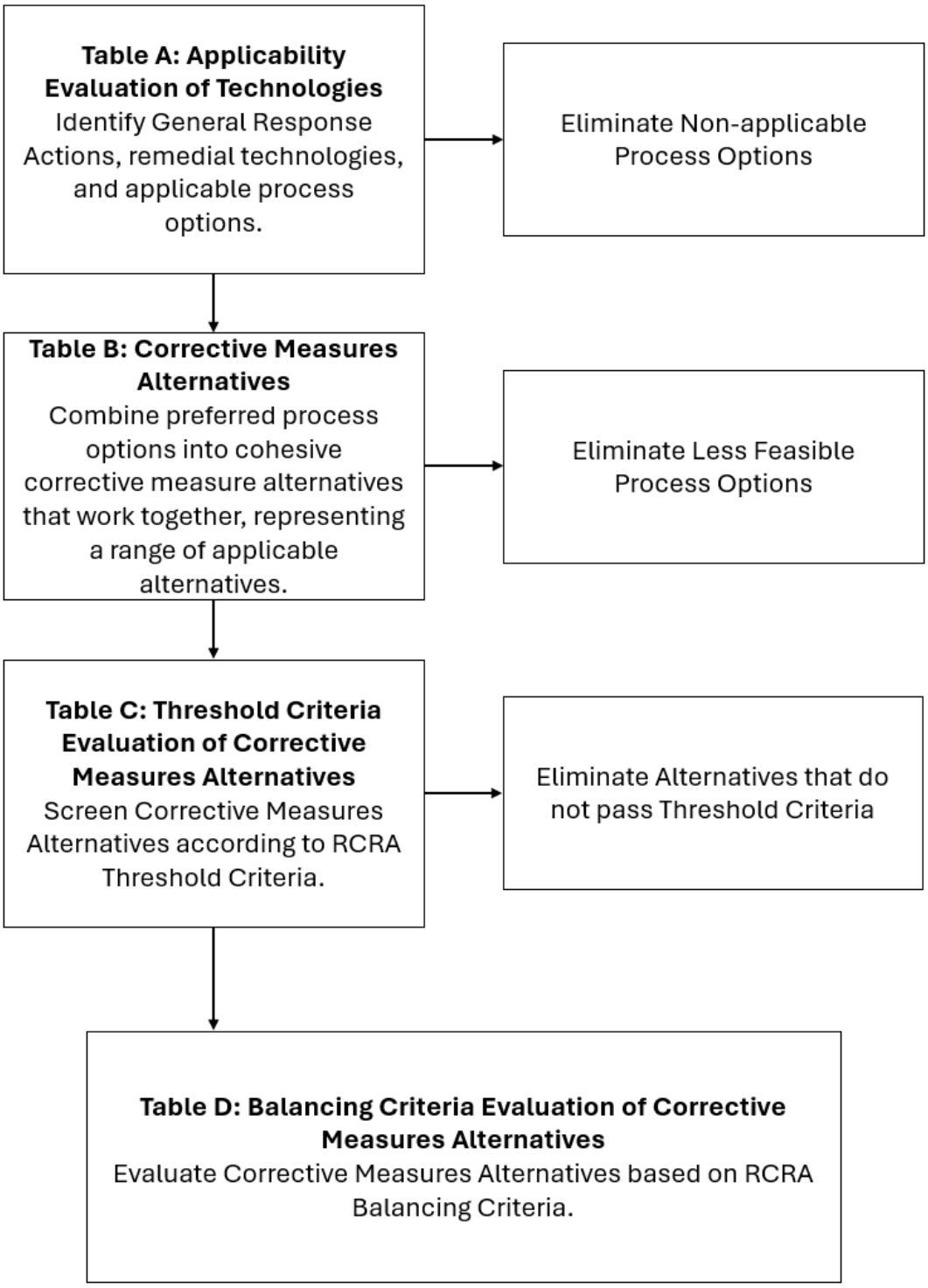
- Combine applicable and preferred process options into corrective measures alternatives representing a range of GRA combinations. A summary of the Corrective Measures Alternatives Array are outlined for GAA A through GAA F in **Tables 36B, 37B, 38B, 39B, 40B,** and **41B.**

- Screen the Corrective Measures Alternatives in accordance with the RCRA Threshold Criteria. A summary of the screening of the Corrective Measures Alternatives for GAA A through GAA F in **Tables 36C, 37C, 38C, 39C, 40C,** and **41C.**

- Evaluate the Corrective Measures Alternatives in accordance with RCRA Balancing Criteria in an individual and comparative analysis. A summary of the evaluation of the Corrective Measures Alternatives for GAA A through GAA F is presented in **Tables 36D, 37D, 38D, 39D, 40D,** and **41D.**

Refer to **Figure 33** for the location of all sitewide monitoring wells, the GAAs, and the limit of disturbance (LOD) of the proposed Container Terminal.

See flow chart below for an overview of the corrective measures development process.



Additional detail regarding each of the steps of the process is outlined below.

8.1.2 Identification of General Response Actions, Remedial Technologies, and Process Options

GRAs are broad classes of media-specific actions that are further specified as applicable remedial technologies and process options for each GAA. In general, the following GRAs were evaluated for each of the GAAs.

- No Action - The No Action Alternative is presented in order to define a baseline condition against which other alternatives are compared and typically refers to an absence of efforts to reduce contaminant mass or otherwise treat or contain contamination. The No Action Alternative will include IMs that have been or are being completed for each GAA.
- Institutional Controls (ICs)–Legal or administrative measures to reduce or minimize potential for exposure to contaminants or disturbance of containment measures.
- Engineering Controls (ECs) - Controls to physically restrict public and employee access, maintain, and/or monitor the site.
- Removal Technologies – Extraction of contaminated media for ex-situ treatment and/or disposal or to reduce volume of contaminants.
- Containment Technologies – In-situ containment and/or stabilization of contaminated media.
- Treatment Technologies – Treatment processes (i.e., soil vapor extraction, amendment injections, thermal, etc.) to reduce toxicity, mobility, or volume of contaminated media, onsite.
- Disposal Technologies – Relocate treated or untreated media in a manner that reduces potential interaction with the public and the environment.

Remedial technologies and process options were evaluated for applicability to GAA-specific media and contaminants and preferred process options were identified on the basis of area-specific conditions such as current land use, redevelopment status, the presence of subsurface obstructions, surface features, and the geology/hydrology of the area. Generally speaking, individual GRAs must be combined together to effectively address GAA specific impacts and provide a comprehensive remedy. A detailed discussion of the remedial technologies and process options for each GAA are located below.

Preferred process options were combined into a collection of GRAs (referred to as Corrective Measures Alternatives) that work most efficiently together and address GAA specific conditions holistically. The Corrective Measures Alternatives provide a comprehensive remedy and are evaluated against the threshold and balancing criteria.

8.1.3 Evaluation of RCRA Threshold Criteria

These Corrective Measures Alternatives must be capable of meeting the RCRA Threshold Criteria to be considered for implementation at the Site. The Threshold Criteria assesses the overall

protection of human health and the environment, as well as achievement of CAOs and control of sources of releases.

- Overall protection of human health and the environment - The overall assessment of protection is based on a composite of factors evaluated under other evaluation criteria, especially short-term effectiveness, long-term effectiveness, and cleanup criteria. The evaluation of this criterion describes how site risks from each pathway are mitigated, reduced, or controlled through remediation, engineering controls, and/or institutional controls.

- Achievement of media objectives – **Section 3.0** of this report presents the Final RGs developed for this site for evaluation of protection of human health and the environment for each identified contaminant. Ability to achieve compliance with the Final RGs will be addressed for each alternative.

- Source control - The assessment of an alternative's ability to control the source is based on treatment that reduces toxicity, mobility, or volume of the principal threat. This includes eliminating or minimizing the contaminants, to the extent feasible. This criteria evaluation will look at an alternative's ability to remove or contain identified sources.

8.1.4 Evaluation of RCRA Balancing Criteria

Those Corrective Measures Alternatives meeting the Threshold Criteria are then carried forward for evaluation in accordance with the RCRA Balancing Criteria. The Balancing Criteria assesses long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; cost effectiveness; and community and State acceptance.

Long-term effectiveness

The focus of this evaluation is the effectiveness of the controls that would be applied to manage impacts from residuals and/or untreated materials, and future remediation considerations. Components of this criterion include:

- Magnitude of impacts remaining from untreated material or treatment residuals at the conclusion of the remedial activities;
- Adequacy and reliability of controls that are used to manage treatment residuals or untreated materials that remain in the target area; and
- Consideration of the need to evaluate and implement a technology to maintain compliance at the established compliance monitoring locations.

Reduction of toxicity, mobility, or volume through treatment

This criterion addresses the preference for remedial actions that, as their principal element, employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume

of the hazardous constituents present. This preference is satisfied when the treatment used reduces the impacts in the target areas through destruction of constituents, irreversible reduction in constituent mobility, or reduction of total volume of impacted media. The evaluation focuses on the following factors:

- Treatment processes employed and materials treated;
- Volume of impacted materials destroyed or treated;
- Degree of expected reductions in toxicity, mobility, and volume;
- Degree to which treatment is reversible; and
- Type and quantity of residuals remaining after treatment.

Short-term effectiveness

This criterion evaluates the short-term effectiveness of each alternative in protecting human health and the environment during the period of remedial action implementation, prior to achieving long-term cleanup goals. Evaluation factors include:

- The potential for human exposure to contaminants during treatment, excavation, handling, transport, containment, or re-disposal of waste materials;
- The need for and reliability of protective measures to minimize short-term risks to human health and the environment; and
- The time required to achieve adequate protection during the remedial action phase.

Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. This involves the analysis of the factors listed below:

- Technical and administrative feasibility and reliability of technologies;
- Ability to construct, operate, and monitor the specific technologies;
- Ease of undertaking future additional remedial action, if necessary;
- Availability of services, materials, and specialists; and
- Availability of adequate off-site treatment, storage, and disposal services.

Cost

This criterion includes an evaluation of capital cost, annual O&M costs, and total present worth of each alternative. The cost estimates are considered “engineering estimates” and are expected to be accurate within +50 to -30 percent for the identified scope of the remedial action.

- Capital Costs:
    - Direct (construction) costs for the equipment, labor, and materials necessary to install the remedial action alternative; and
    - Indirect (non-construction and overhead) costs for engineering, financial, and other services that are not a part of the actual installation activities.
- Annual O&M costs after construction necessary to ensure the continued effectiveness of a remedial action; and
- Total present worth analysis used to discount future costs to a common year.

Regulatory and Community Acceptance

This criterion evaluates the technical and administrative issues and concerns the USEPA, MDE, and community stakeholders may have regarding each alternative.

8.2 Development of Corrective Measures for GAA A

8.2.1 Applicability Evaluation for Identified Process Options

The process for development and evaluation of Corrective Measures Alternatives outlined in **Section 8.1** was implemented for GAA A. Process options were evaluated for applicability with GAA A conditions, as outlined in **Table 36A**. Several technologies were eliminated from further consideration during screening; the technologies were identified as not applicable to GAA A due to the nature of the contaminants or specific conditions at GAA A, as detailed below.

- Excavation and disposal – This removal technology was eliminated from consideration based on the lack of observed NAPL within the groundwater monitoring wells in GAA A. Additionally, removal actions for concrete and other debris are actively underway.
- Product Recovery (Absorbent/Skimmers) - This removal technology was eliminated from consideration based on the lack of observed NAPL within groundwater monitoring wells in GAA A. According to the *Coke Point Landfill Semi-Annual Groundwater Monitoring Report Spring 2024* (dated October 30, 2024), no NAPL was identified during the Spring 2024 monitoring event.
- Multi-Phase Extraction – MPE was eliminated as a potential treatment technology since naphthalene and benzene plumes do not exist at a high enough concentration that NAPL can occur and no soil source has been observed.
- Soil Flushing – This treatment technology was eliminated from consideration based on the characteristics of contaminants within GAA A, mainly that NAPL has not been observed in soil within GAA A.
- Stabilization/Solidification – This treatment technology was eliminated from consideration based on the characteristics of contaminants within GAA A, mainly that NAPL has not been observed in soil within GAA A.
- In-situ Chemical Reduction (ISCR) - ISCR was eliminated as a potential treatment technology since it is not suitable for treating the non-slag related contaminants within GAA A. This process option is typically applied to halogenated VOCs or inorganic compounds.
- Low Temperature thermal treatment / stripping - Low temperature thermal treatment was eliminated as a potential treatment technology since it is not applicable to dissolved phase contaminants in GAA A and no NAPL impacted soil has been observed.
- Electrical Resistance Heating (ERH) - ERH was eliminated as a potential treatment technology because exceedances of Final RGs are minimal and ERH is typically used to target source zones. Subsurface obstructions would inhibit the ability to install electrodes in the spacing required to heat uniformly.
- On-Site Disposal (Corrective Action Management Unit [CAMU]) - A CAMU was eliminated as a disposal option for excavated material due to the lack of available space.

Additionally, removal actions for concrete and other debris are actively underway. The material within the CPLF will be fully reclaimed.

8.2.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA A

Process options that were not eliminated due to inapplicability were retained for consideration as components of a comprehensive alternative. The summary of the retained process options is included in **Table 36A**. The COCs identified to exceed Final RGs in GAA A include naphthalene and bis(2-ethylhexyl)phthalate. There are no shoreline exceedances of Final RGs in GAA A. Naphthalene is the primary COC in GAA A, with exceedances observed in one shallow and one intermediate well surrounding the CPLF and a detection frequency and exceedance frequency of 92% and 5.4%, respectively. Refer to **Table 28C** for Final RG statistics. Naphthalene requires an approximate reduction of 400 ppb to reach Final RGs in GAA A. Detections of bis(2ethylhexyl)phthalate are limited to 2 wells: CP25-MWS and CP05-PZM019 with one minor exceedance observed at CP05-PZM019. More recent sampling has indicated bis(2-ethylhexyl)phthalate to be non-detect at CP05-PZM019. It should be noted that the laboratory detection limits for some samples has exceeded bis(2ethylhexyl)phthalate's Final RG of 1.0 µg/L (refer to **Table 28A**). Remedial alternatives for GAA A were therefore developed to focus on reducing naphthalene concentrations while also addressing bis(2-ethylhexyl)phthalate. Because no single technology alone is sufficient to meet all CAOs, alternatives were developed by integrating technologies with the greatest potential to reduce naphthalene concentrations and achieve overall remedial goals for GAA A, as shown in **Table 36B**.

The presented alternatives for GAA A include ICs and ECs in combination with MNA, impermeable and low permeability capping, in-situ chemical oxidation (ISCO) via oxidant, and bioremediation. These process options were identified as the best suited technologies based on GAA specific conditions.

- MNA was identified as a preferred process option based on results and statistical analysis presented in the *Coke Point Landfill Semi-Annual Groundwater Monitoring Report Spring 2024* (dated October 30, 2024). Statistical analysis involved completion of a Mann-Kendall test to identify linear trends using data since 2011. Locations with naphthalene detections at shoreline wells are accompanied by statistically decreasing trends or no trends (refer to **Appendix G**). Geochemical conditions in GAA A indicate a reducing environment with low dissolved oxygen, depleted ferric iron and nitrate, and available sulfate, supporting the potential for anaerobic biodegradation. MNA will be used to assess that contaminant concentrations in groundwater are continuing to decrease toward Final RGs.
- The presumptive remedy for landfills is containment, which in the scenario at the CPA would consist of capping as a preferred process. Installation of an impermeable and low permeability barrier will reduce the potential for impacted soil to act as a continuing source to groundwater and expedite natural attenuation of contaminants in groundwater.

- Bioremediation was identified as a preferred process option based on naturally reducing aquifer conditions within GAA A. Monitoring results from the Spring 2024 CPLF groundwater monitoring event include little to no dissolved oxygen (DO) and significantly depressed oxidation-reduction potential (ORP) in wells where exceedances were observed, indicating the naturally occurring conditions are conducive to bioremediation. However, elevated pH throughout the shallow aquifer will be a significant implementability challenge for this process option.
- ISCO was identified as a preferred process option based on the sustained elevated pH in the area of the aromatic VOC and PAH exceedances. Introduction of an ISCO amendment may be able to utilize the elevated pH conditions for activation. However, challenges related to even distribution of injectate and REDOX conditions may occur.

During this step in the process, several process options were not selected as part of a comprehensive alternative (Corrective Measures Alternative) due to GAA-specific conditions, as discussed below.

- Hydraulic containment was not selected as process option for GAA A as significant attenuation of contaminant impacts to groundwater have been observed prior to reaching the property boundary or nearby surface waters. The most recent analysis of available groundwater data, which is detailed in the *Coke Point Landfill Semi-Annual Groundwater Monitoring Report Spring 2024* (dated October 30, 2024), has indicated generally decreasing concentration trends in naphthalene within GAA A in a majority of wells and particularly those located further downgradient and closer to the shoreline. As the potential for offsite migration of contaminants is insignificant, it is recommended that remedial options focused on potential source areas be selected over options focused on contaminant containment in groundwater.
- Containment via sheet piling or slurry wall was not selected as a process option for GAA A because contaminants in groundwater are attenuating in the direction of the property boundary or surface water and generally decreasing over time, as detailed in the spring 2024 groundwater monitoring report for CPLF (refer to **Appendix G** for trend analysis data). The potential for offsite migration of contaminants is insignificant.
- Air sparging/soil vapor extraction was not selected as a process option for GAA A because naphthalene and bis(2-ethylhexyl)phthalate are the only COCs and do not easily volatilize. Additionally, GAA A includes only minor exceedances of Final RGs, and active remediation would not be an efficient use of resources.
- Groundwater Pump and Treat was not selected as a process option for GAA A because there are no shoreline exceedances and the exceedances in GAA A are relatively minor with naphthalene needing less than an order of magnitude reduction to meet Final RGs. Naphthalene exceedances are observed at two wells on opposite sides of the landfill, spread-out, making significant mass removal via GWPT unlikely and inefficient. Also, the handling of water may require an additional treatment system onsite. As with the

containment options described above, this treatment option may also be less desirable than other options due to the fact that groundwater contaminant concentrations are already attenuating naturally in the GAA and do not appear to be at risk for offsite migration based on data from ongoing groundwater monitoring activities.

- Enhanced aerobic bioremediation was not selected as a process option for GAA A due to the characteristics of the saturated zone in the area of contaminant impacts. The saturated zone in this area is naturally reducing (i.e. low dissolved oxygen). It would be difficult to "force" the subsurface environmental conditions to be favorable for aerobic bacteria.
- Biosparging was not selected as a process option for GAA A due to the subsurface heterogeneity and naturally reducing aquifer. Targeted and uniform injection of air to increase rate of aerobic biodegradation will be difficult.
- Thermal conduction heating (TCH) was not selected as a process option for GAA A. TCH is typically used to address high concentration source zones. Such high concentrations are not present within GAA A.
- A PRB was not selected as a process option for GAA A because of the significant attenuation of groundwater contaminants observed before they reach the property boundary or surface water and general decreasing concentration trends for contaminants across GAA A. There are no shoreline exceedances of Final RGs in the area. A PRB would generally be appropriate for a condition in which there is high risk of offsite migration of contaminants, which is not the case for GAA A.
- Permitted discharge was not selected as a process option for GAA A. This process option would have been utilized in conjunction with GWPT. As explained above, GWPT was not selected due to the fact that groundwater contaminant concentrations appear to be attenuating naturally and GWPT may not provide a shorter cleanup timeline than natural attenuation.

The remaining remedial technologies and process options were combined to create a workable number of Corrective Measures Alternatives that represent a range of general approaches and provide comprehensive remedies, as discussed in **Section 8.2.3**, below.

8.2.3 Summary of Corrective Measures Alternatives for GAA A

Each of the preferred process options included in **Table 36A** was combined to form Corrective Measures Alternatives for GAA A. The Alternatives for GAA A are described in detail below. As highlighted in **Section 8.2.2**, the stratigraphy and heterogeneity of the native soil deposits pose significant engineering challenges for the implementation of an in-situ and ex-situ treatment technologies and would present difficulty for technologies requiring uniform injections or bulk extraction. Alternatives have been developed and evaluated with these engineering challenges in mind.

8.2.3.1 Alternative 1: No Action

The No Action Alternative is presented in order to define a baseline condition against which other alternatives are compared and typically refers to an absence of efforts to reduce contaminant mass or otherwise treat or contain contamination. The No Action Alternative considers no benefits from future redevelopment of the GAA. Under Alternative 1, no efforts would be employed to reduce potential cross-media transfer of impacts to groundwater, nor would protections be implemented to prevent exposure to impacted groundwater. In addition, no activities would be conducted to evaluate the continuing groundwater trends or the ability of natural attenuation to reach Final RGs.

8.2.3.2 Alternative 2: Reclamation and Capping, MNA, LUCs, and ECs/ICs

Alternative 2 includes the reclamation of the landfill to surface grade and construction of an impermeable and low permeability cap through development. This cap (paving or building construction) will be designed to prevent exposure to contaminated soil/slag and groundwater, reduce potential vertical vapor migration emanating upward, and prevent surface and stormwater from infiltrating through the vadose zone material. Upon construction of the cap for CPLF, the vast majority of the area associated with GAA A will be covered with an engineering barrier subject to ongoing Operation and Maintenance (O&M) requirements.

Alternative 2 also includes MNA, which would serve to reduce the concentration of groundwater contaminants via natural processes. This option would involve sampling of selected monitoring well locations to evaluate the behavior of contaminants in groundwater at GAA A, including the overall stability of the plume with respect to migration and the trends in contaminant concentrations over time. The *Coke Point Area Sampling and Analysis Plan* will be designed to evaluate the effect of implemented source control measures on groundwater concentrations. The sampling program will be designed to collect adequate data to assess contaminant concentrations and supplement existing data to identify the type(s) of natural attenuation processes active at the Site, such that an estimate of the rate at which such processes will reduce contaminant concentrations to required levels can be developed.

In accordance with *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (USEPA, 1999), the monitoring program will specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and is capable of attaining remediation objectives. In addition, the monitoring program will be designed to accomplish the following:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes;
- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume(s) is not expanding (either downgradient, laterally or vertically);

- Verify no unacceptable impact to downgradient receptors;
- Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

The frequency of monitoring will be specified in order to detect, in a timely manner, the potential changes in site conditions. The *Coke Point Area Sampling and Analysis Plan* will be developed to allow flexibility for adjusting the monitoring frequency and analyzed parameters over the life of the remedy.

Alternative 2 will also include the implementation of land use controls (LUCs) and ICs consisting of environmental covenants including land use restrictions (i.e., prohibitions on residential use), groundwater use restrictions (i.e., prohibiting potable and non-potable water use), inspection, operation and maintenance requirements associated with the engineering controls, and site use restrictions addressing intrusive activities with the potential to encounter impacted environmental media. Worker personal protective equipment (PPE) requirements, waste handling and disposal requirements, and construction-specific tasks will be addressed in RADWPs prior to the commencement of work. Future building developments in GAA A will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas sampling conducted as part of an Agency approved sampling plan. Additional engineering controls will include signage and fencing, as needed, to prohibit unauthorized access to the property and prevent disturbance of the cap once it is in place.

8.2.3.3 Alternative 3: Reclamation and Capping, Bioremediation, MNA, LUCs, and ECs/ICs

Alternative 3 includes all the components outlined in Alternative 2, plus groundwater treatment through augmented bioremediation. Based on the groundwater monitoring event conducted at CPLF in Spring 2024, the conditions within the saturated zones in GAA A are naturally reducing (i.e. low dissolved oxygen, low oxidation reduction potential, and generally low concentrations of nitrate and ferric iron). As such, enhanced anaerobic bioremediation would be the selected bioremediation method. The bioremediation corrective action would likely include injections of nutrients, pH buffer, and/or other amendments as needed. Bioremediation would assist in the reduction of contaminant toxicity and volume. However, due to the higher pH levels (10-13) in groundwater in GAA A, treatment may be difficult and, as mentioned above, would likely require the addition of a buffer or buffering agents. Changes in the natural pH of the area comes with some risk of driving changes in emplaced slag, potentially increasing mobility of slag-related contaminants. Additionally, the heterogenous lithology, specifically the presence of lower permeability lenses within the saturated zones in GAA A, presents challenges to bioremediation's

ability to treat contaminants as potential preferential pathways may hinder the ability to deliver amendment to the desired locations.

8.2.3.4 Alternative 4: Reclamation and Capping, ISCO, MNA, LUCs, and ICs/ECs

Alternative 4 includes all of the components outlined in Alternative 2, plus ISCO. ISCO would assist in the reduction of contaminant toxicity and volume. ISCO injections may be performed with various oxidants to take advantage of the elevated pH within GAA A. The injections would target areas with the highest VOC and PAH concentrations in groundwater, mainly in the center portion of CPLF. Performance monitoring would be conducted to evaluate the effectiveness of the ISCO injections.

Due to the potential changes in pH during remediation, ISCO may drive changes in emplaced slag potentially mobilizing or increasing concentrations of slag related contaminants. Additionally, the heterogenous lithology, specifically the presence of subsurface obstructions and lower permeability lenses within the saturated zones in GAA A, presents challenges to ISCO's ability to treat contaminants as potential preferential pathways may hinder the ability to deliver oxidant to the desired locations.

8.2.4 Evaluation of GAA A Alternative 1

Alternative 1 involves maintaining the current conditions and taking no additional corrective measures or interventions. The No Action alternative does not meet any threshold criteria and, therefore, is not evaluated against the balancing criteria.

8.2.4.1 Evaluation of Threshold Criteria for GAA A Alternative 1

Protection of Human Health and the Environment

The No Action Alternative would not be protective of human health and the environment. Under a No action Alternative, no effort would be made to control exposures to impacted groundwater through the implementation of ECs/ICs. In addition, there would be no additional protective systems preventing or mitigating vapor intrusion. Unacceptable exposure to impacted groundwater is possible under the No Action Alternative.

Achievement of Media Objectives

Concentrations of contaminants in groundwater are expected to decrease through natural attenuation processes. However, without continued monitoring, it will not be possible to confirm progress toward the achievement of Final RGs or to make a determination that natural attenuation will result in the achievement of CAOs.

Source Control

No actions would be implemented to further control potential sources to groundwater. However, no additional source control options appear to be necessary based on data available at this time.

8.2.5 Evaluation of GAA A Alternative 2

Alternative 2 involves reclaiming and capping the landfill, MNA, and implementing ICs and ECs to manage potential risks and ensure safety during future development.

8.2.5.1 Evaluation of Threshold Criteria for GAA A Alternative 2

Protection of Human Health and the Environment

Alternative 2 provides protection of human health through the planned capping of CPLF with an impermeable and low permeability cap. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Capping of the area will reduce the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. The cap will provide a barrier to prevent exposure of onsite receptors to contaminated soil. LUCs and ICs will protect human health through limiting allowable use of GAA A and preventing, and / or limiting exposure to impacted media. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 2 will achieve media objectives through the construction of an impermeable and low permeability cap, which will reduce the potential for impacted soil to act as a continuing source to groundwater and expedite natural attenuation of COCs in groundwater, which will help meet CAOs in a shorter timeframe. The use of MNA would assess natural reduction in contaminant concentrations over time and identify any need for additional remedial measures. With this alternative, cross-media transfer and contaminant mass loading are expected by reducing stormwater infiltration into the vadose zone through capping and plume stability and reduction through MNA is expected to continue and to be improved. This remedy is expected to reduce COC concentrations to Final RGs in groundwater via natural contaminant degradation over time until Final RGs are achieved.

Source Control

Alternative 2 includes capping of the area which reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. This approach helps to prevent the migration of contaminants into groundwater. As no NAPL source has been identified within this GAA, capping provides a way of reducing industrial residual vadose zone impacts.

8.2.5.2 Evaluation of Balancing Criteria for GAA A Alternative 2

Long-Term Effectiveness

Alternative 2 would provide long-term effectiveness through capping, reducing potential human exposure. MNA will provide a way to monitor contaminants in groundwater to confirm that natural

attenuation is continuing to occur and that offsite contaminant migration is not occurring. Risks to human receptors from residual contamination and ongoing reduction in the vadose zone soil to groundwater pathway would be managed during the attenuation period through properly administered, monitored, and maintained LUCs (including ICs and ECs). It is anticipated that Final RGs in GAA A will be attained in the long-term, via natural attenuation.

Reduction of Toxicity, Mobility, and Volume

Alternative 2 includes capping and reclamation of the landfill to surface grade. Capping the site will reduce contaminant mobility by reducing stormwater infiltration through the cap and into the unsaturated zone, thereby reducing the potential for vertical migration of vadose zone contaminants into groundwater. The landfill will undergo reclamation to surface grade. Natural attenuation would reduce contaminant volume (contaminant mass) and toxicity.

Short-Term Effectiveness

Alternative 2 provides short-term effectiveness with capping that will prevent human exposure and reduce stormwater infiltration to limit potential contaminant migration in groundwater. Implementation of LUCs and ICs will restrict groundwater use and limit intrusive activities, further protecting human health and the environment. The short-term effectiveness of the remedy will be assessed through routine inspections of engineering controls and groundwater monitoring to confirm that remedy components are performing as intended. These measures will help support long-term progress toward achieving Final RGs.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs for Alternative 2 are associated with installation of wells for MNA monitoring purposes. O&M costs include the implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $16,000
- Present Worth of Annual O&M Costs: $137,000
- Present Worth of Period Costs: $11,000
- Total Present Worth: $164,000

Implementability

Alternative 2 is considered implementable. The construction of the capping system, along with the ongoing landfill reclamation efforts, can be implemented with modern construction practices. An MNA performance monitoring program can be implemented using current sampling technology. A *Coke Point Area Sampling and Analysis Plan* has been provided with the CMS that includes regular sampling of select wells in GAA A.

Community Acceptance

This alternative should have community acceptance as it provides protection of human health by preventing and/or limiting exposure to impacted media. Selected alternatives will be included in a public comment period to enable meaningful community involvement. Distribution of contaminants within this GAA indicate minimal risk to ecological receptors as no off-site migration of contaminants is actively occurring.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE Voluntary Cleanup Program (VCP) criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and will be involved in the redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at other parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.2.6 Evaluation of GAA A Alternative 3

Alternative 3 involves reclaiming and capping the area, bioremediation injections, MNA, and implementing ICs and ECs to manage potential risks and ensure safety during future development.

8.2.6.1 Evaluation of Threshold Criteria for GAA A Alternative 3

Protection of Human Health and the Environment

Alternative 3 provides protection of human health by future capping of CPLF with an impermeable or low permeability cap. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Capping of the area will reduce the pathway between the vadose zone and groundwater. The cap will provide a barrier to prevent exposure of onsite receptors to contaminated soil. LUCs and ICs protect human health through limiting use of the Site and preventing and / or limiting exposure to onsite media. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through a combination of bioremediation and MNA. This alternative may reduce the timeframe needed to achieve media objectives, thereby reducing the potential for human exposure overall.

Achievement of Media Objectives

Alternative 3 will achieve media objectives through the construction of an impermeable and low permeability cap, which will reduce the potential for impacted soil to act as a continuing source to groundwater and expedite natural attenuation of COCs in groundwater. Additionally, bioremediation will decrease contaminant concentrations in groundwater via destruction. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate continued reductions in groundwater contaminant concentrations. With this

alternative, Final RGs are expected to be achieved through active bioremediation processes enhanced by injection of amendment. Developing and maintaining a biologically active treatment area can require a significant amount of injection activity. Bioremediation degradation is anticipated to achieve Final RGs after several rounds of injections. Monitoring will track progress toward Final RG attainment and confirm remedy effectiveness.

Source Control

Alternative 3 includes capping of the area which reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. This approach helps to prevent the migration of contaminants into groundwater, providing long term source control. No NAPL source has been identified within this GAA, capping provides a way of reducing industrial residual vadose zone impacts. Bioremediation may address COCs in groundwater and residual contamination would be reduced through continued natural attenuation.

8.2.6.2 Evaluation of Balancing Criteria for GAA A Alternative 3

Long-Term Effectiveness

Alternative 3 will have challenges addressing long-term effectiveness due to the high pH within the GAA. Risks from residual contamination would be low if ICs/LUCs are properly administered to ensure continued non-residential land use. The continued maintenance of capped areas ensures a maintained reduction in vadose zone soil to groundwater pathway and continued maintenance of potential future vapor barriers and ventilation systems would ensure a maintained reduction in the pathway from soil vapor to indoor air. Active remediation of COCs in groundwater via bioremediation could potentially increase the rate of destruction of contaminants. However, the effectiveness of bioremediation injections will be hindered due to the complex geology and elevated pH within GAA A. Lenses consisting of clay, sand, gravel, and slag will make bioremediation less effective in the long term. Additionally, the high pH in the area of these exceedances makes bioremediation injections less effective as a buffering solution will need to be used to maintain a pH in which beneficial microbial populations can be sustained. Bioremediation would likely require multiple injections to develop and maintain a biologically active area to reach Final RGs. Data collected from continued semiannual groundwater monitoring can be used to assess the long-term effectiveness.

Reduction of Toxicity, Mobility, and Volume

Alternative 3 includes capping and reclamation of the landfill to surface grade. Capping will reduce contaminant mobility by reducing stormwater infiltration through the cap and into the unsaturated zone, thereby reducing the potential for vertical migration of vadose zone contaminants into groundwater. The landfill will undergo reclamation to surface grade. Additional reduction in toxicity and volume will be achieved via destruction of contaminants with the application of bioremediation and then further via natural attenuation.

Short-Term Effectiveness

Alternative 3 provides short-term effectiveness with capping that will prevent human exposure and reduce stormwater infiltration to limit potential contaminant migration in groundwater. Implementation of LUCs and ICs will restrict groundwater use and limit ground intrusive activities. Although bioremediation may enhance long-term contaminant reduction, it requires time to take effect and may face implementation challenges due to geochemical and subsurface obstructions. The short-term effectiveness of the remedy will be assessed through inspections of engineering controls and early groundwater monitoring to ensure remedy components are functioning as intended. These actions will help support progress toward achieving Final RGs over time.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 3 consist of the installation of a bioremediation injection system and monitoring wells. O&M costs include semi-annual bioremediation injections for 2 years and the implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $81,000
- Present Worth of Annual O&M Costs: $449,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $541,000

Implementability

This alternative is considered challenging to implement. Bioremediation would take place via injections on a regular basis to address the groundwater contaminants. Groundwater contaminants exist adjacent to and within the CPLF. Subsurface obstructions and complex geology may make injection well installation difficult. Additionally, preferential pathways could exist within the geology, which may prevent uniform distribution of additives. Due to the high pH that is naturally occurring within GAA A because of the presence of slag, a pH buffer may need to be introduced to drive the pH lower to create a more suitable environment for anaerobic bacteria. Injecting materials into an impacted saturated zone and adjusting pH may mobilize slag-related contaminants by causing biological or chemical changes that influence their mobility.

Community Acceptance

This alternative should have community acceptance as it provides protection of human health by preventing and/or limiting exposure to impacted media. Selected alternatives will be included in a public comment period to enable meaningful community involvement. Distribution of

contaminants within this GAA indicate minimal risk to ecological receptors as there are no exceedances of Final RGs in shoreline wells and no off-site migration of contaminants is actively occurring.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and will be involved during the redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at other TPA parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.2.7 Evaluation of GAA A Alternative 4

Alternative 4 involves reclaiming and capping the area, ISCO injections, MNA, and implementing ICs and ECs to manage potential risks and ensure safety during future development.

8.2.7.1 Evaluation of Threshold Criteria for GAA A Alternative 4

Protection of Human Health and the Environment

Alternative 4 provides protection of human health by future capping of CPLF with an impermeable and low permeability cap. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Capping of the area will reduce the pathway between the vadose zone and groundwater. The cap will provide a barrier to prevent exposure of onsite receptors to contaminated soil. LUCs and ICs protect human health through limiting use of the Site and preventing, and / or limiting exposure to onsite media. Additionally, the development of a Health and Safety Plan (HASP) for future utility workers or construction workers mitigates exposure risks by providing proper handling procedures for impacted material. ISCO activities would potentially prevent human exposure to elevated COCs in groundwater through mass reduction (long term) via destruction. The use of MNA would help assess natural reduction in residual contaminant concentrations over time. This alternative could potentially reduce the timeframe needed to achieve media objectives, thereby reducing the potential for human exposure overall. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 4 will achieve media objectives through the construction of an impermeable and low permeability cap, which will reduce the potential for impacted soil to act as a continuing source to groundwater and expedite natural attenuation of COCs in groundwater, which will help meet CAOs in a shorter timeframe. Additionally, active ISCO injections may decrease concentrations

of COCs in groundwater via destruction, however, it may increase slag-related constituent concentrations. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater. Final RGs are expected to be met through ISCO and long term natural attenuation. Ongoing monitoring will be used to evaluate remedy performance and ensure progress toward achieving Final RGs.

Source Control

Alternative 4 includes capping of the area which reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. This approach helps to prevent the migration of contaminants into groundwater, providing long term source control. No NAPL source has been identified within this GAA, capping provides a way of reducing industrial residual vadose zone impacts. ISCO will reduce COC concentrations in groundwater in source areas and residual contamination would be reduced through continued natural attenuation.

8.2.7.2 Evaluation of Balancing Criteria for GAA A Alternative 4

Long-Term Effectiveness

Alternative 4 will have challenges addressing long-term effectiveness due to the naturally reducing aquifer conditions and complex geology within the GAA. Risks from residual contamination would be low if ICs/LUCs are properly administered to ensure continued non-residential land use. The continued maintenance of capped areas ensures a maintained reduction in vadose zone soil to groundwater pathway and continued maintenance of any future vapor barriers and ventilation systems would ensure a maintained reduction in the pathway from soil vapor to indoor air. Active remediation of COCs in groundwater via ISCO will increase the rate of destruction of contaminants and could potentially reduce the timeframe for remediation. However, the effectiveness of ISCO injections may be hindered due to high oxidant demand and the complexities due to remaining construction debris after reclamation of the landfill to surface grade. Additionally, lenses consisting of clay, sand, gravel, and slag will make distribution of reagents difficult and make ISCO less effective in the long term. ISCO injections would likely require injections for many years to reach Final RGs. Data collected from continued semiannual groundwater monitoring can be used to assess long-term effectiveness.

Reduction of Toxicity, Mobility, and Volume

Alternative 4 includes capping and reclamation of the landfill to surface grade. Capping will reduce contaminant mobility by reducing stormwater infiltration through the cap and into the unsaturated zone, thereby reducing the potential for vertical migration of vadose zone contaminants into groundwater. The landfill will undergo reclamation to surface grade. Reduction in toxicity and volume will be achieved via destruction of contaminants with the application of ISCO and then further via natural attenuation.

Short-Term Effectiveness

Alternative 4 provides short-term effectiveness with capping that will prevent human exposure and reduce stormwater infiltration to limit potential contaminant migration in groundwater. Implementation of LUCs and ICs will restrict groundwater use and limit ground intrusive activities. While ISCO offers potential for accelerated contaminant reduction, it is likely that rebound will be observed from clay and silt lenses that will require multiple rounds of injections before significant treatment effects are observed. The short-term effectiveness of the remedy will be assessed through routine inspections of engineering controls and monitoring of groundwater conditions to confirm that controls are functioning as intended. By destruction of COCs, It is anticipated that Final RGs will be achieved in the long-term.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 4 consist of the installation an ISCO injection system. O&M costs include semi-annual ISCO injections for 2 years and the implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $81,000
- Present Worth of Annual O&M Costs: $505,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $597,000

Implementability

This alternative is considered challenging to implement. ISCO would take place via injections on a regular basis to address COCs in groundwater. Groundwater contaminants exist adjacent to and within the CPLF. Due to the naturally high pH observed at many wells within this GAA, an oxidant would be utilized that has the best chances of success. Injecting materials into an impacted saturated zone and adjusting pH may mobilize slag-related contaminants by causing biological or chemical changes that influence their mobility. Subsurface obstructions and complex geology may make injection well installation difficult. Additionally, preferential pathways could exist within the geology, which may prevent uniform distribution of additives. The average SOD was measured at other areas on Coke Point and observed at 5.5 g/kg soil, with a range of 0.6-15 g/kg soil. Low permeable zones within the local geology may be addressed via low-volume continuous amendment injection systems.

Community Acceptance

This alternative should have community acceptance as it provides protection of human health by preventing, and/or limiting exposure to impacted media. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and will be involved throughout the redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at other TPA parcels and are generally recognized as commonly employed measures for long-term stewardship. This approach has been accepted by the State for similar conditions in the past; however, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.2.8 Comparative Analysis of Remedial Alternatives

This section compares the remedial alternatives to one another against each of the threshold and balancing criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each alternative. The four remedial alternatives compared are:

- Alternative 1: No Action
- Alternative 2: Capping, MNA, ECs/ICs
- Alternative 3: Bioremediation, Capping, MNA, ECs/ICs
- Alternative 4: ISCO, Capping, MNA, ECs/ICs

8.2.8.1 Comparative Analysis of Threshold Criteria

Protection of Human Health and the Environment

While Alternative 1 does not provide protection of human health, Alternatives 2, 3, and 4 do. Alternatives 2, 3, and 4 provide protection of human health using ICs and ECs, which prevent human exposure to contaminants identified in GAA A. Capping of the area in these three alternatives will reduce the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. Alternative 2 relies on natural attenuation of contaminants in groundwater, while reducing and eliminating ways in which humans may be exposed to contaminants during the attenuation period. Alternative 3 may shorten the timeframe for reduction of contaminant concentrations in groundwater through the implementation of bioremediation; however, with the implementation of ICs and ECs human health will be protected prior to reduction of contaminant concentrations. Alternative 4 may also shorten the timeframe for reduction of contaminant concentrations in groundwater; however, this alternative requires transportation and handling of oxidants which may increase risk to human health.

Achievement of Media Objectives

Alternatives 2, 3, and 4 are designed to ultimately achieve Final RGs by reducing concentrations of primary contaminants such as naphthalene and bis(2-ethylhexyl)phthalate in groundwater. Alternative 2 relies primarily on natural attenuation supported by source isolation through capping, which provides a reliable but slower path to meeting Final RGs. Alternatives 3 and 4 incorporate active remediation technologies, bioremediation and ISCO, that have the potential to accelerate contaminant reduction and shorten the time to achieve Final RGs. However, site-specific challenges such as elevated pH, heterogeneous subsurface geology, and high oxidant demand may limit the effectiveness and speed of these active remedies. Given the minimal Final RG exceedances and lack of shoreline exceedances, active remediation is not necessary to achieve media objectives in a reasonable amount of time. Therefore, while Alternatives 3 and 4 may offer faster progress toward Final RGs, Alternative 2 provides a more reasonable and implementable approach for achieving remedial goals over time.

Source Control

Alternative 1 does not provide any form of source control. Alternatives 2, 3, and 4 reduce the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. Additionally, Alternatives 3 and 4 aim to reduce COC contaminant mass in the high concentration areas via destruction by bioremediation and ISCO, respectively. No clear source area has been identified in GAA A; therefore, Alternative 2 provides the appropriate level of source control.

8.2.8.2 Comparative Analysis of Balancing Criteria

Long-Term Effectiveness

Alternatives 2, 3, and 4 provide long-term effectiveness via ICs and ECs which will be continually maintained once installed and will prevent exposure while groundwater contaminants naturally attenuate. Alternatives 3 and 4 provide a potential reduction in the attenuation timeline via active remediation, however, the heterogenous lithology in GAA A may make the implementation of bioremediation or ISCO less effective since the delivery of amendments/oxidants could be hindered by preferential pathways caused by remaining construction debris and clay/silt lenses. Additionally, the naturally elevated pH within the saturated zone in GAA A is not suitable for the microbial populations that would be responsible for contaminant destruction in Alternative 3. A pH buffer would need to be introduced into the subsurface environment to maintain a suitable pH. This may be difficult to maintain over a long enough period to reduce contaminant mass effectively. Based on the most recent available data from semiannual groundwater sampling at CPLF in Spring 2024, COCs, mainly naphthalene, attenuate before reaching the property boundary or surface waters (refer to **Figures 20-23**). Considering the fact that natural attenuation appears to be occurring within GAA A and that offsite migration does not appear to be likely, Alternative 2 provides the best approach to achieve long term effectiveness.

Reduction of Toxicity, Mobility, and Volume

In Alternatives 2, 3, and 4, toxicity and mobility would be reduced via capping, which would prevent exposure to onsite receptors. Capping would also prevent contaminant mobility by preventing infiltration of storm and surface water. The landfill will undergo reclamation to surface grade. Reduction of toxicity and volume would be achieved in Alternatives 3 and 4 via active remediation through either bioremediation or ISCO. It is noted that injections of materials into an impacted saturated zone has the potential to "push" or mobilize contaminants and the introduction of amendments or oxidants could cause biological or chemical changes that influence the mobility of other contaminants. For example, significant pH changes may mobilize slag-related contaminants such as heavy metals that would otherwise be immobile. Alternative 2 will achieve a reduction in volume but without the risks of potentially mobilizing contaminants as described above.

Short-Term Effectiveness

Alternatives 2, 3, and 4 provide immediate short-term effectiveness through the construction of an engineered cap, which prevents stormwater infiltration and limits exposure to impacted soil and groundwater. LUCs and ICs applied under each alternative will further reduce exposure potential in the short term. Alternatives 3 and 4 include active groundwater treatment technologies, which will have more long-term effectiveness but face challenges due to site-specific conditions including elevated pH and low permeability lenses. While the ISCO reaction considered under Alternative 4 may be rapid, it will rely on reagent contact with the contaminants which would be dependent on slow groundwater flow to uniformly distribute oxidant and matrix diffusion of COCs out of low-permeability lenses. Therefore, in the short term, these alternatives provide similar protection as Alternative 2, with their primary contribution to short-term effectiveness being reduction of contaminant mass. Final RGs are anticipated to be achieved in the long-term for all alternatives.

Cost

Alternative 2 provides the most cost-effective option to reach the CAOs and Final RGs. Alternatives 3 and 4 require capital and operational costs, making these options the less cost-effective.

Implementability

Based on the proximity of impacted groundwater to the CPLF and the observance of largely decreasing or stable trends of COCs in groundwater within GAA A, Alternative 2 would be the most implementable. Alternatives 2, 3, and 4 include reclamation of the landfill, which is currently underway and enhances their implementability. Alternatives 3 and 4 will require treatability studies and/or pilot scale installations to establish feasibility near the landfill and within areas with variable lithology. Additional challenges with Alternatives 3 and 4 include the challenges to install injection wells due to the subsurface obstructions from remaining construction debris and complex geology, as well as the potential for preferential pathways within the geology, which may prevent

uniform distribution of amendments, leading to significant uncertainty in the implementation of the active technologies.

Community Acceptance

While Alternatives 2, 3, and 4 should have community acceptance, Alternative 4 may be less acceptable due to the transportation and use of oxidant. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.2.9 Preferred Remedial Alternative

Based on the results of the threshold and balancing analysis, GAA A Alternative 2: Capping, MNA, and ECs/ICs is recommended as the preferred remedial alternative to achieve CAOs and Final RGs in GAA A. The following reasons are presented for the selection of Alternative 2:

- The magnitude of Final RG exceedances in GAA A and the observed stable to downward trends do not warrant an active remediation approach. Onsite and offsite receptors will be protected through ICs, LUCs, and capping. There are no shoreline exceedances of Final RGs.
- Alternative 2 is the most implementable and cost-effective approach of the selected alternatives. Alternatives 3 and 4 have significant implementability challenges relating to the discontinuous nature of the local geology, elevated aquifer pH, and remaining subsurface obstructions.
- The construction of a cap over GAA A will reduce the pathway between the vadose zone and groundwater, reducing water infiltration helping to increase natural attenuation. The cap will provide a barrier to prevent exposure of onsite receptors to contaminated soil. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.
- Sampling of wells located within and around CPLF indicates that COCs in groundwater attenuate before they reach the property boundary or surface waters and that concentrations are either decreasing or stable in most wells. This supports the use of MNA to monitor long-term conditions. With this approach, Final RGs are expected to be met over time through continued natural degradation and plume stability.

- Implementation of LUCs and ICs in this area and across the site provide protection of human health during the remediation timeframe.

8.2.10 Contingency Remedial Criteria

Alternative 2 will be implemented in GAA A with sampling completed as described in the *Coke Point Area Sampling and Analysis Plan*. Following recommendations from USEPA's *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (April 1999), contingency measures are identified as part of the preferred alternative. Despite the observance of largely decreasing or stable VOC and PAH concentrations in groundwater, specific criteria are established in the event that the expected trends in contaminant concentrations are not observed.

The *Coke Point Area Sampling and Analysis Plan* includes identification of monitoring wells within GAA A that will be regularly sampled to determine the effect of the selected remedy implemented at GAA A. As has been the case with ongoing semiannual groundwater monitoring for the CPLF, the data collected from these wells will undergo statistical analysis to identify trends in contaminant concentrations and monitor MNA parameters for conditions favorable to natural attenuation. The statistical methods used to develop trends and subsequent data interpretation and reporting are further discussed in the *Coke Point Area Sampling and Analysis Plan*. The results of the statistical trend analysis will inform the need for additional evaluation. Specifically, the following USEPA identified triggers will be applied to the results of the statistical analysis:

- Statistically significant increasing trends not originally predicted during remedy selection; and
- Contaminants identified in a statistically significant increasing trend at wells where there was previously a decreasing trend or no trend.

If any of the triggers are met, further evaluation will occur, potentially involving more sampling, evaluation of geochemical and biological conditions, reassessment of remediation timelines, or further site investigation to pinpoint the potential new sources causing rising concentrations. Given the current data available for GAA A, a contingency approach will be identified based on this alternative analysis. However, additional field tests and evaluations will be necessary to inform the new contingency alternative.

8.3 DEVELOPMENT OF CORRECTIVE MEASURES FOR GAA B

8.3.1 Applicability Evaluation for Identified Process Options

The process for development and evaluation of Corrective Measures Alternatives outlined in **Section 8.1** was implemented for GAA B. Process options were evaluated for applicability with GAA B conditions, as outlined in **Table 37A**. Several technologies were eliminated from further consideration during screening; the technologies were identified as not applicable to GAA B due to the nature of the contaminants or specific conditions at GAA B, as detailed below.

- In-situ Chemical Reduction - ISCR was eliminated as a potential treatment technology since it is not suitable for treating the non-slag related contaminants within GAA B. This process option is typically applied to halogenated VOCs or inorganic compounds.
- On-Site Disposal (CAMU) - A CAMU was eliminated as a disposal option for excavated material due to the lack of available space in GAA B.

8.3.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA B

Process options that were not eliminated due to inapplicability were retained for consideration as components of a comprehensive alternative. The summary of the retained process options is included in **Table 37A**.

Multiple COCs exceed sitewide Final RGs in GAA B, including naphthalene, benzene, ethylbenzene, toluene, xylenes, 1,1-biphenyl, bis(2-ethylhexyl)phthalate, several PAHs, arsenic, and iron (refer to **Table 22A**). PAHs, including benzo[a]pyrene and dibenz[a,h]anthracene, were detected above Final RGs but are not widespread across GAA B. Exceedances are infrequent and limited to a few wells far from the shorelines of GAA B. Of the high molecular weight PAHs in GAA B, benzo[a]pyrene has the highest exceedance frequency at 3.6% with exceedances observed at three wells at the northern portion of Cell 1 and four wells south of Cell 6. Other PAH exceedance and detection frequencies can be found on **Table 29C**. Other SVOCs, including 1,1-biphenyl and bis(2-ethylhexyl)phthalate were detected above Final RGs but with similarly low exceedance frequencies (<1%) and limited spatial distribution (refer to **Table 29C** and **Figure 26I**). 1,1-biphenyl exceeds Final RGs at one well location and bis(2-ethylhexyl)phthalate at two well locations. Arsenic exceeds Final RGs at three intermediate wells in GAA B, with an exceedance frequency of 1.3%. Based on spatial distribution, the majority of PAH-related exceedances are observed in areas of historical NAPL impacts, particularly near Cell 6. PAH exceedances are localized and do not appear to be migrating in the subsurface. NAPL is present at several locations northwest and southeast of Cell 6 (refer to **Section 6.2.3**), with measurable recoverable thicknesses exceeding 1 inch.

The primary COCs in GAA B are benzene and naphthalene. The benzene plume originates near Cell 6, the former Benzol Processing Area, and migrates west toward Cell 1 before splitting northwest toward Cell 2 and southwest toward Cell 3, following historical and Graving Dock-

influenced groundwater gradients (see **Section 6.2.2**). Benzene concentrations in groundwater exceed Final RGs by over four orders of magnitude in both shallow and intermediate zones, with the highest recorded concentration of 710,000 µg/L at CO187-MWS. The exceedance frequency of benzene in GAA B is 76% (refer to **Table 29C**). The dissolved benzene plume originates northwest of Cell 6, suggesting that both benzene and NAPL share a common source. These findings support targeting active remediation in areas west and northwest of Cell 6 to address the benzene source before further migration into the intermediate zone or offsite discharge occurs. Other VOCs, including ethylbenzene, toluene, and xylenes, were also detected above Final RGs in GAA B. These exceedances are generally limited to areas within the benzene plume and exhibit similar spatial patterns. Exceedance frequencies and required reduction to meet Final RGs for these VOCs are lower than that of benzene (refer to **Table 29C**).

Naphthalene impacts are more spatially extensive than benzene, with concentrations exceeding Final RGs in 67% of samples and widespread detections across both shallow and intermediate zones. Refer to **Figure 26I** for sitewide Final RG exceedances across the area. Additionally, benzene and naphthalene require the largest reduction across all COCs in GAA B to reach Final RGs. Remedial alternatives were focused on intercepting the shallow benzene and NAPL source before continued vertical migration as this is critical to preventing further impacts to the intermediate zone and to protect downgradient receptors.

Remedial alternatives were developed by combining potentially applicable technologies and process options with the best potential for achieving CAOs and Final RGs, as shown in **Table 37B**. The presented alternatives for GAA B include ICs and ECs in combination with NAPL recovery trench/pits, impermeable and low permeability capping, air sparging, biosparging, and GWPT. The following process options were identified as the best suited technologies based on GAA B specific conditions.

- MNA was identified as a preferred process option to assess the long-term effectiveness of the other proposed remedies, including NAPL recovery trench/pits, capping, air sparging, and GWPT. In the long-term, MNA will provide data to confirm that remedial systems were successful, contaminant concentrations in groundwater are continuing to decrease toward Final RGs, and residual dissolved phase impacts are addressed.
- Impermeable and low permeability capping was identified as a preferred process option for preventing vertical migration of contaminants from soil to underlying groundwater. Installation of an impermeable and low permeability cap will prevent vertical contaminant migration by preventing infiltration of surface or storm water into the subsurface.
- Air sparging is a previously implemented IM in the shallow zone of Cell 1, Cell 2, and Cell 3, and is retained as a preferred process option for GAA B. This treatment technology has been proven to be effective in addressing benzene in impacted areas across GAA B. Depending on location, this process option may be challenging due to heterogeneity of the local geology.

- Product Recovery (Absorbent/Skimmers) is a previously implemented IM in Cell 6 in GAA B and is retained as a preferred process option. NAPL has been recovered from within Cell 6 via an MPE system, excavation, and product skimming (*Coke Oven 2023 IM Progress Report* [ARM, 2024]). Approximately 8,819 gallons of NAPL have been recovered from CO173 via product skimming between 2020 and 2024. The success of this process option as an IM appears to be related to the transmissivity of the NAPL and localized permeability (refer to **Section 6.2**).
- Multi-Phase Extraction was previously implemented as an IM in Cell 6 of GAA B. The Cell 6 MPE system consists of approximately fifty (50) MPE recovery wells. This system has operated since 2010 and has recovered approximately 34,600 gallons of NAPL (*Coke Oven 2023 IM Progress Report* [ARM, 2024]). Recovery rates from the Cell 6 MPE system have diminished with only two isolated locations still producing recoverable material.
- Groundwater Pump and Treat was previously implemented as an IM in Cell 2 of GAA B. GWPT is a preferred process option based on applicability to recovery of dissolved phase contaminants in GAA B. This process option would target removal and mass reduction of dissolved phase contaminants in GAA B but would not be applicable to NAPL impacts.
- Biosparging was identified as a preferred process option based on its effectiveness in treating dissolved phase contaminants and the advantages of operating biosparge in concert with air sparge. Naphthalene and BTEX contaminants are known to degrade rapidly in aerobic conditions, making a remedial option such as biosparging appropriate. However, high pHs may inhibit the effectiveness of biosparge and negatively impact microbial activity. The dissolved oxygen demand from biosparge may limit the effectiveness of the remedial option, potentially limiting application to a 'curtain' approach than a plume approach. Biosparge implementation will work synergistically with existing air sparge IMs (Cell 1 and Cell 3) within GAA B, enhancing the effectiveness of this process option.
- Permitted Discharge would be utilized in conjunction with GWPT.

During this step in the process, several process options were not selected as part of a comprehensive alternative (Corrective Measures Alternative) due to GAA B specific conditions, as discussed below.

- Excavation and On-Site or Off-Site Disposal / Landfilling were not selected as a process option for GAA B as it may be difficult to successfully implement due to previous infrastructure (e.g., tank and building foundations) currently in place, and the large volume of waste potentially generated, which may be classified as RCRA hazardous.
- Hydraulic containment and sheet piling / slurry walls were not selected as process options for the GAA B. Groundwater gauging within GAA B indicates the Graving Dock provides significant hydraulic control within the intermediate groundwater zone where concentrations at the shoreline are highest. Remedial options should be focused on decreasing contaminant mass in source areas to achieve subsequent concentration reductions in groundwater being captured by the Graving Dock system and subsequent

shoreline areas. Groundwater flow in the southern direction is no longer evident due to the operation of the Graving Dock. An air sparge system was previously installed in the southern area as an IM and is recommended for continued operation and optimization. Therefore, it is not anticipated that hydraulic containment will be necessary to achieve CAOs within GAA B.

- Soil Flushing and Stabilization / Solidification were not selected as process options for the GAA B, as there appears to be areas where the NAPL is recoverable via more conventional methods (i.e., product recovery, skimming) (*Coke Oven 2023 IM Progress Report* [ARM, 2024]). Due to the success of alternative methods of NAPL recovery, soil flushing may not be necessary to recover mobile NAPL, and stabilization / solidification is not necessary in this GAA. Addition of surfactants or enzymes may be considered under Product Recovery. Subsurface obstructions and heterogeneous geology in GAA B would present significant challenges for effective mixing and implementation of stabilization/solidification. Preferential pathways could limit the uniform distribution of additives, potentially causing mobilization of contaminants in unintended directions and reducing the overall effectiveness of the approach.
- In-situ Chemical Oxidation was not selected as a process option based on the presence of NAPL and the analyzed soil oxidant demand within the source area of GAA B. The NAPL within GAA B presents as an LNAPL, creating a smear zone between the vadose and saturated zones. This type of smear zone is very difficult to treat via ISCO, as achieving sufficient contact between the oxidant and NAPL is challenging. Additionally, subsurface obstructions add to this challenge. Based on preliminary results from six (6) soil samples within GAA B, the amendment demand would be prohibitively high. The average soil oxidant demand (SOD) was measured at 5.5 g oxidant per kg of soil (g/kg soil), with a range of 0.6-15 g/kg.
- Enhanced Aerobic and Anaerobic Bioremediation were not selected as preferred process options for GAA B due to the magnitude of BTEX and naphthalene concentrations, which may inhibit microbial activity and warrant more aggressive remediation methods. Elevated pH conditions may further suppress microbial growth, although the aquifer is naturally reducing and could support anaerobic bioremediation processes under more favorable conditions. In this area, however, bioremediation was not expected to achieve meaningful mass reduction within a reasonable timeframe. In areas of GAA B where contaminant concentrations are lower, biosparging was selected over enhanced bioremediation to take advantage of the aerobic biodegradability of BTEX and naphthalene.
- Steam Enhanced Extraction is not the best suited remedial option because it is limited to NAPL recovery only and is highly dependent on the permeability of the area. Due to subsurface obstructions (i.e., building and tank foundations), SEE may not be as effective as a NAPL recovery trench in removing NAPL. Additionally, the application of heat could mobilize NAPL and dissolved contaminants beyond the capture zone, potentially spreading impacts.

- Thermal Conductance Heating was not selected as a process option for GAA B due to extreme high temperatures associated with TCH operation (as high as 900°C). These high temperatures could cause subsurface NAPL to ignite and may increase NAPL mobility. Additionally, subsurface obstructions would inhibit the ability to install heater wells in the spacing required to heat uniformly.
- Electrical Resistance Heating was not selected as a process option for GAA B. Naphthalene removal efficiency would be limited with this technology. This process option may be considered to increase NAPL recovery; however, it is not necessary, as there are still areas of high NAPL recovery within the NAPL impacted area (*Coke Oven 2023 IM Progress Report* [ARM, 2024]). Additionally, subsurface obstructions would inhibit the ability to install electrodes in the spacing required to heat uniformly.
- Permeable Reaction Barrier was not selected as a process option for GAA B for similar reasons as Hydraulic Containment. Groundwater gauging within GAA B indicates the Graving Dock provides significant hydraulic control within the intermediate groundwater zone where concentrations at the shoreline are highest. Additionally, the application of active remediation in the source area will decrease the mass flux of contaminants migrating towards surface water. Groundwater flow in the southern direction is no longer evident due to the operation of the Graving Dock. An air sparge system was previously installed in the southern area as an IM and is recommended for continued operation and optimization. Therefore, it is anticipated that a PRB will not be necessary to achieve CAOs within GAA B.

The remaining remedial technologies and process options were combined to create a workable number of Corrective Measures Alternatives that provide comprehensive remedies, as discussed in **Section 8.3.3**, below.

8.3.3 Summary of Corrective Measures Alternatives for GAA B

Due to the nature of the plumes resulting from the identified source in GAA B, the GAA will be described in the Corrective Measures Alternatives by the Northern Area and Southern Area. The Northern Area includes Cell 1, Cell 2, Cell 6, and the areas between these cells. The Southern Area includes Cell 3.

Each of the preferred process options included in **Table 37A** was combined to form Corrective Measures Alternatives for GAA A. The Alternatives for GAA B are described in detail below. As highlighted in **Section 8.2.2**, the stratigraphy and heterogeneity of the native soil deposits pose significant engineering challenges for the implementation of an in-situ and ex-situ treatment technologies and would present difficulty for technologies requiring uniform injections or bulk extraction. Alternatives have been developed and evaluated with these engineering challenges in mind.

8.3.3.1 Alternative 1: No Action

The No Action Alternative is presented in order to define a baseline condition against which other alternatives are compared and typically refers to an absence of efforts to reduce contaminant mass or otherwise treat or contain contamination. The No Action Alternative considers no benefits from future redevelopment of the GAA. In the case of GAA B, source removal is ongoing as part of three interim measures, as discussed in **Section 8.3.2**. Under Alternative 1, no efforts would be employed to reduce potential cross-media transfer of impacts to groundwater, nor would protections be implemented to prevent exposure to impacted groundwater. In addition, no activities would be conducted to evaluate the continuing groundwater trends or the ability of natural attenuation to reach Final RGs.

8.3.3.2 Alternative 2: NAPL Recovery Trench/Pits, Capping, Shallow Air Sparge, Intermediate Biosparge, LUCs, and ECs/ICs

Alternative 2 includes the installation of remedial systems in both the Northern Area and Southern Area. In the Northern Area, Alternative 2 includes implementation of a combination of one NAPL recovery trench and recovery pits paired with EFR, an impermeable and low permeability cap, a shallow air sparge curtain, an intermediate biosparge system, ECs, and ICs. The NAPL recovery trench will be located near Cell 6 in the area with observed NAPL, and will work in conjunction with recovery pits and EFR. The shallow air sparge curtain will be installed near the source to target dissolved-phase COCs in groundwater and reduce contaminant migration toward the intermediate zone and Graving Dock. The intermediate biosparge system will be installed near well CO209-MWI to address naphthalene exceedances observed in the area. The impermeable and low permeability cap will be installed during redevelopment of this area and will be subject to O&M requirements. The cap will be designed to limit exposure to contaminated soil/slag and groundwater, reduce potential vertical vapor migration emanating upward, and prevent surface and stormwater from infiltrating through the impacted material due to the Graving Dock and discharge to surface water. Additionally, the existing sheet pile wall (as discussed in **Section 6.2.2** and shown in **Figure 26A**) provides a barrier through preventing contaminant migration into sediment and pore water of the Coal Pier Channel. The Coal Pier Channel begins east of GD01-MWI and CO180-MWS, extending adjacent to the sheet pile wall. In this area, the combination of the sheet pile wall and the Graving Dock system is effective in protecting the pore water of the Coal Pier Channel from further contaminant migration. West of CO180-MWS, considered the mouth of the channel, is the end of the sheet pile wall where the shoreline converts to large stone/rubble.

In the Southern Area, Alternative 2 includes optimization of the existing air sparge system (Cell 3), ECs, and ICs. This existing air sparge system will be optimized to better capture and remove contaminants migrating toward the cove to the south of GAA B. Optimization of this system may include installation of deeper air sparge wells, operation of the system as a biosparge unit, increasing the number of air sparge wells, or adjustment of the system operational parameters.

Alternative 2 will include the implementation of ECs and ICs, across the full GAA B area, consisting of environmental covenants including land use restrictions (i.e., prohibitions on residential use), groundwater use restrictions (i.e., prohibiting potable and non-potable water use), HASPs for utility workers, inspection, operation and maintenance requirements associated with the engineering controls, and site use restrictions addressing intrusive activities with the potential to encounter impacted environmental media. Worker PPE requirements, waste handling and disposal requirements, and construction-specific tasks will be addressed in RADWPs prior to the commencement of work. Future building developments in GAA B will include soil gas sampling as part of a RADWP. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Additional engineering controls will include signage and fencing, as needed, to prohibit unauthorized access to the property and prevent disturbance of the cap once it is in place.

8.3.3.3 Alternative 3: NAPL Recovery Trench/Pits, Capping, Shallow/Intermediate Air Sparge, Intermediate Biosparge, LUCs, and ECs/ICs

Alternative 3 includes all the components outlined in Alternative 2, plus intermediate air sparge system within the Northern Area of GAA B, near well CO181-MWI. The AS system will be installed only where the semi-confining clay layer is not observed, and where hydraulic connectivity between the shallow and intermediate zone aquifers is evident. The semi-confining clay layer is not observed in wells west of CO183-MWI to the Patapsco River, and north of CO184-MWS/I to the Coal Pier Channel. The system will address the pore water exceedances observed on the western shore of the mouth of the Coal Pier Channel.

8.3.3.4 Alternative 4: NAPL Recovery Trench/Pits, Capping, Shallow Air Sparge, Intermediate GWPT, Intermediate Biosparge, LUCs, and ECs/ICs

Alternative 4 includes all of the components outlined in Alternative 2, plus the operation of the existing Cell 2 GWPT system within the intermediate zone. The goal of the GWPT system in this alternative is to decrease the amount of contaminants migrating towards the western shore of the mouth of the Coal Pier Channel. This system would be anticipated to operate for up to five years, concurrent with NAPL removal or until contaminant recovery has reached asymptotic levels, whichever occurs first.

8.3.3.5 Alternative 5: NAPL Recovery Trench/Pits, Capping, Shallow Air Sparge, Two Intermediate Biosparge Systems, LUCs, and ECs/ICs

Alternative 5 includes all of the components outlined in Alternative 2, plus the application of biosparging within the intermediate zone of the Northern Area. The system will be installed only where the semi-confining clay layer is not observed, and where hydraulic connectivity between the shallow and intermediate zone aquifers is evident (near well CO181-MWI). Microbial and

geochemical sampling completed in this area indicate the presence of both anaerobic and aerobic microbial populations. The system will address the pore water exceedances observed on the western shore of the mouth of the Coal Pier Channel. The biosparging corrective action would include the installation of biosparge injection wells that introduce air to stimulate aerobic degradation of contaminants. The dissolved oxygen demand from biosparge may limit the effectiveness of the remedial option.

8.3.4 Evaluation of GAA B Alternative 1

Alternative 1 involves maintaining the current conditions and taking no additional corrective measures or interventions. The No Action alternative does not meet any threshold criteria and, therefore, is not evaluated against the balancing criteria.

8.3.4.1 Evaluation of Threshold Criteria for GAA B Alternative 1

Protection of Human Health and the Environment

The No Action Alternative would not be protective of human health and the environment. Under a No action Alternative, no effort would be made to control exposures to impacted groundwater through the implementation of ECs/ICs. In addition, there would be no additional protective systems preventing or mitigating vapor intrusion. Unacceptable exposure to impacted groundwater is possible under the No Action Alternative.

Achievement of Media Objectives

Although IMs have been implemented within GAA B, the source has not been fully remediated. Therefore, it is unlikely that concentrations of contaminants in groundwater will decrease through natural attenuation processes within a reasonable timeframe. Without continued monitoring, it will not be possible to confirm progress toward the achievement of Final RGs or to make a determination that natural attenuation will result in the achievement of CAOs.

Source Control

No actions would be implemented to further control potential sources to groundwater.

8.3.5 Evaluation of GAA B Alternative 2

Alternative 2 involves a NAPL recovery trench and recovery pits paired with EFR, an impermeable and low permeability cap, a shallow air sparge curtain, an intermediate biosparge system (near CO209-MWI), optimization of the existing air sparge system (Cell 3) within the Southern Area, and the implementation of ICs and ECs.

8.3.5.1 Evaluation of Threshold Criteria for GAA B Alternative 2

Protection of Human Health and the Environment

Alternative 2 provides protection of human health by preventing exposure to contaminants in groundwater in the short and long term through LUCs and capping of GAA B to be completed during development. In the Northern Area of GAA B, groundwater concentrations of contaminants in the shallow zone would decrease due to removal of NAPL via a recovery trench and pits, as well as removal of dissolved phase contaminants via shallow air sparge implementation. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. Additionally, the shallow air sparge system would be designed to intercept contaminants prior to migration into the intermediate zone, thus decreasing contaminant concentrations in the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Protection of the environment will be maintained by the existing sheet pile wall preventing contaminant migration from the shallow zone into the sediment and pore water of the Coal Pier Channel and through operation of the Graving Dock system capturing contaminant migration in the intermediate zone. The sheet pile wall terminates at the western shore of the mouth of the Coal Pier Channel, where pore water impacts have been identified. These impacts will be addressed over time through capture and removal of contaminants in the source area, resulting in cleaner groundwater migrating into the intermediate zone and reduced impacts to pore water at the mouth of the channel. An intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location.

In the Southern Area of GAA B, groundwater concentrations of contaminants in the shallow zone may decrease due to removal of contaminants via shallow air sparge. Subsequently, groundwater concentrations of contaminants in the intermediate zone may decrease due to the reduced migration of contaminants from the treated shallow groundwater zone. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.

Achievement of Media Objectives

Alternative 2 reduces the potential for releases of contaminants to groundwater via NAPL removal, which reduces the continuing source migration and expedites meeting COAs. The existing sheet pile wall provides a barrier preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Removal of dissolved phase contaminants via shallow air sparge from both the northern and southern portion of the GAA will decrease contaminant concentrations downgradient and reduce adverse impacts to ecological receptors and surface water. Beneficial biodegradation due to the introduction of oxygen will decrease concentrations of SVOCs that do not volatilize in the sparging process. Operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area. Shallow air sparge will be located near the source to enhance source control and capture. Due to the capture zone of the Graving Dock, it is unlikely contaminants in the intermediate zone will negatively

impact ecological receptors and/or surface water. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the NAPL removal and reduction of dissolved phase impact is successfully inhibiting additional impacts to groundwater.

By removing mass from the source zone, limiting ongoing contaminant migration, and removing contaminant through shallow air sparging and intermediate biosparging, Alternative 2 is expected to support mass reduction and plume stabilization within the shallow zone. The existing Graving Dock system will continue to provide capture of the intermediate zone; however, the capture zone may not sufficiently protect pore water on the western shore of the mouth of the Coal Pier Channel. These measures are anticipated to reduce contaminant mass in the subsurface and support long-term progress toward achieving Final RGs in both shallow and intermediate groundwater.

Source Control

Alternative 2 includes source removal via a NAPL recovery trench paired with EFR, which will reduce the NAPL to dissolved phase pathway of contaminants. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. Shallow air sparge in the Northern Area will reduce high dissolved phase concentrations and prevent contaminants from migrating from the shallow zone to the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Additional shallow air sparge in the Southern Area will prevent contaminants from migrating from the shallow groundwater zone towards the cove. Additional dissolved phase source control via intermediate biosparge in the Northern Area will prevent further migration of contaminants.

8.3.5.2 Evaluation of Balancing Criteria for GAA B Alternative 2

Long-Term Effectiveness

Alternative 2 would provide long-term effectiveness through NAPL source removal and capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. Removal of contaminant mass via air sparge provides long term effectiveness through reduced migration and lower potential for shoreline impacts. In the Northern Area, removal of dissolved phase contaminant mass via intermediate biosparge provides long term effectiveness through contaminant mass removal and degradation, providing reduced migration and lower potential for shoreline impacts. Over time, these measures are expected to improve groundwater quality and support progress toward achieving Final RGs. The continued maintenance of capped areas will ensure the long-term integrity of the remedy by maintaining a reduced pathway for contaminant migration from vadose zone soil to groundwater.

Reduction of Toxicity, Mobility, and Volume

Alternative 2 achieves the reduction of toxicity, mobility, and volume through the removal of mobile NAPL, decreased contaminant migration via shallow air sparge curtain/system and intermediate biosparge, and natural attenuation of downgradient and intermediate contaminants. In the Northern Area, the NAPL recovery trench will capture NAPL that is contributing to dissolved phase contaminants. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. The air sparge systems in the Northern and Southern Areas will reduce mobility of dissolved phase contaminants, while natural attenuation decreases the toxicity of downgradient concentrations. The addition of an intermediate biosparge system in the Northern Area will further reduce toxicity of contaminants within the intermediate groundwater zone. Additionally, capping will reduce contaminant mobility by reducing infiltration through impacted soils and provide a natural low permeability barrier to the migration of contaminants to surface water.

Short-Term Effectiveness

Alternative 2 provides short-term effectiveness by removing NAPL source material, reducing dissolved phase concentrations via shallow air sparge and intermediate biosparge, reducing exposure pathways through installation of a cap, and implementation of LUCs and ICs. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. NAPL recovery and air sparging in both the Northern and Southern Areas will begin to reduce mass in shallow groundwater near the source zones, limiting further migration. The shallow air sparge curtain will enhance source control by removing volatile compounds and promoting biodegradation near the source areas, thereby reducing the potential for vertical migration to the intermediate zone and limiting downgradient transport toward surface water. Intermediate biosparging will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. These measures will help stabilize site conditions and protect human and ecological receptors in the short term, setting the stage for achieving Final RGs by reducing contaminant mass. Pore water impacts identified at the western shore of the mouth of the Coal Pier Channel may persist in the short term and are expected to decline over time as contaminant mass in the source area is reduced. Effectiveness will be monitored through routine inspections, system performance evaluations, and early groundwater sampling to confirm that engineering controls and active systems are functioning as intended.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 2 include installation of a NAPL recovery trench, the Northern Area shallow air sparge system, Northern Area intermediate biosparge system, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench and air sparge systems for 5 years and implementation of the MNA sampling plan

and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $736,000
- Present Worth of Annual O&M Costs: $1,787,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $2,534,000

Implementability

Alternative 2 is considered implementable and many process options are already being implemented as IMs in this GAA (i.e., air sparge). Due to subsurface obstructions and hard slag within GAA B, installation of wells and trenches may be challenging but would not prevent implementation.

Community Acceptance

This alternative should have community acceptance as it is protective of human health via source area removal, prevention of downgradient migration, and control of migration to surface water. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.3.6 Evaluation of GAA B Alternative 3

Alternative 3 involves a NAPL recovery trench and recovery pits paired with EFR, an impermeable and low permeability cap, a shallow air sparge curtain, intermediate air sparge (near CO181-MWI) and biosparge systems (near CO209-MWI) within the Northern Area, optimization of the existing air sparge system (Cell 3) within the Southern Area, and the implementation of ICs and ECs.

8.3.6.1 Evaluation of Threshold Criteria for GAA B Alternative 3

Protection of Human Health and the Environment

Alternative 3 provides protection of human health by preventing exposure to contaminants in groundwater in the short and long term through LUCs and capping of GAA B to be completed

during development. In the Northern Area of GAA B, groundwater concentrations of contaminants in the shallow zone would decrease due to removal of NAPL via a recovery trench and pits, as well as removal of dissolved phase contaminants via shallow air sparge implementation. Shallow air sparge will be located near the source to enhance source control and capture. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. Additionally, the shallow air sparge system would intercept contaminants prior to migration into the intermediate zone, thus decreasing contaminant concentrations in the intermediate zone. Additional reduction of contaminants will occur in the intermediate zone through application of a deeper air sparge system in the northwest corner of the site where the semi-confining clay layer is not observed. This system would target removal of contaminant mass prior to migration below the Coal Pier Channel and potentially into the pore water along the western shore of the mouth of the Coal Pier Channel where the current sheet pile wall does not extend. An intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location. Additional protection of the environment will be maintained through capture and control due to the operation of the Graving Dock system.

In the Southern Area of GAA B, groundwater concentrations of contaminants in the shallow zone may decrease due to removal of contaminants via shallow air sparge. Subsequently, groundwater concentrations of contaminants in the intermediate zone may decrease due to the reduced migration of contaminants from the treated shallow groundwater zone. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.

Achievement of Media Objectives

Alternative 3 reduces the potential for releases of contaminants to groundwater via NAPL removal, which reduces the continuing source migration and expedites meeting CAOs. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. The existing sheet pile wall will provide a barrier preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Shallow air sparge will be located near the source to enhance source control and capture. Removal of dissolved phase contaminants via shallow air sparge from both the Northern and Southern Areas of the GAA will decrease contaminant concentrations downgradient. Beneficial biodegradation due to the introduction of oxygen will decrease concentrations of SVOCs that do not volatilize in the sparging process. In the Northern Area, operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area. Operation of the intermediate air sparge system would target removal of contaminant mass prior to migration below the Coal Pier Channel and potentially into the pore water along the western shore at the mouth of the Coal Pier Channel where the current sheet pile wall does not extend. In the Southern Area, the shallow air sparge curtain will reduce adverse impacts to ecological receptors and surface water. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm

that the source removal and dissolved concentration reduction is effectively mitigating additional impacts to groundwater.

By removing mass from source zones, limiting ongoing contaminant migration to nearby surface water, and promoting contaminant degradation through shallow air sparging, intermediate air sparging, and intermediate biosparging, Alternative 3 is expected to enhance mass reduction across GAA B. These combined technologies are anticipated to improve the long-term effectiveness of natural attenuation processes and accelerate progress toward achieving Final RGs in both shallow and intermediate groundwater.

Source Control

Alternative 3 includes source removal via a NAPL recovery trench/pits paired with EFR, which will reduce the NAPL to dissolved phase pathway of contaminants. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. Additional dissolved phase source control via shallow and intermediate zone air sparge and intermediate biosparge in the Northern Area will prevent further migration of contaminants to nearby surface water. Shallow air sparge will be located near the source to enhance source control and capture. Shallow zone air sparge in the Southern Area will prevent high concentrations of contaminants from migrating toward the cove.

8.3.6.2 Evaluation of Balancing Criteria for GAA B Alternative 3

Long-Term Effectiveness

Alternative 3 would provide long-term effectiveness through NAPL source removal and capping, reducing potential exposure and the potential for migration of contaminants to groundwater. The continued maintenance of the capped areas ensures a maintained reduction in vadose zone soil to groundwater pathways. In the Northern Area, removal of NAPL via a recovery trench/pits and dissolved phase contaminant mass via shallow and intermediate air sparge and intermediate biosparge provides long term effectiveness through contaminant mass removal and degradation, providing reduced migration and lower potential for shoreline impacts. The use of air sparge and biosparge will have long-term impacts on microbial populations in GAA B, providing increased degradation potential after shutdown of these systems. In the Southern Area, removal of contaminant mass via shallow air sparge provides long-term effectiveness through reduced migration and lower potential for off-site impacts.

Reduction of Toxicity, Mobility, and Volume

Alternative 3 achieves the reduction of toxicity, mobility, and volume through the removal of mobile NAPL, decreased contaminant migration via shallow and intermediate air sparge wall(s)/trench(s), intermediate biosparge, and natural attenuation of downgradient and intermediate contaminants. In the Northern Area, the NAPL recovery trench will capture NAPL that is contributing to dissolved phase contaminants. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. The air sparge systems in the Northern and Southern

Areas will reduce mobility of dissolved phase contaminants off-site, while natural attenuation decreases the toxicity of downgradient concentrations. The addition of intermediate air sparge and biosparge systems in the Northern Area will further reduce toxicity of contaminants within the intermediate groundwater zone.

Short-Term Effectiveness

Alternative 3 provides short-term effectiveness by removing NAPL source material, reducing dissolved phase concentrations in both the shallow and intermediate zones with air sparge and biosparge, reducing exposure pathways through installation of a cap, and providing protection of onsite receptors through implementation of LUCs and ICs. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. NAPL recovery, air sparging in both the Northern and Southern Areas, and biosparging in the Northern Area will begin to reduce mass in groundwater near the source zones, limiting further migration. The shallow air sparge curtain will enhance source control by removing dissolved phase volatile compounds and promoting biodegradation near the source areas, thereby reducing the potential for vertical migration to the intermediate zone and limiting downgradient transport toward surface water. In addition, intermediate air sparging will be installed in areas with hydraulic connectivity between shallow and intermediate zones where the semi-confining clay layer is absent, and intermediate biosparging will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. These combined measures reduce downgradient migration and advance progress toward Final RGs through contaminant destruction and mass removal. Routine inspections and groundwater monitoring will assess early system performance and effectiveness of controls and treatment.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 3 include installation of a NAPL recovery trench, installation of the Northern Area shallow and intermediate air sparge systems, Northern Area intermediate biosparge, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench and air sparge systems for 5 years and implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $955,000
- Present Worth of Annual O&M Costs: $1,787,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $2,753,000

Implementability

Alternative 3 is considered implementable and many process options are already being implemented in this GAA (i.e., air sparging). Due to subsurface obstructions and hard slag within GAA B, installation of wells and trenches may be challenging but would not prevent implementation.

Community Acceptance

This alternative should have community acceptance as it is protective of human health via source removal and prevention of downgradient migration. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.3.7 Evaluation of GAA B Alternative 4

Alternative 4 involves a NAPL recovery trench and recovery pits paired with EFR, an impermeable and low permeability cap, a shallow air sparge curtain, operation of the existing GWPT system (Cell 2) within the intermediate zone, intermediate biosparging (near CO209-MWI) in the Northern Area, optimization of the existing air sparge system (Cell 3) within the Southern Area, and the implementation of ICs and ECs.

8.3.7.1 Evaluation of Threshold Criteria for GAA B Alternative 4

Protection of Human Health and the Environment

Alternative 4 provides protection of human health by preventing exposure to contaminants in groundwater in the short and long term through LUCs and capping of GAA B to be completed during development. In the Northern Area of GAA B, groundwater concentrations of contaminants in the shallow zone would decrease due to removal of NAPL via a recovery trench and pits, as well as removal of dissolved phase contaminants via shallow air sparge implementation. Shallow air sparge will be located near the source to enhance source control and capture. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. Additionally, the shallow air sparge system would intercept contaminants prior to migration into the intermediate zone, thus decreasing contaminant concentrations in the intermediate zone. Additional reduction of contaminants will occur in the intermediate zone through continuation of the GWPT IM in Cell 2. As discussed in **Section 8.3.2**, it is anticipated that this system will operate for 5 years or until

asymptotic contaminant recovery is observed, whichever occurs first. An intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location. Protection of the environment will be maintained by the existing sheet pile wall preventing contaminant migration from the shallow zone into the sediment and pore water of the Coal Pier Channel and through capture and control due to the operation of the Graving Dock system capturing contaminant migration in the intermediate zone. The sheet pile wall terminates at the western shore of the mouth of the Coal Pier Channel, where pore water impacts have been identified.

In the Southern Area of GAA B, groundwater concentrations of contaminants in the shallow zone may decrease due to removal of contaminants via shallow air sparge. Subsequently, groundwater concentrations of contaminants in the intermediate zone may decrease due to the reduced migration of contaminants from the treated shallow groundwater zone. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.

Achievement of Media Objectives

Alternative 4 reduces the potential for releases of contaminants to groundwater via NAPL removal, which reduces the continuing source migration and expedites meeting CAOs. The existing sheet pile wall will provide a barrier preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Removal of dissolved phase contaminants via shallow air sparge from both the Northern and Southern Areas of the GAA will decrease contaminant concentrations downgradient and reduce adverse impacts to ecological receptors and surface water. Beneficial biodegradation due to the introduction of oxygen will decrease concentrations of SVOCs that do not volatilize in the sparging process. In the Northern Area, operation of the intermediate GWPT system will decrease dissolved phase contaminants migrating to the Graving Dock. However, due to the capture zone of the Graving Dock, it is unlikely contaminants in the intermediate zone will negatively impact ecological receptors and/or surface water. It is also unlikely that GWPT will meet Final RGs for COCs in the intermediate zone, but will help recover mass. The GWPT system will be able to recover recalcitrant COCs such as PAHs and arsenic; however, the extent of these COC exceedances is limited. Operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area. Shallow air sparge will be located near the source to enhance source control and capture. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater.

By removing mass from source zones, limiting ongoing contaminant migration, and actively extracting dissolved-phase contaminants through shallow air sparging and intermediate GWPT, Alternative 4 will help stabilize the groundwater plume. Due to the amount of mass likely in the

subsurface, it is uncertain how effective GWPT will be at achieving the Final RGs in the intermediate zone in a reasonable amount of time. These measures are expected to support natural attenuation and facilitate the long-term achievement of Final RGs.

Source Control

Alternative 4 includes source removal via a NAPL recovery trench/pits paired with EFR, which will reduce the NAPL to dissolved phase pathway of contaminants. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. Additional dissolved phase source control via shallow zone air sparge, intermediate GWPT, and intermediate biosparge in the Northern Area will prevent further migration of contaminants. Shallow air sparge will be located near the source to enhance source control and capture. Shallow zone air sparge in the Southern Area will prevent high concentrations of contaminants from migrating towards the cove.

8.3.7.2 Evaluation of Balancing Criteria for GAA B Alternative 4

Long-Term Effectiveness

Alternative 4 would provide long-term effectiveness through source removal and capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. The continued maintenance of the capped areas ensures a maintained reduction in vadose zone soil to groundwater pathways. In the Northern Area, removal of NAPL via a recovery trench/pits and dissolved phase contaminant mass via shallow air sparge provides long-term effectiveness through reduced migration and lower potential for shoreline impacts. In the Northern Area, GWPT does not provide additional long-term effectiveness for receptors than what the Graving Dock is already providing. For this reason, GWPT is not anticipated to be a long-term remedy for the Northern Area intermediate groundwater zone. Additionally, due to the amount of mass likely in the subsurface, it is uncertain how effective GWPT will be at achieving Final RGs in the intermediate zone in a reasonable amount of time. In the Northern Area, removal of dissolved phase contaminant mass via intermediate biosparge provides long term effectiveness through contaminant mass removal and degradation, providing reduced migration and lower potential for shoreline impacts. In the Southern Area, removal of contaminant mass via shallow air sparge provides long-term effectiveness through reduced migration and lower potential for off-site impacts.

Reduction of Toxicity, Mobility, and Volume

Alternative 4 achieves the reduction of toxicity, mobility, and volume through the removal of mobile NAPL, decreased contaminant migration via shallow and intermediate air sparge wall(s)/trench(s) and intermediate biosparge, and natural attenuation of downgradient and intermediate contaminants. In the Northern Area, the NAPL recovery trench will capture NAPL that is contributing to dissolved phase contaminants. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. The air sparge systems in the Northern and Southern

Areas will reduce mobility of dissolved phase contaminants off-site, while natural attenuation decreases the toxicity of downgradient concentrations. The addition of intermediate zone GWPT and intermediate biosparge systems in the Northern Area will further reduce toxicity of contaminants within the intermediate groundwater zone. Additionally, capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils.

Short-Term Effectiveness

Alternative 4 provides short-term effectiveness by addressing source material and reducing exposure pathways through installation of a cap, implementation of LUCs and ICs, and operation of shallow air sparge systems. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. NAPL recovery and air sparging in both the Northern and Southern Areas will begin to reduce mass in shallow groundwater near the source zones, limiting further migration in the short-term. Additionally, an intermediate GWPT system will operate in the Northern Area to actively remove dissolved-phase contaminants migrating toward the Graving Dock. While GWPT requires time to influence broad plume stability, it offers immediate reduction in contaminant mass migrating to the Graving Dock. Continued operation of the Graving Dock provides capture, control, and treatment of the COC mass prior to discharge. Intermediate biosparging will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. These combined measures may somewhat reduce remediation timeframe, reduce risk of off-site migration, and support attainment of Final RGs by limiting contaminant mobility and mass. Routine inspections and groundwater monitoring will assess early system performance and effectiveness of controls and treatment.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 4 include installation of a NAPL recovery trench, installation of the Northern Area shallow air sparge and intermediate biosparge systems, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench, air sparge systems, and existing GWPT system for 5 years and implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $1,058,000
- Present Worth of Annual O&M Costs: $2,615,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $3,684,000

Implementability

Alternative 4 is considered implementable and many process options are already being implemented in this GAA (i.e., air sparging, GWPT). Due to subsurface obstructions and hard slag within GAA B, installation of wells and trenches may be challenging but would not prevent implementation.

Community Acceptance

This alternative should have community acceptance as it is protective of human health via source area removal and prevention of downgradient migration. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.3.8 Evaluation of GAA B Alternative 5

Alternative 5 involves a NAPL recovery trench and recovery pits paired with EFR, an impermeable and low permeability cap, a shallow air sparge curtain, biosparging within the intermediate zone at two locations (near CO181-MWI and CO209-MWI) in the Northern Area, optimization of the existing air sparge system (Cell 3) within the Southern Area, and the implementation of ICs and ECs.

8.3.8.1 Evaluation of Threshold Criteria for GAA B Alternative 5

Protection of Human Health and the Environment

Alternative 5 provides protection of human health by preventing exposure to contaminants in groundwater in the short and long term through LUCs and capping of GAA B to be completed during development. In the Northern Area of GAA B, groundwater concentrations of contaminants in the shallow zone would decrease due to removal of NAPL via a recovery trench and pits, as well as removal of dissolved phase contaminants via shallow air sparge implementation. Shallow air sparge will be located near the source to enhance source control and capture. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. Additionally, the shallow air sparge system would intercept contaminants prior to migration into the intermediate zone, thus decreasing contaminant concentrations in the intermediate zone. The existing sheet pile wall will provide a barrier preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Additional reduction of contaminants will occur in the intermediate zone

through implementation of biosparging. The first intermediate biosparge system will be located in the northwest corner of the site, where the semi-confining clay layer is not present and vertical connectivity between the shallow and intermediate zones is greater (near well CO181-MWI). This system will target removal of contaminant mass prior to migration beneath the Coal Pier Channel and into pore water at the western shore of the mouth of the channel, where the sheet pile wall does not extend. The second intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location. Protection of the environment will be maintained through operation of the Graving Dock system, and biosparging in the intermediate zone.

In the Southern Area of GAA B, groundwater concentrations of contaminants in the shallow zone may decrease due to removal of contaminants via shallow air sparge. Subsequently, groundwater concentrations of contaminants in the intermediate zone may decrease due to the reduced migration of contaminants from the treated shallow groundwater zone. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.

Achievement of Media Objectives

Alternative 5 reduces the potential for releases of contaminants to groundwater via NAPL removal, which reduces the continuing source migration and expedites meeting COAs. The existing sheet pile wall will provide a barrier preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Removal of dissolved phase contaminants via shallow air sparge from both the northern and southern portion of the GAA will decrease contaminant concentrations downgradient and reduce adverse impacts to ecological receptors and surface water. Shallow air sparge will be located near the source to enhance source control and capture. Beneficial biodegradation due to the introduction of oxygen will decrease concentrations of SVOCs that do not volatilize in the sparging process. In the Northern Area, operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area. Operation of the intermediate biosparge system located near CO181-MWI (where the semi-confining clay layer is not present) would target removal of contaminant mass prior to migration below the Coal Pier Channel and potentially into the pore water along the western shore at the mouth of the Coal Pier Channel where the current sheet pile wall does not extend. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater.

By removing mass from the source zone, limiting ongoing contaminant migration, and enhancing biodegradation through shallow air sparging and intermediate biosparging, this remedy is expected to reduce benzene and naphthalene concentrations in key downgradient areas. These actions will

support sustained natural attenuation and help advance progress toward meeting Final RGs over time.

Source Control

Alternative 5 includes source removal via a NAPL recovery trench/pits paired with EFR, which will reduce the NAPL to dissolved phase pathway of contaminants. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. Additional dissolved phase source control via shallow zone air sparge and intermediate zone biosparge in the Northern Area will prevent further migration of contaminants. Shallow air sparge will be located near the source to enhance source control and capture. Shallow zone air sparge in the Southern Area will prevent concentrations of contaminants from migrating towards the cove.

8.3.8.2 Evaluation of Balancing Criteria for GAA B Alternative 5

Long-Term Effectiveness

Alternative 5 would provide long-term effectiveness through source removal and capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. The continued maintenance of the capped areas ensures a maintained reduction in vadose zone soil to groundwater pathways. In the Northern Area, removal of NAPL via a recovery trench/pits and dissolved phase contaminant mass via shallow air sparge provides long-term effectiveness through reduced migration. The addition of two intermediate groundwater zone biosparge system in the Northern Area provides long-term effectiveness in increasing biodegradation, reducing contaminant concentrations, and mitigating off-site migration risk. Areas of high pH may negatively impact the efficacy of biosparging and aerobic contaminant degradation. Additionally, the dissolved oxygen demand when applying biosparge may be higher than oxygen saturation limits can supply. In the Southern Area, removal of contaminant mass via shallow air sparge provides long-term effectiveness through reduced migration and lower potential for off-site impacts. The dissolved oxygen demand from biosparge may limit the effectiveness of the remedial option.

Reduction of Toxicity, Mobility, and Volume

Alternative 5 achieves the reduction of toxicity, mobility, and volume through the removal of mobile NAPL, decreased contaminant migration via shallow and intermediate air sparge wall(s)/trench(s), two intermediate biosparge systems, and natural attenuation of downgradient and intermediate contaminants. In the Northern Area, the NAPL recovery trench will capture NAPL that is contributing to dissolved phase contaminants. The NAPL recovery trench and pits will be paired with EFR to optimize NAPL removal. The air sparge systems in the Northern and Southern Areas will reduce mobility of dissolved phase contaminants off-site, while natural attenuation decreases the toxicity of downgradient concentrations. The addition of two intermediate zone biosparging systems in the Northern Area provides a reduction of toxicity, mobility, and volume

of contaminants. Additionally, capping of the area reduces the pathway between the vadose zone and groundwater, reducing the mobility of contaminants in groundwater.

Short-Term Effectiveness

Alternative 5 provides short-term effectiveness by removing NAPL source material, reducing dissolved phase contaminant mass via shallow air sparge and intermediate biosparge, reducing exposure pathways through installation of a cap, and implementation of LUCs and ICs. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. NAPL recovery, air sparging in both the Northern and Southern Areas, and biosparging in the Northern Area will begin to reduce mass in groundwater near the source zones. The shallow air sparge curtain will enhance source control by removing volatile compounds and promoting biodegradation near the source areas, thereby reducing the potential for vertical migration to the intermediate zone and limiting downgradient transport toward surface water. One biosparging system will be implemented in the northwest portion of the site, where the semi-confining clay layer is not present and vertical hydraulic connectivity between the shallow and intermediate zones is greater. This targeted application will promote biodegradation of contaminants in the intermediate zone before they migrate beneath the Coal Pier Channel and toward pore water at the western shore of the channel mouth. The second intermediate biosparging system will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. Although biological treatment onset may be delayed due to dissolved oxygen demand and site heterogeneity, this approach works alongside other measures to reduce migration and initiate contaminant mass reduction, supporting progress toward Final RGs. Routine inspections and monitoring will be conducted to evaluate the performance of engineering and biological treatment components.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 5 include installation of a NAPL recovery trench, installation of the Northern Area shallow air sparge system, installation of the two Northern Area intermediate biosparge systems, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench and air sparge / biosparge systems for 5 years and implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $927,000
- Present Worth of Annual O&M Costs: $2,361,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $3,299,000

Implementability

Alternative 5 is considered implementable and many process options are already being implemented in this GAA (i.e., air sparging). However, the naturally high pH of groundwater within GAA B may impact the implementability and effectiveness of biosparge systems (reduced aerobic degradation effectiveness). Additionally, the dissolved oxygen demand when applying biosparge may be higher than oxygen saturation limits can supply. Pilot testing would be necessary to evaluate the feasibility and performance of biosparging under site-specific geochemical conditions. Due to subsurface obstructions and hard slag within GAA B, installation of wells and trenches may be challenging but would not prevent implementation.

Community Acceptance

This alternative should have community acceptance as it is protective of human health via source area removal and prevention of downgradient migration. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.3.9 Comparative Analysis of Remedial Alternatives

This section compares the remedial alternatives to one another against each of the threshold and balancing criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each alternative. The five remedial alternatives compared are:

- Alternative 1: No Action
- Alternative 2: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Biosparge, Capping, MNA, ECs/ICs
- Alternative 3: NAPL Recovery Trench/Pits, Shallow/Intermediate Air Sparge, Intermediate Biosparge, Capping, MNA, ECs/ICs
- Alternative 4: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate GWPT, Intermediate Biosparge, Capping, MNA, ECs/ICs
- Alternative 5: NAPL Recovery Trench/Pits, Shallow Air Sparge, Two Intermediate Biosparge Systems, Capping, MNA, ECs/ICs

8.3.9.1 Comparative Analysis of Threshold Criteria

Protection of Human Health and the Environment

While Alternative 1 does not provide protection of human health, Alternatives 2, 3, 4, and 5 do. Alternatives 2, 3, 4, and 5 provide protection of human health through LUCs and capping, which will prevent human exposure to contaminants identified in GAA B. Additionally, Alternatives 2, 3, 4, and 5 will reduce contaminant concentrations via shallow air sparge and intermediate biosparge and remove source material via a NAPL recovery trench and pits. Operation of the Graving Dock dewatering system provides significant capture, control, and treatment within the intermediate zone, decreasing the potential of negative impacts to offsite human health and the environment. The existing sheet pile wall will provide a barrier preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Reduction of contaminant concentrations reduces human exposure risk within GAA B, including workers who maintain the Graving Dock system. Alternative 3 provides additional of protection of human health and the environment through implementation of the intermediate air sparge system to capture contaminant mass prior to migration toward the western shore of the mouth of the Coal Pier Channel and an Alternative 4 utilizes an existing GWPT system to provide a similar level of protection of the environment as Alternative 3. Additionally, it is noted that the location of the existing GWPT may not address impacted groundwater in the area of pore water exceedances observed on the western shore of the mouth of the Coal Pier Channel. Alternative 5 provides biosparging treatment in the intermediate groundwater, in the vicinity of pore water exceedances on the western shore of the mouth of the Coal Pier Channel.

Achievement of Media Objectives

Although it is expected that natural attenuation of contaminants in groundwater will eventually occur under Alternative 1, the presence of NAPL and lack of performance monitoring will preclude the ability to evaluate progress toward achievement of the CAOs and Final RGs. Implementation of Alternatives 2, 3, 4, and 5 would provide the data needed to evaluate the effect of the source removal and treatment activities conducted at GAA B, supporting more reliable tracking of progress toward Final RGs. Alternatives 2, 3, 4, and 5, which involve direct removal of dissolved phase contaminants through active remediation (i.e., air sparge, groundwater pump and treat, or biosparge), are expected to expedite the time required to achieve both CAOs and Final RGs by actively reducing contaminant mass and limiting ongoing migration.

Alternatives 2, 3, 4, and 5 provide dissolved phase contaminant removal in the intermediate zone via air sparging, groundwater pump and treat, or biosparging, which would further expedite groundwater remediation and Final RG attainment. These alternatives include intermediate biosparging near well CO209-MWI to address naphthalene exceedances in the intermediate zone observed in the area. Alternative 3 includes intermediate air sparging and Alternative 5 includes intermediate biosparging in the northwest corner of the site where the semi-confining clay layer is absent, allowing for vertical hydraulic connectivity between shallow and intermediate zones.

These target broader mass removal in the intermediate zone prior to potential contaminant migration beneath the Coal Pier Channel and toward pore water at the western shore of the mouth of the channel, where the sheet pile wall does not extend. Alternative 4's existing GWPT system in Cell 2 has demonstrated localized decreases in contaminant concentrations (refer to *Coke Oven 2023 IM Progress Report*) but may be limited in broader intermediate zone effectiveness due to variable hydraulic conductivity and pumping well location. The Graving Dock currently provides capture, control, and treatment of mass in the intermediate zone. GWPT offers the most potential for arsenic removal, supporting Final RG achievement for metal contaminants. It is likely that PAH solubility and mobility will decrease with the reduction of NAPL, BTEX, and naphthalene in groundwater. Similarly, as COC concentrations are reduced in GAA B and geochemical conditions become more oxidizing, the speciation of arsenic may move towards the less mobile and less toxic arsenate compound.

The application of biosparging in Alternatives 2-5 faces challenges from local geology and high pH conditions (10–12 s.u.), which may limit the onset or efficiency of biodegradation. However, biosparging targets key COCs and is expected to contribute to long-term reductions toward Final RGs. Notably, for Alternatives 2, 3, 4, and 5, treatment of intermediate groundwater can be limited to small, targeted areas due to the expansive capture zone provided by the Graving Dock system. These focused treatments enhance mass reduction and migration potential, supporting broader achievement of Final RGs.

Source Control

Alternatives 2, 3, 4, and 5 provide a significant degree of source removal through the construction of a NAPL recovery trench and pits. They also reduce the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. These alternatives provide a similar level of source control, with minimal variation in advantages or disadvantages.

8.3.9.2 Comparative Analysis of Balancing Criteria

Long-Term Effectiveness

Alternatives 2, 3, 4, and 5 provide long-term effectiveness due to NAPL source removal, impermeable and low permeability capping, and dissolved phase contaminant remediation (i.e., air sparge, GWPT, biosparge). Due to the restrictions of the semi-confining clay layer, Alternatives 3 and 5 may not achieve significant mass reduction within the intermediate groundwater zone, potentially impacting the long-term effectiveness of the systems. Treatment of the intermediate groundwater via Alternative 4 is not designed to target long-term effectiveness, as the GWPT IM system was originally designed to decrease contaminant migration to the Graving Dock. If Alternative 4 is selected, some minor updates and optimization of the GWPT system may be needed. Based on microbial testing and the presence of both anaerobic and aerobic microbial communities, Alternatives 3 and 5 may be able to provide the highest degree of long-term effectiveness coupled with MNA. Biosparging in Alternatives 2-5 is applied near well CO209-

MWI, and in Alternative 5, is also applied more broadly in the northwest portion of the site (near CO181-MWI) to address vertically connected intermediate groundwater. Challenges related to pH, geology, and dissolved oxygen demand may limit the Alternatives in the intermediate groundwater zone. Achievement of Final RGs in the long-term is most likely to occur with Alternatives 3, 4, and 5 due to their increased mass reduction.

Reduction of Toxicity, Mobility, and Volume

Toxicity, mobility, and volume of contaminants will be reduced through Alternatives 2, 3, 4, and 5. These alternatives include removal of contaminant mass via a NAPL recovery trench and pits, and removal of dissolved phase contaminant mass via air sparging, GWPT, and/or biosparging. These alternatives also include impermeable and low permeability capping to reduce mobility of the contaminants from the vadose zone to groundwater and groundwater to surface water, respectively. Alternatives 2, 3, 4, and 5 include remediation that targets both the shallow and intermediate groundwater zone. Alternative 3 and 5 also include contaminant reduction in the area in which the semi-confining clay layer is not observed through intermediate air sparge and biosparge, respectively. Alternatives 2, 3, 4 and 5 include biological and chemical changes driven within the subsurface that may influence the mobility and concentration (toxicity) of the slag related contaminants in GAA B.

Short-Term Effectiveness

Alternatives 2, 3, 4, and 5 provide immediate short-term effectiveness by implementing an impermeable cap that limits stormwater infiltration and reduces vapor intrusion, along with NAPL recovery trenches / pits and shallow air sparging systems to address contamination in the shallow groundwater. They also include intermediate biosparging near CO209-MWI to address elevated naphthalene concentrations, though biosparging is a longer-term treatment expected to reduce contaminants over several years. These measures, combined with ICs and LUCs, and operation of the existing sheet pile wall and Graving Dock pumping system, will prevent direct exposure to impacted soil and groundwater and help contain contaminant migration. Alternative 3 further enhances short-term effectiveness by adding intermediate air sparging in hydraulically connected zones. Intermediate air sparging is anticipated to reduce the potential for COCs to migrate to pore water at the western shore of the mouth of the Coal Pier Channel. Alternative 5 applies intermediate biosparging in the same hydraulically connected area as the intermediate air sparging in Alternative 3, targeting mass reduction before migration beneath the Coal Pier Channel. While biosparging generally requires a longer timeframe to achieve significant reductions, it complements other short-term measures by initiating contaminant degradation in the intermediate zone. Alternative 4 includes operation of an intermediate GWPT system in the Northern Area, providing some additional short-term contaminant removal, though its effectiveness may be limited by system duration and site conditions. Early implementation of LUCs and ICs across all alternatives supports short-term protection by restricting groundwater use and limiting site access. Collectively, these measures stabilize contaminant conditions and limit further migration, thereby supporting progress toward achieving Final RGs over the long term.

Cost

Alternative 2 provides the most cost-effective option to achieve the CAOs. Alternatives 3, 4 and 5 require greater capital and operational costs making these options the least cost-effective. Alternative 4 will require less capital costs than Alternatives 3 and 5, but will incur greater operational costs.

Implementability

Alternatives 2, 3, 4, and 5 are all considered implementable, and many process options are already being implemented in GAA B (i.e., air sparge, GWPT). Due to subsurface obstructions and hard slag, installation of wells and trenches may be challenging. Alternatives 2, 3, 4 and 5 will face implementability challenges due to a high pH groundwater environment and complex geology. Pilot testing will be necessary to evaluate the feasibility and performance of biosparging under site-specific conditions. Alternatives 2 and 4 will be the most implementable, as they require the least amount of intrusive groundwork (the GWPT system envisioned for Alternative 4 is existing in the form of an IM currently).

Community Acceptance

Alternatives 2, 3, 4, and 5 should have community acceptance, as they are protective of human health and the environment via source removal, dissolved phase contaminant removal, and prevention of off-site migration. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.3.10 Preferred Remedial Alternative

Based on the results of the threshold and balancing analysis, GAA B Alternative 3: NAPL Recovery Trench/Pits, Shallow/Intermediate Air Sparge, Intermediate Biosparge, Capping, LUCs, and ECs/ICs is recommended as the preferred remedial alternative to achieve CAOs in GAA B. The following reasons are presented for the selection of Alternative 3:

- The capture and removal of NAPL currently in the source area will occur via one NAPL removal trench and a series of recovery pits (as necessary). NAPL transmissivity testing and current NAPL recovery efforts indicate that the NAPL within GAA B is of various viscosities and recoverability. Implementation of a NAPL recovery trench, aimed at cutting

off the migration of NAPL toward the Graving Dock, will drive recovery of the mobile NAPL without extending additional time and resources towards identifying individual locations in which NAPL is recoverable. Additionally, it has been observed that much of the recoverable and mobile NAPL appears to exist within the footprint of the former Benzol Processing Area tank farm. This area will be the main focus of additional pits or recovery sumps deemed necessary.

- As discussed in **Section 6.2**, the conceptual site model indicates that the source is moving from the shallow groundwater zone into the intermediate groundwater zone in areas where the semi-confining clay layer is not observed. Alternative 3 includes installation of an air sparge curtain close to the source area and before the semi-confining clay layer pinches out (to the west). The location of this air sparge curtain is aimed at intercepting contaminants prior to migration from the shallow into the intermediate groundwater zone. By intercepting contaminants at this location, downgradient impacts are expected to attenuate via natural processes in a reasonable amount of time.
- Additional intermediate air sparge and biosparge systems will be installed. The biosparge system located near well CO209-MWI will help address naphthalene exceedances observed in the area. This would address contaminants along the west shoreline of GAA B. Removal of dissolved phase contaminant mass via intermediate air sparge near CO181-MWI reduces migration near the western shore of the mouth of the Coal Pier Channel where pore water exceedances have been observed.
- Implementation of Alternative 3 is expected to accelerate attainment of Final RGs by actively reducing contaminant mass through targeted NAPL recovery and combined shallow/intermediate air sparging and biosparging. The remedy limits ongoing contaminant migration from source zones, removes dissolved phase VOCs, enhances biodegradation of key COCs such as benzene and naphthalene, and helps stabilize groundwater conditions. Continuous monitoring and institutional controls will support confirmation of Final RG achievement over time, ensuring long-term protection of human health and the environment.
- Groundwater gauging within the intermediate groundwater zone indicates the Graving Dock provides significant capture within this area. Influence on the intermediate groundwater gradient is observed throughout the GAA B source area, as well as in the northwestern portion of GAA B. Contaminant mass not captured via the intermediate air sparge system will still be within the Graving Dock's capture zone.
- After completion of active remediation, groundwater contaminants are expected to attenuate naturally over time and sitewide groundwater monitoring would provide data to confirm that contaminant concentrations are decreasing and confirm that contaminants in groundwater are not migrating laterally toward nearby surface water bodies. MNA would also be used to assess the success of the implemented remedial strategy.
- Microbial sampling was conducted within GAA B, with results showing the presence of both anaerobic and aerobic microbial and enzyme assisting populations. Samples collected

from intermediate wells indicated the presence of sulfate reducing bacteria (SRB), candidatus benzenivoras ORM2 (BNVX), toluene dioxygenase (TDO), and naphthalene dioxygenase (NDO), all potentially related to degradation of BTEX related contaminants. The presence of a healthy microbial population and degradation assisting enzymes indicate that air sparging and biosparging in the intermediate groundwater will provide increased decay rates via biodegradation.

- Alternative 3 provides reasonable protection and is an implementable and cost-effective approach to return the area into productive re-use.

8.3.11 **Contingency Remedial Criteria**

Alternative 2 will be implemented in GAA B with sampling completed as described in the *Coke Point Area Sampling and Analysis Plan*. The complexity and extent of impacts within GAA B warrant the identification of a contingency remedy, in the event Alternative 3 does not produce the desired results.

The *Coke Point Area Sampling and Analysis Plan* includes identification of monitoring wells within GAA B that will be regularly sampled to determine the effect of the source removal and control remedies implemented. The data collected from these wells will undergo statistical analysis to identify trends in contaminant concentrations. The statistical methods used to develop trends and subsequent data interpretation and reporting are further discussed in the *Coke Point Area Sampling and Analysis Plan*. The results of the statistical trend analysis will inform the need for additional evaluation. Although MNA is not immediately applicable to GAA B, the following USEPA identified triggers related to statistical trend analysis will be applied to the sampling results:

- Statistically significant increasing trends not originally predicted during remedy selection; and
- Contaminants identified in a statistically significant increasing trend at wells where there was previously a decreasing trend or no trend.

If any of the triggers are met, further evaluation will occur, involving additional sampling, evaluation of geochemical and biological conditions, reassessment of remediation timelines, or further site investigation to pinpoint the potential new sources causing rising concentrations. Given the current data available for GAA B, and results of the data gap investigation, a contingency approach will be identified based on this alternative analysis. However, additional field tests and evaluations will be necessary to inform the new contingency alternative.

8.4 Development of Corrective Measures for GAA C

8.4.1 Applicability Evaluation for Identified Process Options

The process for development and evaluation of Corrective Measures Alternatives outlined in **Section 8.1** was implemented for GAA C. Process options were evaluated for applicability with GAA C conditions, as outlined in **Table 38A**. Several technologies were eliminated from further consideration during screening; the technologies were identified as not applicable to GAA C due to the nature of the contaminants or specific conditions at GAA C, as detailed below.

- Multi-Phase Extraction – This treatment technology was eliminated from consideration based on the characteristics of the contamination within GAA C, mainly the presence of DNAPL. MPE is typically designed for LNAPL collection. Additionally, the DNAPL consists mainly of No. 6 fuel with high concentrations of SVOCs, which will not volatize readily.
- Soil Flushing – This treatment technology was eliminated from consideration based on the characteristics of contaminants within GAA C. GAA C contamination is related mostly to heavy fuels for which soil flushing has not typically been shown to be a successful treatment strategy. Additionally, there are a large amount of subsurface obstructions making it difficult to distribute chemicals evenly or on target.
- In-situ Chemical Reduction - ISCR was eliminated as a potential treatment technology since it is not suitable for treating the non-slag related contaminants within GAA C (PAHs and aromatic VOCs). This process option is typically applied to halogenated VOCs or inorganic compounds.
- Thermal Conduction Heating – TCH was eliminated as a potential treatment technology since the technology relies on volatilizing contaminants for collection via soil vapor extraction and subsequent treatment. The majority of the contaminants identified within GAA C do not readily volatilize and may burn prior to reaching volatilization temperatures. Additionally, subsurface obstructions would inhibit the ability to install heater wells in the spacing required to heat uniformly.
- Electrical Resistance Heating - ERH was eliminated as a potential treatment technology for similar reasons to TCH, mainly that the contaminants identified within GAA C do not readily volatilize. ERH would not be able to reach high enough temperatures to remove contaminants from the subsurface. Subsurface obstructions would inhibit the ability to install electrodes in the spacing required to heat uniformly.
- On-Site Disposal (CAMU) - A CAMU was eliminated as a disposal option for excavated material due to the lack of available space.

8.4.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA C

Process options that were not eliminated due to inapplicability were retained for consideration as components of a comprehensive alternative. The summary of the retained process options is included in **Table 38A**. As discussed in **Section 6.3.3,** NAPL has been observed in GAA C. The NAPL is primarily in shallow soil under the former locations of the two ASTs. NAPL observed in the saturated zone appears to be DNAPL and is highly viscous. Previous attempts to bail or recover the DNAPL have been unsuccessful. The COCs identified in GAA C include a range of PAHs, benzene, ethylbenzene, xylenes, and bis(2-ethylhexyl)phthalate. The PAH exceedances (excluding naphthalene) of Final RGs are limited to six wells, five of which are located within the known DNAPL area. One of these wells, B18-044-PZ, contains benzo[a]pyrene concentrations that are an order of magnitude above its aqueous solubility limit, indicating that results may be biased by the presence of NAPL and are unlikely to represent dissolved-phase concentrations. Outside of the DNAPL area, exceedances of high molecular weight PAHs, excluding naphthalene, are minor (less than an order of magnitude higher than Final RGs) and limited to one well, further supporting the conclusion that the most significant mass of PAHs is associated with DNAPL (refer to **Figure 27I**).

Naphthalene exceedances are more widespread and extend to most wells within GAA C (refer to **Figures 32A-G**), indicating broader contaminant distribution and persistence. Benzene exceedances of Final RGs are limited to two wells, and bis(2-ethylhexyl)phthalate exceedances are limited to one well. Based on the exceedance frequency (refer to **Table 30C**) and lateral distribution of each of these COCs, remedial options were focused on addressing DNAPL (where majority of PAH exceedances are observed), naphthalene, and benzo[a]pyrene. Benzo[a]pyrene was selected as a focus of this alternative analysis due to its high concentrations within the DNAPL area, environmental persistence, and increased toxicity relative to the other PAHs within this area. Isolated contamination located near the B18-082-PZ / COA-MW-001 area was not targeted for remediation because it is fully delineated, significantly attenuates laterally, and is not affecting nearby surface water.

Additionally, benzo[a]pyrene and naphthalene require the largest reduction in concentrations within this GAA to meet Final RGs. Process options that will reduce NAPL, naphthalene, and benzo[a]pyrene to Final RGs will also address the remaining COCs such as other PAHs, benzene, ethylbenzene, xylenes and bis(2-ethylhexyl)phthalate. No single process option or approach will satisfactorily mitigate risk and hazard. Due to the field observations regarding the DNAPL in the saturated zone, it has been determined that removal or recovery is infeasible. Therefore, remedial alternatives were focused on containment and removal, where possible. Development of remedial alternatives was completed by combining potentially applicable technologies and process options with the best potential for achieving CAOs, as shown in **Table 38B**.

The presented alternatives for GAA C include ICs and ECs in combination with MNA, capping, sheet pile/slurry wall extension, and excavation. These process options were identified as the best suited technologies based on GAA C specific conditions.

- Excavation was identified as a preferred process option to remove NAPL impacted soils as it has been previously conducted to remove lead impacted soils within GAA C. Hot spot excavation has previously been conducted as an IM in other areas of the TPA property with similar contaminants and general site conditions, specifically with respect to NAPL impacted soil within the vadose zone. Excavation would remove NAPL impacted soil within the vadose zone, preventing it from further impacting underlying groundwater and preventing potential exposure to future occupants at the site. Due to the depth and location of DNAPL within the saturated zone just east of the Coal Pier Channel relieving dock, excavation is not contemplated to remove DNAPL. Excavation of the DNAPL would require removal of soils to the top of the semi-confining clay layer (refer to **Figure 27D**) which would jeopardize the structure of the Coal Pier Channel relieving dock (refer to **Appendix H-1**; Bethlehem Steel Sparrows Point Drawing 192463) and is therefore infeasible. Additionally, LNAPL previously identified at 1-inch piezometer B18-082-PZ in 2018 / 2019 was not confirmed via installation of a test pit (COA-003-TP) or a 2-inch replacement well (COA-MW-001) in 2024. Therefore, the area of B18-082-PZ is not contemplated for excavation.
- Capping was identified as a preferred process option based on the presence of NAPL in soil beneath GAA C (ARM 2020a). NAPL consists mainly of No.6 fuel oil and was observed in both the vadose and saturated zones. It is, by its nature, unlikely to migrate due to its high viscosity. Vertical migration of contaminants from soil to underlying groundwater is possible via the infiltration of precipitation through impacted soil. Installation of an impermeable and low permeability cap will prevent vertical contaminant migration by preventing infiltration of surface water into the subsurface.
- The extension of the existing sheet pile wall (refer to **Section 6.3.1** for details, and to **Figure 27A** for the location of the existing sheet pile wall) with sheet pile or slurry wall was identified as a preferred process option based on the location of GAA C with respect to the nearby Coal Pier channel and observations of sheen in the Coal Pier Channel. An extended sheet pile/slurry wall would aim to reduce permeability in the direction of groundwater flow. The installation of the extended sheet pile/slurry wall would reduce migration of sheen and COCs in groundwater to surface water.
- MNA was identified as a preferred process option to reduce groundwater concentrations through natural processes after the source is addressed via capping and/or excavation activities. MNA will assess the effectiveness of the other proposed remedies, including capping, sheet pile/slurry wall extension, and excavation, and will provide data to confirm that contaminant concentrations in groundwater are continuing to decrease toward Final RGs. MNA will also provide data to confirm that impacts within GAA C do not migrate and potentially impact surface water to the west.

During this step in the process, several process options were not selected as part of a comprehensive alternative (Corrective Measures Alternative) due to GAA-specific conditions, as discussed below.

- Hydraulic containment was not selected as a process option for GAA C as the source of contaminants in groundwater is likely DNAPL. Hydraulic containment pumping to contain the migration of DNAPL towards the Coal Pier Channel is unlikely to be effective due to the presence of historical tank foundations and other subsurface obstructions in this area. These obstructions are likely to impede capture of the dissolved phase plume. Extension of the sheet pile wall will be more effective in containing COCs observed in GAA C.
- Air Sparge/Soil Vapor Extraction was not selected as a process option for GAA C due to the limited effectiveness on the types of contaminants present within GAA C, including No.6 fuel (DNAPL), naphthalene, and benzo[a]pyrene which do not readily volatilize. The presence of DNAPL would preclude the use of air sparging. Additionally, contamination located near the B18-082-PZ / COA-MW-001 area is fully delineated, significantly attenuates laterally, and is not affecting nearby surface water or other receptors.
- Product Recovery (Skimmers) was not selected as a process option for GAA C due to the characteristics of the NAPL present in the subsurface. The NAPL is composed largely of No.6 fuel oil which is extremely viscous and not recoverable. As an example, No.6 fuel oil often needs to be continuously heated to be “pumpable” when it is stored for use in industrial applications.
- Stabilization/Solidification was not selected as a process option for GAA C because, as mentioned above, No.6 fuel is by its nature viscous, not recoverable, and unlikely to migrate. Stabilization/solidification would require subsurface mixing which would be difficult due to the presence of historic tanks and building foundations.
- Groundwater Pump and Treat was not selected as a process option for GAA C because of the presence of DNAPL within GAA C. While it can remove dissolved contaminants, GWPT is not effective at removing DNAPL. Implementation of GWPT in GAA C would operate like a hydraulic containment system, which is unlikely to be effective due to subsurface historical tank infrastructure and subsurface obstructions that will impede capture zones. Extension of the sheet pile wall will be more effective in containing COCs observed in GAA C.
- In-situ Chemical Oxidation was not selected as a process option for GAA C because of the presence of NAPL. The high oxidant demand of NAPL would require excessive amounts of ISCO reagents. Even trace amounts of NAPL can significantly increase the oxidant demand. Depending on the type of reagent selected, strong reactions can take place during introduction to NAPL, raising significant health and safety concerns both for onsite workers and the surrounding community. Although ISCO likely has the best effectiveness on benzo[a]pyrene, the majority of benzo[a]pyrene exceedances in GAA C are located in

areas in/near the DNAPL impacts. Subsurface obstructions would make it very difficult to distribute chemicals to areas where NAPL has not been observed, making ISCO unrealistic to implement in GAA C. Additionally, contamination located near the B18-082-PZ / COA-MW-001 area is fully delineated, significantly attenuates laterally, and is not affecting nearby surface water.

- Bioremediation, including enhanced anaerobic bioremediation, enhanced aerobic bioremediation, and biosparging, was not selected as a process option for GAA C due to the presence of DNAPL in the subsurface, which can negatively affect bacteria populations responsible for breaking down contaminants. Bioremediation is effective in treating naphthalene; however, it is best applied to dissolved phase, residual groundwater contaminant plumes. Bioremediation effectiveness on benzo[a]pyrene is a current topic of academic research and it is questionable as to the effectiveness bioremediation will have on the benzo[a]pyrene in GAA C in the short-term. Additionally, contamination located near the B18-082-PZ / COA-MW-001 area is fully delineated, significantly attenuates laterally, and is not affecting nearby surface water.
- Low-temperature thermal recovery was not selected as a process option for GAA C due to the high viscosity DNAPL present in the subsurface. The goal of low-temperature thermal recovery would be to heat the subsurface enough for DNAPL to reduce in viscosity enough for recovery, however, it is unlikely that the viscosity could be reduced enough for this to be achieved. Further, based on previous attempts as outlined in the No. 10 Tank Area Investigation Report dated January 6, 2020, removal of No.6 fuel DNAPL from the subsurface via bailing is impractical.
- A permeable reactive barrier was not selected as a process option for GAA C due to the DNAPL present within GAA C, which likely will not be effectively treated within the PRB causing blockage or plugging of the PRB.
- Permitted discharge is typically paired with GWPT. GWPT is discussed above.

The remaining remedial technologies and process options were combined to create a workable number of Corrective Measures Alternatives that provide comprehensive remedies, as discussed in **Section 8.4.3**, below.

8.4.3 Summary of Corrective Measures Alternatives for GAA C

Each of the preferred process options included in **Table 38A** was combined to form Corrective Measures Alternatives for GAA C. The Alternatives for GAA C are described in detail below. As highlighted in **Section 8.2.2**, the stratigraphy and heterogeneity of the native soil deposits pose significant engineering challenges for the implementation of in-situ and ex-situ treatment technologies and would present difficulty for technologies requiring uniform injections or bulk extraction. Alternatives have been developed and evaluated with these engineering challenges in mind.

8.4.3.1 Alternative 1: No Action

The No Action Alternative is presented in order to define a baseline condition against which other alternatives are compared and typically refers to an absence of efforts to reduce contaminant mass or otherwise treat or contain contamination. In the case of GAA C, source removal has not yet been conducted. The No Action Alternative considers no benefits from future redevelopment of the GAA. Under Alternative 1, no efforts would be employed to reduce potential cross-media transfer of impacts to groundwater, nor would protections be implemented to prevent exposure to impacted groundwater. In addition, no activities would be conducted to evaluate the continuing groundwater trends or the ability of natural attenuation to reach Final RGs.

8.4.3.2 Alternative 2: Excavation, Sheet Pile/Slurry Wall Extension, Capping, MNA, LUCs, and ECs/ICs

Alternative 2 includes the construction of a cap. All pavement installed in conjunction with the construction of the Container Terminal will include a minimum of four inches of subgrade and a minimum of four inches of asphalt or concrete, which will prevent exposure to contaminated soil/slag and groundwater and prevent surface stormwater from infiltrating through impacted material. The portion of GAA C outside of the Container Terminal LOD will be completed as a paved cap for potential future use as a parking lot. Upon completion of construction activities, paved areas will be subject to periodic inspections and ongoing maintenance requirements.

Alternative 2 includes excavation of NAPL impacted soils. Excavation would focus on the area of the former No. 10 AST and extend to the top of groundwater, which occurs at depths between 6 and 11 feet bgs. As shown in **Figures 27F through 27I**, NAPL impacted soil beneath the former tank is the likely source of the DNAPL in the saturated zone. Removal of the NAPL impacted soil in the unsaturated zone will ensure there is no further NAPL migration to the underlying groundwater. An excavation volume would be determined prior to implementation but has been estimated at 6,800 cubic yards for costing purposes. This approach conceptually would involve removing vadose zone soil containing NAPL. The excavated soil would be characterized and based on the results, profiled and managed as hazardous or nonhazardous waste. The extent of the excavation will be determined by the presence of the NAPL.

Additionally, Alternative 2 includes extension of the existing sheet pile wall with sheet pile or slurry wall running perpendicular to the flow of groundwater to the Coal Pier Channel to stop contaminant migration. The extension would include either sheet pile or a slurry wall and would aim to reduce the permeability of the soil/slag in a way that migration of the NAPL would be contained. The sheet pile/slurry wall extension would be approximately 250 feet, extending the existing cut-off wall that was installed in 1989.

Alternative 2 also includes MNA, which would reduce residual concentrations of COCs in groundwater over time via natural processes and would serve to document the reduction in concentration. This option would involve sampling of selected monitoring well locations to

evaluate the behavior of contaminants in groundwater at GAA C, including the overall stability of the plume with respect to migration and the trends in contaminant concentrations over time. The *Coke Point Area Sampling and Analysis Plan* has been designed to evaluate the effect of source control measures on groundwater concentrations. The sampling program will be designed to collect adequate data to assess contaminant concentrations and supplement existing data to identify the type(s) of natural attenuation processes active at the site, such that an estimate of the rate at which such processes will reduce contaminant concentrations to required levels can be refined.

In accordance with *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (USEPA, 1999), the monitoring program will specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and is capable of attaining remediation objectives. In addition, the monitoring program will be designed to accomplish the following:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes;
- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume(s) is not expanding (either downgradient, laterally or vertically);
- Verify no unacceptable impact to downgradient receptors;
- Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

The frequency of monitoring will be specified in order to detect, in a timely manner, the potential changes in site conditions. The *Coke Point Area Sampling and Analysis Plan* will be developed to allow flexibility for adjusting the monitoring frequency and analyzed parameters over the life of the remedy.

Alternative 2 will also include the implementation of LUCs and ICs consisting of environmental covenants including land use restrictions (i.e., prohibitions on residential use), groundwater use restrictions (i.e., prohibiting potable and non-potable water use), inspection, operation and maintenance requirements associated with the engineering controls, and site use restrictions addressing intrusive activities with the potential to encounter impacted environmental media. Worker PPE requirements, waste handling and disposal requirements, and construction-specific tasks will be addressed in RADWPs prior to the commencement of work. Additional engineering controls will include signage and fencing, as needed, to prohibit unauthorized access to the property and prevent disturbance of the cap once it is in place. The planned use of the properties within GAA C are paved parking lots. There are currently no plans for development of permanent structures, however, if the site were to be redeveloped in the future with buildings, soil gas

sampling would be included as part of a RADWP. Any future buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.

8.4.3.3 Alternative 3: Hot Spot Excavation, Capping, MNA, LUCs, and ICs/ECs

Alternative 3 includes components outlined in Alternative 2 with the exception of the sheet pile/slurry wall extension. Alternative 3 includes excavation of NAPL impacted soils, as described in Alternative 2. Excavation would focus on the former No. 10 AST area and extend to the top of groundwater, which occurs at depths between 6 and 11 feet bgs. As shown in **Figures 27F through 27I**, NAPL impacted soil beneath the former tank is the likely source of the DNAPL in the saturated zone. Removal of the NAPL impacted soil in the unsaturated zone will ensure there is no further NAPL migration to the underlying groundwater. An excavation volume would be determined prior to implementation but has been estimated at 6,800 cubic yards for costing purposes. This approach conceptually would involve removing vadose zone soil containing NAPL. The excavated soil would be characterized and based on the results, profiled and managed as hazardous or nonhazardous waste. The extent of the excavation will be determined by the presence of the NAPL.

8.4.4 **Evaluation of GAA C Alternative 1**

Alternative 1 involves maintaining the current conditions and taking no additional corrective measures or interventions. The No Action alternative does not meet any threshold criteria and, therefore, is not evaluated against the balancing criteria.

8.4.4.1 Evaluation of Threshold Criteria for GAA C Alternative 1

Protection of Human Health and the Environment

The No Action Alternative would not be protective of human health and the environment. Under a No action Alternative, no effort would be made to control exposures to impacted groundwater through the implementation of ECs/ICs. In addition, there would be no additional protective systems preventing or mitigating vapor intrusion. Unacceptable exposure to impacted groundwater is possible under the No Action Alternative.

Achievement of Media Objectives

The planned development of GAA C is for vehicle parking. As such, the site will effectively be capped even in the No Action Alternative. This will provide some source control by preventing infiltration through impacted soil into underlying groundwater. Concentrations of contaminants in groundwater are then expected to decrease through natural attenuation processes. However, without monitoring, it will not be possible to confirm progress toward achievement of Final RGs or to make a determination that natural attenuation will result in the achievement of CAOs.

Source Control

No actions would be implemented to further control potential sources to groundwater. Maintenance and inspection of the cap would not be considered in this alternative.

8.4.5 Evaluation of GAA C Alternative 2

Alternative 2 involves the construction of a cap, excavation of NAPL impacted soils, extension of the existing sheet pile wall with sheet pile or slurry wall cutting off groundwater flow to the Coal Pier Channel, and the implementation of MNA, LUCs, and ECs/ICs.

8.4.5.1 Evaluation of Threshold Criteria for GAA C Alternative 2

Protection of Human Health and the Environment

Alternative 2 reduces the potential for release of contaminants to groundwater by removing source material. The excavation of NAPL impacted soils will reduce the leaching of residual contaminants to underlying groundwater, speeding up natural attenuation. Alternative 2 provides additional protection of human health by capping GAA C to prevent exposure of future occupants to contaminated soil and prevent downward surface and storm water infiltration, thereby reducing the leaching of contaminants to underlying groundwater. LUCs and ICs protect human health through limiting use of the Site and preventing, and / or limiting exposure to onsite media. Additionally, the development of a HASP for future utility workers or construction workers mitigates exposure risks by providing proper handling procedures for impacted material. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA. Alternative 2 provides protection of the environment as the extension of the sheet pile/slurry wall between Coal Pier Channel and the DNAPL source (No. 10 AST) will intercept the further migration of groundwater contamination to surface water by providing an additional layer of containment.

Achievement of Media Objectives

Alternative 2 reduces the potential for NAPL impacted soil to act as a continuing source of contamination to groundwater by removing the NAPL source in the vadose zone and preventing infiltration of stormwater through impacted soil. Reduction in vertical migration of contaminants to groundwater may help decrease the time needed to reach Final RGs as it may expedite natural attenuation. The extension of the existing sheet pile wall with sheet pile or slurry wall between Coal Pier Channel and NAPL impacted soil will provide low permeability containment of impacted groundwater and intercept the migration of dissolved contaminants to surface water. The use of MNA would help assess the natural reduction in contaminant concentrations over time. If future information demonstrates potential plume migration that requires additional management, appropriate response actions will be implemented. With this alternative, Final RGs are expected to be reached by source removal, promoting natural contaminant degradation, and plume stability through MNA and by preventing stormwater infiltration and migration of COCs through capping

and extension of the sheet pile wall. This remedy is expected to reduce COC concentrations in groundwater over time until Final RGs are achieved.

Source Control

Alternative 2 includes excavation of vadose zone material which immediately reduces the contaminant mass in the source area and controls releases to groundwater. Additionally, Alternative 2 includes extending the current sheet pile wall with sheet pile or slurry wall between the Coal Pier Channel and groundwater impacts beneath GAA C. This provides containment of contaminants in groundwater by reducing the mobility of DNAPL. Capping the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils.

8.4.5.2 Evaluation of Balancing Criteria for GAA C Alternative 2

Long-Term Effectiveness

Alternative 2 is expected to achieve long-term effectiveness through excavation of NAPL impacted soils and extension of the sheet pile wall to provide source containment, and MNA to confirm that natural attenuation is occurring and receptors are protected. Risks from residual contamination would be minimal after removal of NAPL impacted soils, installation of the sheet pile/slurry wall extension, and implementation of ICs/LUCs to ensure continued non-residential land use, prohibition of groundwater use, and proper handling of incidentally disturbed soils. The sheet pile/slurry wall extension will provide a barrier to the migration of DNAPL into the Coal Pier Channel. MNA will provide a way to monitor contaminants outside of the DNAPL area to confirm that natural attenuation is occurring and that contaminants are not migrating.

Reduction of Toxicity, Mobility, and Volume

Toxicity, mobility, and volume will be reduced by NAPL impacted soil removal. Capping the site will reduce contaminant mobility by reducing stormwater infiltration through the cap and into the unsaturated zone, thereby reducing the potential for vertical migration of vadose zone contaminants into groundwater. The extension of the sheet pile/slurry wall will provide containment of impacted groundwater. Natural attenuation would reduce contaminant volume (contaminant mass) and toxicity.

Short-Term Effectiveness

Alternative 2 provides short-term effectiveness by immediately isolating impacted media through construction of an engineered cap and extension of the existing sheet pile wall, as well as reducing contaminant mass through excavation of NAPL impacted vadose zone soils. These measures will limit potential exposure pathways by preventing contact with contaminated soil and reducing stormwater infiltration that could mobilize contaminants into groundwater. Excavation to the top of groundwater introduces moderate short-term risks, including potential increases in dissolved-phase COC concentrations due to disturbance of source material. The containment of DNAPL

through the barrier wall extension will help prevent further migration of contaminants toward surface water, eliminating sheen and providing short-term protection of downgradient ecological receptors. Implementation of LUCs and ICs in the remedy will further reduce potential exposure by restricting groundwater use and limiting intrusive activities. The short-term effectiveness of the remedy will be assessed through routine inspections of engineering controls and early monitoring of groundwater conditions to confirm that containment is functioning as intended. By excavating contaminant mass and preventing further migration, these measures also lay the groundwork for achieving Final RGs over time.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the excavation of NAPL impacted vadose zone soils, installation of the sheet pile/slurry wall extension, and installation of wells for MNA monitoring. O&M costs include implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $511,000
- Present Worth of Annual O&M Costs: $137,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $659,000

Implementability

Alternative 2 is considered implementable but may be challenging due to subsurface obstructions previously observed in the western portion of GAA C. Great care will have to be taken during excavation when working near the existing bulkhead to ensure no damage. The construction of an MDE-approved cap can be implemented with modern construction practices during the development of the Container Terminal. Installation of the sheet pile/slurry wall extension would need to be assessed prior to construction to understand subsurface obstructions in the area of installation. Depending on results of this assessment, the determination between a sheet pile or slurry wall will be made. An MNA performance monitoring program can be implemented using current sampling technology. The *Coke Point Area Sampling and Analysis Plan* is provided with the CMS that includes regular sampling of select wells in this GAA.

Community Acceptance

This alternative should have community acceptance as it provides protection of human health by preventing and/or limiting exposure to on-site media. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.4.6 Evaluation of GAA C Alternative 3

Alternative 3 involves the construction of a cap, excavation of NAPL impacted soils, and the implementation of MNA, LUCs, and ECs/ICs.

8.4.6.1 Evaluation of Threshold Criteria for GAA C Alternative 3

Protection of Human Health and the Environment

Alternative 3 reduces the potential for release of contaminants to groundwater by removing source material. This excavation of NAPL impacted soils will reduce the leaching of residual contaminants to underlying groundwater, speeding up natural attenuation. Additionally, Alternative 3 provides protection of human health by capping GAA C to prevent exposure of future occupants to contaminated soil and prevent downward surface and storm water infiltration, thereby reducing the leaching of residual contaminants to underlying groundwater and potentially reducing the time needed to reach site wide CAOs. LUCs and ICs protect human health through limiting use of the Site and preventing, and / or limiting exposure to onsite media. Additionally, the development of a HASP for future utility workers or construction workers mitigates exposure risks by providing proper handling procedures for impacted material. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 3 reduces the potential for NAPL or impacted soil to act as a continuing source of contamination to groundwater by removing source material to expedite natural attenuation and by preventing infiltration of stormwater through impacted soil or NAPL through capping. Reduction in vertical migration of contaminants to groundwater may help decrease the time needed to reach sitewide CAOs as it will expedite natural attenuation. The use of MNA would help assess natural reduction in contaminant concentrations over time and assess the need for additional remedial action, if any.

With this alternative, Final RGs are expected to be reached via removing vadose zone soils impacted with NAPL, promoting natural contaminant degradation and plume stability through MNA, and capping the source area. This remedy is expected to reduce contaminant mass in the

vadose zone that is contributing to groundwater impacts, thereby accelerating progress toward achieving Final RGs in groundwater.

Source Control

Alternative 3 includes excavation of vadose zone material which immediately reduces the contaminant mass in the source area and controls releases to groundwater. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils.

8.4.6.2 Evaluation of Balancing Criteria for GAA C Alternative 3

Long-Term Effectiveness

Alternative 3 is expected to be effective in the long term. Risks from residual contamination would be low with the implementation of ICs/LUCs to ensure continued non-residential land use, prohibition of groundwater use, and proper handling of incidentally disturbed soils. Removal of NAPL impacted soils will decrease migration of sheen into the Coal Channel in the long-term. MNA will provide a way to monitor contaminants in groundwater to confirm that natural attenuation is occurring and that groundwater contaminants are not migrating.

Reduction of Toxicity, Mobility, and Volume

Toxicity, mobility, and volume will be reduced by NAPL impacted soil removal. Capping the site will reduce contaminant mobility by reducing stormwater infiltration through the cap and into the unsaturated zone, thereby reducing the potential for vertical migration of vadose zone contaminants into groundwater. Natural attenuation would reduce contaminant volume (contaminant mass) and toxicity.

Short-Term Effectiveness

Alternative 3 provides short-term effectiveness by reducing contaminant mass through excavation of NAPL impacted vadose zone soils, in addition to capping and land use controls. Excavation to the top of groundwater introduces moderate short-term risks, including potential increases in dissolved-phase COC concentrations due to disturbance of source material. However, worker and environmental safety risks can be mitigated through site-specific health and safety plans, appropriate soil management procedures, and PPE. Immediate short-term protection of human health and the environment will be achieved by removing accessible NAPL, preventing exposure through engineered caps, and restricting groundwater use and site access via early implementation of ICs and LUCs. Short-term protection of human health and the environment is expected shortly after cap construction. Continued migration of sheen into the Coal Pier Channel may be observed in the short-term. Effectiveness will be assessed through early monitoring of groundwater and inspections of engineering controls. These actions will help reduce near-term risks and begin to drive COC concentrations toward Final RGs by removing a primary source of contamination.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the excavation of vadose zone source material and installation of wells for MNA monitoring. O&M costs include implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $185,000
- Present Worth of Annual O&M Costs: $137,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $333,000

Implementability

Alternative 3 is considered implementable but may be challenging due to subsurface obstructions previously observed in the western portion of GAA C. Great care will have to be taken when working near the existing bulkhead to ensure no damage. The construction of an MDE-approved cap can be implemented with modern construction practices during the development of the Container Terminal. Remedial excavation can be completed in conjunction with redevelopment activities such as site grading. An MNA performance monitoring program can be implemented using current sampling technology. The *Coke Point Area Sampling and Analysis Plan* is provided with the CMS that includes regular sampling of select wells in this GAA.

Community Acceptance

This alternative should have community acceptance as it is protective of human health via mass reduction. It provides protection of human health by preventing and/or limiting exposure to on-site media. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. This approach has been accepted by the State for similar conditions in the past; however, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.4.7 Comparative Analysis of Remedial Alternatives

This section compares the remedial alternatives to one another against each of the threshold and balancing criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each alternative. The three remedial alternatives compared are:

- Alternative 1: No Action
- Alternative 2: Excavation, Sheet Pile/Slurry Wall Extension, Capping, MNA, ECs/ICs
- Alternative 3: Excavation, Capping, MNA, ECs/ICs

8.4.7.1 Comparative Analysis of Threshold Criteria

Protection of Human Health and the Environment

While Alternative 1 does not provide protection of human health, Alternatives 2 and 3 do in the long-term. Alternatives 2 and 3 provide protection of human health using LUCs and ICs and containment and/or removal of source material, which prevent human exposure to contaminants identified in GAA C. Alternative 2 provides source removal via excavation of NAPL impacted soils and containment of groundwater contaminants and DNAPL via extension of the existing sheet pile wall with sheet pile or slurry wall. Alternative 3 provides some reduction in contaminant mass at the site via removal of NAPL impacted soil, reducing potential for migration of NAPL into the Coal Pier Channel and aiding the reduction of groundwater contaminants via natural attenuation. The combination of source removal and containment presented in Alternative 2 is expected to provide more immediate protection of human health and the environment, as compared to Alternative 3.

Achievement of Media Objectives

Although it is expected that natural attenuation of contaminants in groundwater will occur under Alternative 1, the lack of performance monitoring will preclude the ability to evaluate progress toward achievement of the CAOs or Final RGs. Implementation of Alternatives 2 and 3 would provide the necessary performance data to assess the effect of source containment and/or removal activities on contaminant concentrations in groundwater. Alternative 2 includes both source removal via excavation of NAPL impacted vadose zone soils and containment of impacted soils and DNAPL using a cap and a sheet pile/slurry wall. Containment is expected to reduce further migration of naphthalene and benzo[a]pyrene, two COCs that require the largest reductions to meet Final RGs. By limiting stormwater infiltration and controlling groundwater flow near the Coal Pier Channel, Alternative 2 provides a physical barrier that supports natural attenuation processes to reduce COC concentrations over time. Alternative 3 includes excavation of NAPL impacted vadose zone soils, directly removing highly concentrated sources of COCs. This removal is expected to decrease overall contaminant mass and shorten the timeframe for Final RG attainment. By physically eliminating portions of the source area, Alternatives 2 and 3 are expected to provide

an aggressive reduction in contaminant mass and mobility, potentially expediting progress toward Final RG attainment in groundwater.

Source Control

Alternative 1 provides no form of source control, as no further action will take place. Alternatives 2 and 3 provide source control through excavation of NAPL impacted vadose zone soils and capping of the area which reduces the pathway between the vadose zone and groundwater. Alternative 2 provides additional containment via extension of the existing sheet pile wall with sheet pile or slurry wall between the impacted groundwater at the site and the Coal Pier Channel to the west. Alternative 3 may require a longer time period to stop migration of NAPL into the Coal Pier Channel as additional containment of impacted groundwater is not contemplated.

8.4.7.2 Comparative Analysis of Balancing Criteria

Long-Term Effectiveness

Alternatives 2 and 3 provide long-term effectiveness due to removal of NAPL impacted soils along with capping to further reduce the potential migration of stormwater through any residually impacted soil into underlying groundwater. Alternative 2 provides additional long-term containment of contamination and prevention of exposure to human receptors via extension of the sheet pile wall. With all remedial alternatives in GAA C, the adherence to LUCs and ICs would be particularly crucial as DNAPL would remain within the subsurface. The sheet pile/slurry wall extension in Alternative 2 will provide a barrier to the migration of contaminants in groundwater to surface water. Alternative 3 would require a longer time period before presence of sheen in the Coal Pier Channel is stopped due to potentially remaining NAPL between the extent of excavation and the Coal Pier Channel. Alternative 2 provides the best approach to achieve long-term effectiveness as it permanently removes the source while also providing additional containment via a barrier wall extension that is expected to mitigate the observation of sheen in the Coal Pier Channel in the short-term.

Reduction of Toxicity, Mobility, and Volume

The volume of contaminants in soil will be reduced in Alternatives 2 and 3 via removal of NAPL impacted soil in the vicinity of the No. 10 AST. Toxicity, mobility, and volume of contaminants will be reduced in Alternatives 2 and 3 through natural attenuation, which will be implemented via MNA in each case. Mobility of contaminants from the vadose zone to groundwater will be reduced via capping in Alternatives 2 and 3. Additional reduction of mobility of groundwater contaminants is targeted in Alternative 2 via extension of the existing sheet pile wall with sheet pile or slurry wall.

Short-Term Effectiveness

Alternatives 2 and 3 both provide short-term effectiveness by preventing exposure through capping and applying ICs and LUCs to restrict access and use. Alternative 2 includes sheet pile/slurry wall

containment, which provides early reduction in offsite COC migration, especially toward the Coal Pier Channel, and is expected to achieve short-term protection of human health and the environment relatively quickly. Alternatives 2 and 3 involve excavation of NAPL impacted vadose zone soils, which introduces moderate short-term implementation risks due to disturbance of contaminated material; however, these risks can be mitigated through proper safety protocols and soil handling procedures. Both alternatives are expected to provide short-term protection shortly after cap construction and source control implementation. Through actively reducing contaminant mass and providing containment to reduce contaminant concentrations over time, Alternative 2 is anticipated to accelerate short-term reductions in groundwater contaminant levels and support progress toward Final RG attainment.

Cost

Alternatives 2 and 3 require capital and operational costs. Alternative 3 provides a more cost-effective approach.

Implementability

Serious challenges to implementation of Alternative 2 include the potential to encounter subsurface obstructions in the form of historical infrastructure and solidified slag that may impede the ability to extend the existing sheet pile wall with sheet pile or slurry wall. Excavation of NAPL impacted vadose zone soils in Alternatives 2 and 3 may be combined with site redevelopment activities, however, the depth of excavation required will pose similar subsurface obstruction challenges as installation of the sheet pile/slurry wall extension.

Community Acceptance

Alternatives 2 and 3 should have community acceptance as they are protective of human health via source containment, however, concerns about long term effectiveness may be raised with Alternative 3 since short-term prevention of NAPL migration may not be achieved. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.4.8 Preferred Remedial Alternative

Based on the results of the threshold and balancing analysis, the recommended preferred remedial alternative is GAA C Alternative 2: Excavation, Sheet Pile/Slurry Wall Extension, Capping, MNA, ECs/ICs. The implementation of a sheet pile/slurry wall extension and excavation will be most likely to achieve site wide CAOs in GAA C. The following reasons are presented for the selection of Alternative 2:

- The majority of NAPL within GAA C is composed of No. 6 fuel oil, which is a heavy fuel that is extremely viscous and not recoverable at ambient temperatures. Based on the Conceptual Site Model, the DNAPL in the saturated zone appears to be essentially immobile. Sheen seen in the Coal Pier Channel is likely due to contaminant migration through stormwater infiltration of NAPL impacted soil into the underlying groundwater and seepage to nearby surface water. This can be minimized through the installation of an impermeable and low permeability cap. Future plans for use of GAA C include paved parking areas.
- Excavation of NAPL impacted soils will reduce the leaching of residual contaminants to underlying groundwater providing control of the NAPL source and speeding up natural attenuation.
- Several VOCs are present within the vadose zone of GAA C, which could pose a potential vapor intrusion issue if site redevelopment plans included permanent structures. While the current redevelopment plan includes only a paved parking area with no enclosed structures, this does not eliminate the potential for future exposure should land use change. Therefore, although vapor intrusion is not anticipated under the current redevelopment scenario, any planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.
- The combination of excavating NAPL impacted soils and extending the existing sheet pile wall with sheet pile or slurry wall between GAA C and the Coal Pier Channel will decrease the potential migration of contaminants into nearby surface water bodies in the short term. The excavation footprint would be determined in the Corrective Measures Implementation plan, targeting the No. 10 tank area and focusing on removal of NAPL impacted soils. The sheet pile wall extension would be installed approximately 5-feet into the underlying clay; GAA C impacts have been identified above the clay layer.
- The fine-grained lithology within GAA C limits the mobility of contaminants in groundwater. Groundwater contaminants are expected to attenuate naturally over time and sitewide groundwater monitoring would provide data to confirm that contaminant concentrations are decreasing. MNA would also be used to assess the success of the implemented remedial strategy. Due to the presence of the highly viscous DNAPL in the area, achievement of Final RGs in the short term is challenging and, therefore, this remedy

provides the best approach to protect human health and the environment while natural attenuation addresses Final RGs.

- Implementation of LUCs and ICs in this area and across the site provide protection of human health.
- Alternative 2 provides direct protection for nearby surface water while expeditiously returning land to productive use.

8.4.9 Contingency Remedial Criteria

Alternative 2 will be implemented in GAA C with sampling completed as described in the *Coke Point Area Sampling and Analysis Plan*. The following recommendations from USEPA's *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (April 1999), contingency measures are identified as part of the preferred alternative. Despite the observance of largely decreasing or stable contaminant concentrations in groundwater, specific criteria are established in the event that the expected trends in contaminant concentrations are not observed.

The *Coke Point Area Sampling and Analysis Plan* includes identification of monitoring wells within GAA C that will be regularly sampled to determine the effect of the source removal and control remedies implemented. The data collected from these wells will undergo statistical analysis to identify trends in contaminant concentrations. The statistical methods used to develop trends and subsequent data interpretation and reporting are further discussed in the *Coke Point Area Sampling and Analysis Plan*. The results of the statistical trend analysis will inform the need for additional evaluation. Specifically, the following USEPA identified triggers will be applied to the results of the statistical analysis:

- Statistically significant increasing trends not originally predicted during remedy selection; and
- Contaminants identified in a statistically significant increasing trend at wells where there was previously a decreasing trend or no trend.

If any of the triggers are met, further evaluation will occur, potentially involving more sampling, evaluation of geochemical and biological conditions, reassessment of remediation timelines, or further site investigation to pinpoint the potential new sources causing rising concentrations. Given the current data available for GAA C, a contingency approach will be identified based on this alternative analysis. However, additional field tests and evaluations will be necessary to inform the new contingency alternative.

8.5 Development of Corrective Measures for GAA D

8.5.1 Applicability Evaluation for Identified Process Options

The process for development and evaluation of Corrective Measures Alternatives outlined in **Section 8.1** was implemented for GAA D. Process options were evaluated for applicability with GAA D conditions, as outlined in **Table 39A**. Several technologies were eliminated from further consideration during screening; the technologies were identified as not applicable to GAA D due to the nature of the contaminants or specific conditions at GAA D, as detailed below.

- Multi-Phase Extraction – Multi-phase extraction was eliminated as a treatment option because NAPL removal has previously been performed within the GAA. NAPL encountered at CT-006-SB, CO05DPZM, and CT-007-SB has been removed via skimming and excavation, as documented in the *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024). Nominal NAPL (3/4-inch) was identified in test pit CT-006-TP in December 2023 (*Coke Point Terminal Interim Status Update*, dated January 4, 2024). Additional NAPL recovery would not be significant past what has already been completed.
- Soil Flushing – Soil flushing was eliminated as a treatment option because NAPL removal has previously been performed within the GAA. NAPL encountered at CT-006-SB, CO05DPZM, and CT-007-SB has been removed via skimming and excavation, as documented in the *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024). Nominal NAPL (3/4-inch) was identified in test pit CT-006-TP in December 2023 (*Coke Point Terminal Interim Status Update*, dated January 4, 2024).
- Stabilization/Solidification – Stabilization/solidification was eliminated as a disposal option because NAPL removal has previously been performed within the GAA. NAPL encountered at CT-006-SB, CO05DPZM, and CT-007-SB has been removed via skimming and excavation, as documented in the *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024). Nominal NAPL (3/4-inch) was identified in test pit CT-006-TP in December 2023 (*Coke Point Terminal Interim Status Update*, dated January 4, 2024). Stabilization/solidification is not a practical option for treating small quantities of residual NAPL.
- In-situ Chemical Reduction - ISCR was eliminated as a potential treatment technology since it is not suitable for treating the non-slag related contaminants within GAA D. This process option is typically applied to halogenated VOCs or inorganic compounds.
- Low Temperature thermal treatment / Stripping - Low temperature thermal treatment was eliminated as a potential treatment because it is not appliable to dissolved phase contaminants present at the GAA.
- Electrical Resistance Heating - ERH was eliminated as a potential treatment technology due to the large number of subsurface obstructions that would inhibit the ability to install

electrodes in the spacing required to heat uniformly. Additionally, this technology would have limited effectiveness on PAHs (including naphthalene).

- On-Site or Off-Site Disposal/Landfilling – On-site and off-site disposal/landfill was eliminated as a disposal option because NAPL removal has previously been performed within the GAA. NAPL encountered at CT-006-SB, CO05DPZM, and CT-007-SB has been removed via skimming and excavation, respectively, as documented in the *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024). Nominal NAPL (3/4-inch) was identified in test pit CT-006-TP in December 2023 (*Coke Point Terminal Interim Status Update*, dated January 4, 2024).
- On-Site Disposal (CAMU) - A CAMU was eliminated as a disposal option for excavated material due to the lack of available space.

8.5.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA D

Process options that were not eliminated due to inapplicability were retained for consideration as components of a comprehensive alternative. The summary of the retained process options is included in **Table 39A**. The COCs identified in GAA D include 2-methylnaphthalene, benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, indeno[1,2,3-c,d]pyrene, bis(2-ethylhexyl)phthalate, naphthalene, benzene, ethylbenzene, and xylenes. The majority of COC exceedances in GAA D are observed at CO05B-PZM. All PAH exceedances except for benzo[a]pyrene are observed at this well. Benzo[a]pyrene exceedances are observed at three total wells. Of these three wells, two locations (CO05-PZM006 and CO05C-PZM) exceed the Final RG by less than 0.5 ppb (refer to **Figure 28C**). Similarly, ethylbenzene has exceedances at two well locations and bis(2-ethylhexyl)phthalate has an exceedance at one well location. Xylenes have an exceedance at one well location; however, more recent sampling of this well indicates concentrations below the Final RGs. The maximum concentrations of ethylbenzene, bis(2-ethylhexyl)phthalate, and xylenes slightly exceed their respective Final RGs. Ethylbenzene exceeds its Final RG by 63 ppb, bis(2-ethylhexyl)phthalate meets its Final RG exactly, and xylenes exceed it Final RG by 80 ppb.

Across GAA D, benzene exceeded its Final RG in 3 of 18 wells and had a detection frequency of 48%. Benzene exceedances are observed in three well locations. Naphthalene exceedances are the most widespread in GAA D, with exceedances seen in 5 of 18 wells. The maximum concentration of both benzene and naphthalene is observed in the same well with most of the PAH exceedances, CO05B-PZM (refer to **Figure 28C**). Eleven wells within GAA D do not have any observed exceedances of Final RGs. Due to lateral distribution of COCs and magnitude of reduction needed, remedial options were focused on addressing naphthalene and benzene in this GAA. No single process option or approach will satisfactorily mitigate risk and hazard. Therefore, remedial alternatives were developed by combining potentially applicable technologies and process options with the best potential for achieving CAOs, as shown in **Table 39B**.

The presented alternatives for GAA D include ICs and ECs in combination with the revetment wall proposed as part of the planned wharf development at the Coke Point Container Terminal Area, MNA, impermeable and low permeability capping, ISCO, and bioremediation. The alternatives incorporate corrective action activities that have already been implemented for GAA D, including source removal via NAPL excavation and recovery (skimming). These process options were identified as the best suited technologies based on groundwater assessment area-specific conditions.

- Hot Spot Excavation was previously conducted as an IM in GAA D. Excavation was identified as the best suited technology due to the presence of NAPL impacted soils in the vadose zone. Soils were removed and disposed of as described in *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024).
- Capping was identified as a preferred process option as a significant portion of the GAA will be covered in paving during planned site development within the Coke Point Container Terminal Area. All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete), as described in the *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024).
- Product Recovery (Skimmers) was previously conducted as an IM in GAA D. NAPL encountered at CT-006-SB, CO05DPZM, and CT-007-SB was removed and disposed of as described in *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024). Nominal NAPL (3/4-inch) was identified in test pit CT-006-TP in December 2023 (*Coke Point Terminal Interim Status Update*, dated January 4, 2024). Subsequently, sheen or less than 1-2 inches of NAPL have been observed. Measurable NAPL is removed with absorbent socks.
- MNA was identified as a preferred process option based on the (previous) removal of NAPL sources. MNA will assess the effectiveness of the other proposed remedies and will provide data to confirm that contaminant concentrations in groundwater are continuing to decrease toward Final RGs.
- Bioremediation was identified as a preferred process option based on the redevelopment schedule and geochemical conditions within the wells with contaminant exceedances. Monitoring results indicate depressed oxidation-reduction potential (ORP) in wells where exceedances were observed, indicating the naturally occurring conditions are conducive to anaerobic bioremediation.
- ISCO was identified as a preferred process option based on the redevelopment schedule and sustained elevated pH in the area of the contaminant exceedances. Introduction of an ISCO amendment may be able to utilize the elevated pH conditions for activation.

During this step in the process, several process options were not selected as part of a comprehensive alternative (Corrective Measures Alternative) due to groundwater assessment area-specific conditions, as discussed below.

- Hydraulic containment was not selected as a process option for the GAA because NAPL hot spots previously removed at CT-006-SB, CO05DPZM, and CT-007-SB have resulted in a significant reduction in source mass (*Container Terminal Area B Response and Development Work Plan*, dated October 17, 2024). Exceedances of Final RGs in GAA D are limited in both magnitude and extent, with no exceedances identified at the shoreline. As such, hydraulic containment was not retained for further evaluation, as remaining impacts can be managed using less infrastructure-intensive technologies.
- Sheet piling / slurry wall was not selected as a process option for the GAA due to the current designs for wharf development. These plans consist of a revetment wall in the turning basin consisting of at least 5.9-inch-thick concrete and 6-inches of bedding stone. The maximum thickness is 1.32-feet of concrete and 12-inches of bedding stone.
- Air sparging/soil vapor extraction was not selected as a process option for the GAA as naphthalene is the most widespread COC in this GAA and naphthalene does not readily volatilize. Injection approaches (bioremediation and ISCO) are better suited to address the impacts in this GAA.
- Groundwater Pump and Treat was not selected as a process option for the GAA. The presence of clay and silt in GAA D mean that diffusion of COCs out of the tight matrices of these soil types will take an extensive amount of time increasing the likelihood of rebound after GWPT. Exceedances in GAA D several wells, with no one area identified in which sufficient mass removal could be achieved via GWPT. Additionally, the handling of water may require an additional treatment system onsite, which is exceedingly difficult in the middle of a container terminal.
- Enhanced aerobic bioremediation was not selected as a process option for the GAA because the aquifer in the area of contaminant impacts is naturally reducing. Aerobic bioremediation may be ineffective due to the challenges related to reversing redox conditions from reducing to oxidizing.
- Biosparging was not selected as a process option for the GAA because previous excavation removed NAPL observed in GAA D, leaving only 3–5 wells with benzene and/or naphthalene exceedances. These exceedances are not clustered in one singular area and are sometimes comingled with PAH exceedances. Additionally, redox conditions in the aquifer favor anaerobic bioremediation. Therefore, anaerobic bioremediation was selected as a better suited process to target individual well locations.
- Thermal Conductance Heating was not selected as a process option for the GAA due to planned reuse of the area. Soil temperatures during TCH operation can reach up to levels at which soil desiccation occurs, possibly impacting the structural stability of the area. TCH is typically used to address high concentration source zones. Additionally, subsurface obstructions would inhibit the ability to install heater wells in the spacing required to heat uniformly.
- A PRB was not selected as a process option for the GAA as the natural groundwater gradient in the area is extremely flat, potentially limiting the amount of treatment achieved

via groundwater flow through a PRB. Additionally, the planned redevelopment of this area includes dredging and installation of a revetment wall that will further flatten the groundwater gradient. Installation of a PRB will likely provide no additional treatment due to the limited groundwater flow.

- Permitted Discharge is a process option that would have been utilized in conjunction with GWPT. As noted above, GWPT was not selected due to the timeframe for cleanup as compared to MNA.

The remaining remedial technologies and process options were combined to create a workable number of Corrective Measures Alternatives that provide comprehensive remedies, as discussed in **Section 8.5.3**, below.

8.5.3 Summary of Corrective Measures Alternatives for GAA D

Each of the preferred process options included in **Table 39A** was combined to form Corrective Measures Alternatives for GAA D. The Alternatives for GAA D are described in detail below. As highlighted in **Section 8.2.2**, the stratigraphy and heterogeneity of the native soil deposits pose significant engineering challenges for the implementation of an in-situ and ex-situ treatment technologies and would present difficulty for technologies requiring uniform injections or bulk extraction. Alternatives have been developed and evaluated with these engineering challenges in mind.

8.5.3.1 Alternative 1: No Action

The No Action Alternative is presented in order to define a baseline condition against which other alternatives are compared and typically refers to an absence of efforts to reduce contaminant mass or otherwise treat or contain contamination. The No Action Alternative considers no benefits from future redevelopment of the GAA. In the case of GAA D, source (i.e., NAPL) removal was conducted as part of two interim measures, as discussed in **Section 8.5.1**. Under Alternative 1, no efforts would be employed to reduce potential cross-media transfer of impacts to groundwater, nor would protections be implemented to prevent exposure to impacted groundwater. In addition, no activities would be conducted to evaluate the continuing groundwater trends or the ability of natural attenuation to reach Final RGs.

8.5.3.2 Alternative 2: Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, MNA, Revetment Wall, LUCs, and ECs/ICs

Alternative 2 includes corrective action activities that have already been implemented for GAA D, including source removal via NAPL excavation and recovery (skimming) as discussed in **Section 8.5.2**, above.

In addition, Alternative 2 includes the construction of an impermeable and low permeability pavement surface over significant portion of GAA D, in accordance with the *Container Terminal*

Area B Response and Development Work Plan (dated October 17, 2024). The paved area will have a minimum of four (4) inches of compacted aggregate base and a minimum of four (4) inches of overlying pavement surface (asphalt or concrete). The pavement surface will prevent exposure to contaminated soil/slag and groundwater, reduce potential vertical vapor migration emanating upward, and prevent surface and stormwater from infiltrating through the impacted material. Upon completion of surface paving, the vast majority of the area associated with GAA D will be covered with an engineered barrier subject to ongoing Operation and Maintenance (O&M) requirements.

Alternative 2 also includes MNA, which would serve to reduce the concentration of contaminants in groundwater to the Final RGs via natural processes. This option would involve sampling of selected monitoring well locations to evaluate the behavior of contaminants in groundwater at GAA D, including the overall stability of the plume with respect to migration and the trends in contaminant concentrations over time. The *Coke Point Area Sampling and Analysis Plan* is designed to evaluate the effect of implemented source control measures on groundwater concentrations. The sampling program will be designed to collect adequate data to assess contaminant concentrations and supplement existing data to identify the type(s) of natural attenuation processes active at the site, such that an estimate of the rate at which such processes will reduce contaminant concentrations to required levels can be developed.

In accordance with *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (USEPA, 1999), the monitoring program will specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and is capable of attaining remediation objectives. In addition, the monitoring program will be designed to accomplish the following:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes;
- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume(s) is not expanding (either downgradient, laterally or vertically);
- Verify no unacceptable impact to downgradient receptors;
- Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

The frequency of monitoring will be specified in order to detect, in a timely manner, the potential changes in site conditions. The *Coke Point Area Sampling and Analysis Plan* will be developed to allow flexibility for adjusting the monitoring frequency and analyzed parameters over the life of the remedy.

In Alternative 2, capping will be supplemented by the construction of a revetment wall along the east of GAA D. As part of the planned wharf development at the Coke Point Container Terminal Area, a revetment wall consisting of minimum 5.9-inch-thick concrete and 6-inches of bedding material is proposed to extend into the turning basin. The revetment wall will extend down to the bottom of the turning basin, approximately 50 feet below sea level, as detailed in the *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024).

Alternative 2 will also include the implementation of LUCs and ICs consisting of environmental covenants including land use restrictions (i.e., prohibitions on residential use), groundwater use restrictions (i.e., prohibiting potable and non-potable water use), inspection, operation and maintenance requirements associated with the engineering controls, and site use restrictions addressing intrusive activities with the potential to encounter impacted environmental media. Worker PPE requirements, waste handling and disposal requirements, and construction-specific tasks will be addressed in RADWPs prior to the commencement of work. Future building developments in this GAA will include soil gas sampling as part of a RADWP. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Additional engineering controls will include signage and fencing, as needed, to prohibit unauthorized access to the property and prevent disturbance of the cap once it is in place.

8.5.3.3 Alternative 3: Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, Bioremediation, MNA, Revetment Wall, LUCs, and ECs/ICs

Alternative 3 includes all the components outlined in Alternative 2, plus groundwater treatment through bioremediation. The bioremediation corrective action would include injections of nutrients, pH buffer, and/or other amendments as needed to stimulate biological degradation of the COCs to the Final RGs. These injections would likely occur prior to completion of the Container Terminal construction. Bioremediation would assist in the reduction of contaminant toxicity and volume. However, due to the higher pH levels (9-12) in groundwater in GAA D, treatment may be difficult and likely require the addition of a buffer or buffering agents. Changes in the natural pH of the area includes risk in driving changes in emplaced slag, potentially increasing mobility of slag-related contaminants. Additionally, the presence of low permeability lenses (clay and silt) presents challenges to bioremediation's ability to maintain contact with contaminants to drive destruction and prevent matrix diffusion rebound from the low permeability lenses. A large number of subsurface obstructions would make it difficult to distribute chemicals evenly or on target.

8.5.3.4 Alternative 4: Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, ISCO, MNA, Revetment Wall, LUCs, and ICs/ECs

Alternative 4 includes all of the components outlined in Alternative 2, plus ISCO. ISCO would assist in the reduction of contaminant toxicity and volume. ISCO injections may be performed via an oxidant to take advantage of the elevated pH in the areas of the contaminant plumes. The injections targeting the contaminant plumes would likely occur prior to completion of the Container Terminal construction. Additionally, the presence of low permeability lenses (clay and silt) presents challenges to ISCO's ability to maintain contact with contaminants to drive destruction and prevent matrix diffusion rebound from the low permeability lenses.

Due to the potential changes in pH during remediation, ISCO may drive changes in emplaced slag potentially mobilizing or increasing concentrations of slag related contaminants. A large number of subsurface obstructions would make it difficult to distribute chemicals evenly or on target.

8.5.4 Evaluation of GAA D Alternative 1

Alternative 1 involves maintaining the current conditions and taking no additional corrective measures or interventions. The No Action alternative does not meet any threshold criteria and, therefore, is not evaluated against the balancing criteria.

8.5.4.1 Evaluation of Threshold Criteria for GAA D Alternative 1

Protection of Human Health and the Environment

The No Action Alternative would not be protective of human health and the environment. Under a No action Alternative, no effort would be made to control exposures to impacted groundwater through the implementation of ECs/ICs. In addition, there would be no additional protective systems preventing or mitigating vapor intrusion. Unacceptable exposure to impacted groundwater is possible under the No Action Alternative.

Achievement of Media Objectives

Because source removal and source control measures have been implemented at GAA D, it is anticipated that concentrations of contaminants in groundwater will decrease through natural attenuation processes. However, without monitoring, it will not be possible to confirm progress toward the achievement of Final RGs or to make a determination that natural attenuation will result in the achievement of CAOs.

Source Control

No actions would be implemented to further control potential sources to groundwater. However, no additional source control options appear to be necessary based on data available at this time.

8.5.5 Evaluation of GAA D Alternative 2

Alternative 2 involves corrective action activities already implemented for GAA D, such as hot spot excavation and NAPL product recovery, along with the construction of an impermeable and low permeability pavement surface, the construction of a revetment wall, and the implementation of MNA, LUCs, and ECs/ICs.

8.5.5.1 Evaluation of Threshold Criteria for GAA D Alternative 2

Protection of Human Health and the Environment

Alternative 2 provides protection of human health through previous NAPL removal via product skimming and excavation, and future capping/surface paving of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Capping (via surface paving) helps to prevent downward surface and storm water infiltration, reducing infiltration and minimizing migration of dissolved phase contamination. A cap also provides a barrier to prevent exposure to contaminated soil. Furthermore, the installation of the revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) during wharf development will minimize groundwater flux to surface water, providing an additional layer of protection. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. LUCs and ICs protect human health through limiting use of the Site and preventing, and / or limiting exposure to onsite media. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 2 reduces the potential for releases of contaminants to groundwater by capping a significant portion of the area to reduce infiltration and contaminant mobility and leachability. This alternative includes previous removal of NAPL via excavation and skimming, thereby reducing the mass of contaminants present and the potential for leaching into groundwater and facilitating the natural attenuation of the residual contaminants in groundwater and decrease the time needed to reach site wide CAOs. The use of MNA would help assess natural reduction in contaminant concentrations over time and assess the need for additional remedial action. With this alternative, Final RGs are expected to be reached via prior removal of vadose zone soils impacted with NAPL, promoting natural contaminant degradation and plume stability through MNA, and isolating the source area through engineered capping and revetment wall construction. This remedy is expected to reduce contaminant mass and limit further migration of benzene and naphthalene to groundwater, thereby supporting long-term progress toward achieving Final RGs.

Source Control

Alternative 2 includes previously completed NAPL removal via product skimming and excavation which controls releases to groundwater. Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping via a pavement surface reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. The capping of a significant portion of GAA D will occur based on the work described in the RADWP. A revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) will also provide additional control of groundwater discharge to surface water.

8.5.5.2 Evaluation of Balancing Criteria for GAA D Alternative 2

Long-Term Effectiveness

Alternative 2 would provide long-term effectiveness through previously implemented source removal (at test pit CT-006-TP) and future capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. MNA will reduce the concentrations of contaminants in groundwater. Risks to human receptors from residual contamination would be managed during the attenuation period through properly administered, monitored, and maintained LUCs (including ICs and ECs). The installation of a revetment wall during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark. There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Reduction of Toxicity, Mobility, and Volume

Reduction of toxicity and volume will occur through previously implemented source zone removal by excavation and product skimming. Capping will reduce contaminant mobility by reducing storm and surface water infiltration through the cap and into the unsaturated zone. Natural attenuation would reduce concentrations and toxicity, volume (contaminant mass), and mobility of the non-slag related contaminants in groundwater. Reduction of volume of groundwater contaminants intercepting surface water will be achieved via dredging for installation of the revetment wall during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Short-Term Effectiveness

Alternative 2 provides short-term effectiveness by isolating impacted media through construction of an engineered cap and revetment wall, which will immediately limit exposure pathways by preventing contact with contaminated soil, reducing vertical vapor migration, and minimizing stormwater infiltration that could mobilize contaminants in groundwater. Previous removal of NAPL through excavation and recovery further reduces the potential for ongoing contaminant migration, particularly in areas with historical source material. Implementation of LUCs and ICs will reduce exposure risks by restricting groundwater use and intrusive activities. The short-term effectiveness of the remedy will be evaluated through routine inspections of engineering controls and early groundwater monitoring to confirm that the cap, revetment wall, and institutional controls are functioning as intended. By stabilizing conditions and preventing further releases, these actions will support early protection of human health and the environment while advancing long-term progress toward achieving Final RGs.

Cost

Costs associated with installation and management of the capping system, revetment wall, and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of installation of wells for MNA monitoring. O&M costs include implementation of the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $16,000
- Present Worth of Annual O&M Costs: $128,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $155,000

Implementability

Alternative 2 is considered implementable. An MNA performance monitoring program can be implemented using current sampling technology. The *Coke Point Area Sampling and Analysis Plan* is provided with the CMS that includes regular sampling of select wells in this GAA. ECs (i.e., capping and vapor mitigation systems) will be implemented during and after planned development.

Community Acceptance

This alternative should have community acceptance as it provides protection of human health by preventing, and/or limiting exposure to on-site media. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.5.6 Evaluation of GAA D Alternative 3

Alternative 3 involves corrective action activities already implemented for GAA D, such as hot spot excavation and NAPL product recovery, along with the construction of an impermeable and low permeability pavement surface, the construction of a revetment wall, groundwater treatment through bioremediation, and the implementation of MNA, LUCs, and ECs/ICs.

8.5.6.1 Evaluation of Threshold Criteria for GAA D Alternative 3

Protection of Human Health and the Environment

Alternative 3 reduces the potential for releases of contaminants to groundwater by removing source material and capping select areas to reduce infiltration and contaminant mobility and leachability. Alternative 3 provides protection of human health through previous NAPL removal via product skimming and excavation, and future capping/surface paving of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Additionally, bioremediation remove contaminant mass of VOCs and SVOCs, thereby reducing the potential for human exposure. The use of MNA would help assess natural reduction in contaminant concentrations over time. This alternative may reduce the timeframe needed to achieve media objectives, thereby reducing the potential for human exposure overall. Capping (via surface paving) helps to prevent downward surface and storm water infiltration, therefore reducing infiltration and minimizing migration of dissolved phase contamination. A cap also provides a barrier to prevent exposure to contaminated soil. Furthermore, the installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) during wharf development will minimize groundwater flux to surface water, providing an additional layer of protection. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. LUCs and ICs protect human health through limiting use of the Site and preventing, and / or

limiting exposure to onsite media. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 3 reduces the potential for releases of contaminants to groundwater by removing source material and capping select areas to reduce infiltration and contaminant mobility and leachability. This alternative includes previously implemented NAPL removal, reducing the mass of contaminants present and the potential for leaching into groundwater potentially helping decrease the time needed to reach site wide CAOs. Additionally, bioremediation activities would increase the rate of natural attenuation of contaminants in groundwater via destruction and the use of MNA would help assess natural reduction in contaminant concentrations over time. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater. With this alternative, Final RGs are expected to be reached via source control achieved through prior NAPL removal and excavation, plume stability and natural degradation through MNA, enhanced contaminant mass reduction through bioremediation, and isolating the contaminated groundwater through engineered capping and revetment wall construction. This remedy is expected to reduce contaminant mass, thereby supporting long-term progress toward achieving Final RGs.

Source Control

Alternative 3 includes source removal which controls releases to groundwater (previously completed via NAPL excavation and skimming). Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping via a pavement surface reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. The capping of a significant portion of GAA D will occur based on the work described in the RADWP. A revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) will also provide additional control of groundwater discharge to surface water.

8.5.6.2 Evaluation of Balancing Criteria for GAA D Alternative 3

Long-Term Effectiveness

Alternative 3 would provide long-term effectiveness through previously implemented source removal (at test pit CT-006-TP) and future capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. Source removal via product skimming and excavation (already completed at test pit CT-006-TP) provides long term protection. Risks from residual contamination would be low if ICs/LUCs are properly administered to ensure continued non-residential land use. MNA will reduce the concentrations of contaminants in groundwater. Risks to human receptors from residual contamination would be managed during the attenuation period through properly administered, monitored, and maintained LUCs (including ICs

and ECs). The installation of a revetment wall during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark. There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. Active remediation of VOCs and SVOCs impacts via bioremediation will increase the rate of destruction of contaminants. Bioremediation would likely require multiple injections to achieve and maintain a bioactive area in which COCs will be reduced to Final RGs.

Reduction of Toxicity, Mobility, and Volume

Reduction of toxicity and volume will occur through previously implemented source zone removal by excavation and product skimming. Reduction of mobility will be achieved via future capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in toxicity and volume will be achieved via degradation of contaminants with application of bioremediation and then further by natural attenuation. Reduction of groundwater contamination will be documented and analyzed via MNA. Reduction of volume of groundwater contaminants intercepting surface water will be achieved via dredging for installation of the revetment wall during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Short-Term Effectiveness

Alternative 3 provides short-term effectiveness by isolating impacted media through construction of an engineered cap and revetment wall, which will immediately limit potential exposure by preventing contact with contaminated soil, reducing vertical vapor migration, and minimizing stormwater infiltration. Source control already achieved through NAPL recovery and excavation further reduces the potential for ongoing contaminant migration. Implementation of LUCs and ICs will reduce exposure risks by limiting intrusive activities and groundwater use. Although bioremediation may enhance long-term contaminant reduction by promoting anaerobic degradation of COCs such as benzene and naphthalene, its short-term contribution is limited due to the time it takes to achieve a bioactive treatment area. The short-term effectiveness of this remedy will be assessed through inspections of engineering controls and early groundwater monitoring to confirm performance. Together, these actions help stabilize site conditions and support the trajectory toward meeting Final RGs over time.

Cost

Costs associated with installation and management of the capping system, revetment wall, and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of bioremediation injection wells and monitoring wells. O&M costs include implementation of semi-annual bioremediation injections for 1 year and the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $125,000
- Present Worth of Annual O&M Costs: $389,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $525,000

Implementability

This alternative is considered challenging to implement. The bioremediation portion of this alternative may be challenging to implement if it occurs after completion of surface paving. Bioremediation would take place via injections on a regular basis to address the VOCs and SVOCs. Introduction of pH buffer would likely be required and may impact effectiveness as elevated pH is a major challenge. A pilot test would be required.

Community Acceptance

This alternative should have community acceptance as it provides protection of human health by preventing, and/or limiting exposure to on-site media. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.5.7 Evaluation of GAA D Alternative 4

Alternative 4 involves corrective action activities already implemented for GAA D, such as hot spot excavation and NAPL product recovery, along with the construction of an impermeable and low permeability pavement surface, the construction of a revetment wall, ISCO injections, and the implementation of MNA, LUCs, and ECs/ICs.

8.5.7.1 Evaluation of Threshold Criteria for GAA D Alternative 4

Protection of Human Health and the Environment

Alternative 4 reduces the potential for releases of contaminants to groundwater by removing source material and capping select areas to reduce infiltration and contaminant mobility and leachability. Alternative 4 provides protection of human health through previous NAPL removal via product skimming and excavation, and future capping/surface paving of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Additionally, ISCO activities will prevent human exposure to contaminants in groundwater through mass reduction (long term) via destruction using ISCO. Furthermore, the installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) during wharf development will minimize groundwater flux to surface water, providing an additional layer of protection. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. The use of MNA would help assess natural reduction in contaminant concentrations over time. This alternative may reduce the timeframe needed to achieve media objectives, thereby reducing the potential for human exposure overall. In addition, this alternative would prevent human exposure to groundwater through LUCs and construction of a pavement surface during site development activities.

Achievement of Media Objectives

Alternative 4 reduces the potential for releases of contaminants to groundwater by removing source material and capping select areas to reduce infiltration and contaminant mobility and leachability. This alternative includes previously implemented NAPL removal, reducing the mass of contaminants present and the potential for leaching into groundwater potentially helping decrease the time needed to reach site wide CAOs. Active ISCO injections may decrease concentrations of contaminants in groundwater via destruction and the use of MNA would help assess natural reduction in contaminant concentrations over time. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater. With this alternative, Final RGs are expected to be reached via source control achieved through prior previous NAPL removal and excavation, plume stability and natural degradation through MNA, active contaminant destruction via ISCO, and isolating impacted groundwater through engineered capping and revetment wall construction. This remedy is expected to reduce contaminant mass and limit further migration of benzene and naphthalene to groundwater, thereby supporting long-term progress toward achieving Final RGs.

Source Control

Alternative 4 includes source removal which controls releases to groundwater (previously completed via NAPL excavation and skimming). Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping via a pavement surface reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. The capping of a significant portion of GAA D will occur based on the work described in the RADWP. A revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) will also provide additional control of groundwater discharge to surface water. ISCO may address VOCs and SVOCs groundwater impacts.

8.5.7.2 Evaluation of Balancing Criteria for GAA D Alternative 4

Long-Term Effectiveness

Alternative 4 is expected to be effective in the long term. Risks from residual contamination would be low if ICs/LUCs are properly administered to ensure continued non-residential land use. Source removal via product skimming and excavation (already completed at test pit CT-006-TP) provides long term protection. The continued maintenance of the capped areas (i.e. pavement surface) ensures a maintained reduction in vadose zone soil to groundwater pathway. Active remediation of the contaminant plumes via ISCO will increase the rate of destruction of contaminants. However, the effectiveness of ISCO injections may be hindered due to the complex geology in the area of the contaminant exceedances. Lenses consisting of clay, slag, silt, and sand will make ISCO less effective in the long term. ISCO injections would likely require quarterly injections for many years to reach Final RGs. The installation of a revetment wall during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, current offshore impacts will be removed by dredging and the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark. There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. A groundwater sampling program will be implemented to assess the long-term effectiveness.

Reduction of Toxicity, Mobility, and Volume

Toxicity, mobility, and volume have been reduced by NAPL impacted soil removal. Capping will also reduce infiltration and, therefore, reduce mobility of impacted groundwater. ISCO should increase the rate of reduction in groundwater concentrations, leading to further reductions in toxicity, mobility, and volume. Reduction of volume of groundwater contaminants intercepting surface water will be achieved via dredging for installation of the revetment wall during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There

were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Short-Term Effectiveness

Alternative 4 provides short-term effectiveness by isolating impacted media through construction of an engineered cap and revetment wall, which will immediately reduce exposure pathways by preventing contact with contaminated soil and limiting stormwater infiltration into impacted areas. Source control previously achieved through NAPL removal and targeted excavation further limits contaminant mobility and potential for groundwater impact. LUCs and ICs will reduce short-term exposure potential by restricting groundwater use and intrusive activities. ISCO will contribute to long-term contaminant mass reduction by chemically oxidizing COCs; however, its short-term benefits may be constrained by matrix diffusion from low permeability lenses. Early groundwater monitoring and inspections of engineering controls will be used to confirm remedy performance. These measures provide immediate protection and establish conditions necessary to support progress toward achieving Final RGs.

Cost

Costs associated with installation and management of the capping system, revetment wall, and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of ISCO injection wells and monitoring wells. O&M costs include implementation of semi-annual ISCO injections for 1 year and the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $125,000
- Present Worth of Annual O&M Costs: $538,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $674,000

Implementability

This alternative is considered challenging to implement if it occurs after the completion of surface paving. ISCO would take place via injections on a regular basis to address the contaminant plumes. Low permeable zones within the local geology may be addressed via low-volume continuous amendment injection systems. The average soil oxidant demand (SOD) was measured at other areas on Coke Point and observed at 5.5 g/kg soil, with a range of 0.6-15 g/kg soil so ISCO may require a large quantity of oxidant to overcome the matrix demand. Due to the naturally high pH observed at many wells within this GAA, an oxidant would be utilized that has the best chances of success.

Community Acceptance

This alternative should have community acceptance as it is protective of human health via mass reduction. However, injection of oxidant may be less appealing to the community due to its reactive nature. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. This approach has been accepted by the State for similar conditions in the past; however, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.5.8 Comparative Analysis of Remedial Alternatives

This section compares the remedial alternatives to one another against each of the threshold and balancing criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each alternative. The four remedial alternatives compared are:

- Alternative 1: No Action
- Alternative 2: Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, MNA, Revetment Wall, LUCs, and ECs/ICs
- Alternative 3: Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, Bioremediation, MNA, Revetment Wall, LUCs, and ECs/ICs
- Alternative 4: Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, ISCO, MNA, Revetment Wall, LUCs, and ICs/ECs

8.5.8.1 Comparative Analysis of Threshold Criteria

Protection of Human Health and the Environment

While Alternative 1 does not provide protection of human health, Alternatives 2, 3, and 4 do. Alternatives 2, 3, and 4 provide protection of human health using LUCs and ICs, which prevent human exposure to contaminants identified in GAA D. Alternatives 2, 3, and 4 also provide protection of human health and the environment via completed source material removals, surface capping, planned removal of impacted sediment and pore water, and the proposed revetment wall. Alternative 2 relies on natural attenuation of contaminants in groundwater, while reducing and eliminating ways in which humans and the environment may be exposed to contaminants during the attenuation period. Alternative 3 aims at shortening the timeframe to reach Final RGs through

the implementation of bioremediation. Alternative 4 also aims at shortening the timeframe to achieve Final RGs; however, this alternative requires transportation and handling of oxidants which may increase risk to human health. Protection of human health and the environment via ICs, ECs, capping, and MNA will likely be sufficient.

Achievement of Media Objectives

Although it is expected that natural attenuation of contaminants in groundwater will occur under Alternative 1, the lack of performance monitoring will preclude the ability to evaluate progress toward achievement of the CAOs and Final RGs. Implementation of Alternatives 2, 3, and 4 would provide the data needed to evaluate the effect of the source removal and containment activities conducted at GAA D and confirm that natural attenuation is effectively reducing groundwater contaminant concentrations. These alternatives include engineered controls such as capping and a revetment wall, which will limit stormwater infiltration and reduce the potential for migration of impacted groundwater, supporting progress toward achieving Final RGs. Alternatives 3 and 4, which involve direct destruction of groundwater contaminants through active remediation (bioremediation or ISCO), may offer the potential for faster contaminant reduction, particularly for benzene and naphthalene. However, both technologies are expected to face challenges due to groundwater geochemistry and local variations in geology. The areas affected by contaminants contain lenses of sand, slag, clay, and silt, which may inhibit uniform treatment. Additionally, the naturally high pH observed in many wells in GAA D poses implementation challenges for bioremediation. While Alternatives 3 and 4 may reduce the time needed to meet Final RGs, as no receptors are impacted in this area, Alternative 2 presents the most reliable and implementable approach for achieving Final RGs through a combination of previous source control and natural attenuation.

Source Control

All of the alternatives provide a form of source control through the previously implemented removal of NAPL, via excavation and product skimming. Removal of existing offshore impacts and future capping that will be implemented during site development activities would provide additional source removal and control under Alternatives 2, 3, and 4 only. Under Alternatives 2, 3, and 4, installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) would further limit groundwater discharge to surface water, enhancing source control along the shoreline.

8.5.8.2 Comparative Analysis of Balancing Criteria

Long-Term Effectiveness

Alternatives 2, 3, and 4 provide the highest levels of long-term effectiveness due to previous removal of NAPL via excavation and product skimming, a future revetment wall, and future surface paving/capping. The local geology, characterized by lenses of low permeability zones, may pose challenges to the long-term effectiveness of Alternatives 3 and 4. The challenges of treating

low permeability zones within an aquifer may require significant engineering efforts that may not be successful. Implementation of an in-situ remedy, such as bioremediation or ISCO, includes a low risk of migration of contaminants at a faster rate. Additionally, attempts to adjust the natural pH or geochemistry of the area using Alternative 3 and 4 may drive changes to emplaced slag, resulting in potentially higher concentrations of slag related contaminants.

Reduction of Toxicity, Mobility, and Volume

All of the alternatives consider removal of NAPL mass through the previously implemented excavation and product skimming. Toxicity, mobility, and volume of contaminants will be reduced through Alternatives 2, 3, and 4. Capping to reduce mobility of the contaminants from the vadose zone to groundwater is considered under Alternatives 2, 3, and 4. Reduction of volume of groundwater contaminants intercepting surface water will occur via installation of the revetment wall during wharf redevelopment. Alternatives 3 and 4 include active injection of amendment to drive destruction (volume reduction) of contaminants. Injection of material within a plume may increase the mobility of the non-slag and slag related contaminants. Additionally, Alternatives 3 and 4 include biological and chemical changes driven within the subsurface that may influence the mobility and concentration (toxicity) of the slag related contaminants in this GAA.

Short-Term Effectiveness

Alternatives 2, 3, and 4 provide immediate short-term effectiveness through construction of an engineered cap and revetment wall, which reduce potential exposure pathways by limiting contact with impacted soil and reducing stormwater infiltration that could mobilize contaminants. Implementation of LUCs and ICs under each alternative will further limit short-term exposure by restricting groundwater use and intrusive activities. While Alternatives 3 and 4 include active groundwater treatment technologies (bioremediation and ISCO), these approaches require additional time to become effective and face challenges due to site redevelopment, site-specific conditions such as elevated groundwater pH, subsurface heterogeneity, and low-permeability lenses. Because there are no receptors impacted in this area and residual groundwater impacts are of limited extent and magnitude, there is no need to expedite Final RG attainment through active groundwater treatment. All alternatives similarly contribute to short-term protection through physical controls. These measures collectively stabilize site conditions and support long-term progress toward achieving Final RGs.

Cost

Alternative 2 provides the most cost-effective option to reach the CAOs. Alternatives 3 and 4 require additional capital costs, making these options the least cost-effective.

Implementability

Alternative 2 is the most implementable and is considered implementable with all process options implemented during and after planned development. Alternatives 3 and 4 present significant implementation uncertainties and would require treatability studies and / or pilot scale installations

to establish feasibility in the low permeability lenses. Alternatives 3 and 4 may be challenging to implement in concert with the planned redevelopment and reuse of the GAA. Bioremediation and ISCO would likely take place via injections prior to completion of the Container Terminal construction.

Community Acceptance

Alternatives 2, 3, and 4 should have community acceptance, Alternative 4 may be less acceptable due to the transportation and use of oxidant. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.5.9 Preferred Remedial Alternative

Based on the results of the threshold and balancing analysis, Alternative 2: Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, MNA, Revetment Wall, and ECs/ICs is recommended as the preferred remedial alternative to achieve CAOs in GAA D. The following reasons are presented for the selection of Alternative 2:

- Removal of NAPL via excavation and product skimming has been completed at CT-006-TP, CO05DPZM, and CT-007-TP. Minimal NAPL has been identified as remaining in this assessment area, suggesting that additional source removal is not necessary.
- Dredging will remove existing shoreline impacts. Installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) along the eastern shoreline during wharf development will occur based on the work described in the Container Terminal RADWP and will provide protection of off-site receptors.
- The capping of a significant portion of GAA D will occur based on the work described in the Container Terminal RADWP. Additionally, the cap will prevent exposure to onsite receptors. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.
- MNA under Alternative 2 will provide the necessary data to confirm groundwater concentrations remain stable to decreasing with eventual statistical support indicating contaminant concentration trends are moving toward Final RGs. The MNA program will

be developed and designed to detect potential changes in plume stability (extent and concentration) and corresponding receptor risk.

- Implementation of LUCs and ICs in this area and across the site provide protection of human health.
- Alternative 2 is the most implementable and cost-effective approach of the alternatives. Alternatives 3 and 4 pose significant implementability challenges that introduce uncertainty about effectiveness.
- Alternative 2 provides protection of human health and the environment while best facilitating redevelopment and reuse of the GAA.

8.5.10 Contingency Remedial Criteria

Alternative 2 will be implemented in GAA D with sampling completed as described in the *Coke Point Area Sampling and Analysis Plan*. The following recommendations from USEPA's *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (April 1999), contingency measures are identified as part of the preferred alternative. Despite the observance of largely decreasing or stable contaminant concentrations in groundwater, specific criteria are established in the event that the expected trends in contaminant concentrations are not observed.

The *Coke Point Area Sampling and Analysis Plan* includes identification of monitoring wells within GAA D that will be regularly sampled to determine the effect of the source removal and control remedies implemented. The data collected from these wells will undergo statistical analysis to identify trends in contaminant concentrations. The statistical methods used to develop trends and subsequent data interpretation and reporting are further discussed in the *Coke Point Area Sampling and Analysis Plan*. The results of the statistical trend analysis will inform the need for additional evaluation. Specifically, the following USEPA identified triggers will be applied to the results of the statistical analysis:

- Statistically significant increasing trends not originally predicted during remedy selection; and
- Contaminants identified in a statistically significant increasing trend at wells where there was previously a decreasing trend or no trend.

If any of the triggers are met, further evaluation will occur, potentially involving more sampling, evaluation of geochemical and biological conditions, reassessment of remediation timelines, or further site investigation to pinpoint the potential new sources causing rising concentrations. Given the current data available for GAA D, a contingency approach will be identified based on this alternative analysis. However, additional field tests and evaluations will be necessary to inform the new contingency alternative.

8.6 Development of Corrective Measures for GAA E

8.6.1 Applicability Evaluation for Identified Process Options

The process for development and evaluation of Corrective Measures Alternatives outlined in **Section 8.1** was implemented for GAA E. Process options were evaluated for applicability with GAA E conditions, as outlined in **Table 40A**. Several technologies were eliminated from further consideration during screening; the technologies were identified as not applicable to GAA E due to the nature of the contaminants or specific conditions at GAA E, as detailed below.

- Soil Flushing – Soil flushing was eliminated as a disposal option because the majority of DNAPL encountered at Cell 4 has previously been excavated within the GAA. Excavation of approximately 18,165 tons of DNAPL impacted material was performed in 2023 as an IM (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]). Additional DNAPL recovery would not provide sufficient benefit past what has already been completed.
- Stabilization/Solidification – Stabilization/solidification was eliminated as a disposal option because the majority of DNAPL encountered at Cell 4 has previously been removed within the GAA. Excavation of approximately 18,165 tons of DNAPL impacted material was performed in 2023 as an Interim Measure (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]). Only minor DNAPL remains after excavation and would not justify stabilization/solidification in situ. This technology is not well suited for small residual thicknesses of DNAPL overlain by a large volume of unimpacted overburden, as it would require extensive mixing and treatment of otherwise clean material.
- In-situ Chemical Reduction - ISCR was eliminated as a potential treatment technology since it is not suitable for treating the non-slag related contaminants within GAA E. ISCR is most applicable for CVOCs, PCBs, and Chromium VI.
- Low Temperature thermal treatment / Stripping - Low temperature thermal treatment was eliminated as a potential treatment technology because it is not applicable to the dissolved phase contaminants within GAA E.
- Electrical Resistance Heating – ERH was eliminated as a potential treatment technology due to subsurface obstructions that would inhibit the ability to install electrodes in the spacing required to heat uniformly. Additionally, due to temperature limitations, technology would have limited effectiveness on BTEX/naphthalene and no effectiveness on PAHs.
- On-Site Disposal (CAMU) - A CAMU was eliminated as a disposal option for excavated material due to the lack of available space.

8.6.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA E

Process options that were not eliminated due to inapplicability were retained for consideration as components of a comprehensive alternative. The summary of the retained process options is included in **Table 40A**. The COCs that exceed Final RGs in GAA E are benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzene, naphthalene, and bis(2-ethylhexyl)phthalate. There are no shoreline exceedances of Final RGs in GAA E. Occurrences of benz[a]anthracene, benzo[a]pyrene, and benzo[b]fluoranthene are limited to CO24-PZM007 with concentrations less than 4.0 µg/l. Bis(2-ethylhexyl)phthalate exceedances are limited to two wells and a maximum concentration of 2.4 µg/l (refer to **Figure 29D**). Additionally, detection frequencies of these four COCs are all below 10% (refer to **Table 32C**).

Naphthalene and benzene exceedances of Final RGs are primarily focused within the Cell 4/Cell 5 area. All of the benzene exceedances (based on the most recent sampling event) are less than one order of magnitude above Final RGs. Benzene has an exceedance frequency of 49% (refer to **Table 32C**). Maximum naphthalene concentrations are observed at CO25-PZM008 and CO61-PZM007, both downgradient of the Cell 4 source area in locations where concentrations are expected to decrease over time due to the excavation activities (refer to **Figure 29D**). All other locations with naphthalene exceedances within GAA E require one order of magnitude reduction in concentration to meet the Final RGs. Therefore, due to lateral distribution and magnitude of reduction needed, remedial options were focused on addressing naphthalene and benzene in this GAA. No single process option or approach will satisfactorily mitigate risk and hazard. Therefore, remedial alternatives were developed by combining potentially applicable technologies and process options with the best potential for achieving CAOs, as shown in **Table 40B**.

The presented alternatives for GAA E include ICs and ECs, MNA, construction of a revetment wall, impermeable and low permeability capping, ISCO, and bioremediation. These process options were identified as the best suited technologies based on groundwater assessment area-specific conditions.

- MNA was identified as a preferred process option based on the (previous) removal of DNAPL source, results of the trend analysis presented in **Appendix G,** and geochemical data collected from the Cell 4 area. MNA will assess the effectiveness of the other proposed remedies and will provide data to confirm that contaminant concentrations in groundwater are continuing to decrease toward Final RGs.
- Hot Spot Excavation was previously conducted as an IM in GAA E. Excavation was identified as the best suited technology due to the presence of DNAPL impacted soils in the vadose zone. Approximately 18,165 tons of soils were removed and disposed of between January and June 2023 as described in *2023 Coke Oven Area Annual Interim Measures Report* (ARM, March 4, 2024).
- Capping was identified as a preferred process option as a significant portion of the GAA will be covered in paving during planned site development within the Coke Point Container

Terminal Area. All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete), as described in the *Container Terminal Area B Response and Development Work Plan* (dated October 17, 2024). Additionally, development of the wharf will include the construction of a revetment wall in the turning basin made up of at least 5.9-inches of concrete and 6-inches of bedding stone.

- Bioremediation was identified as a preferred process option based on geochemical conditions within the impacted area. Both naphthalene and benzene are readily treated via bioremediation; however, PAHs are typically more difficult to address using bioremediation. Additionally, geochemical data indicate depressed ORP and available sulfate, potentially indicating the naturally occurring conditions are conducive to anaerobic bioremediation.
- ISCO was identified as a preferred process option based on the sustained elevated pH in the area of the contaminant exceedances and its ability to achieve significant reductions in concentrations over short periods of time. Introduction of an ISCO amendment may be able to utilize the elevated pH conditions for activation.

During this step in the process, several process options were not selected as part of a comprehensive alternative (Corrective Measures Alternative) due to GAA E specific conditions, as discussed below.

- Hydraulic containment was not selected as a process option for GAA E due to several factors. Excavation of DNAPL impacted material was conducted in 2023 in Cell 4; concentrations of BEX and naphthalene have statistically significant downward trends at wells surrounding Cell 4. These trends are in locations both upgradient, downgradient, and cross-gradient to Cell 5, indicating these trends are representative of the broader GAA, with further reductions expected with long-term monitoring (refer to **Appendix G** for trend details).
- Air sparging/soil vapor extraction was not selected as a process option for GAA E as naphthalene is the most widespread COC in this GAA and naphthalene does not readily volatilize. Injection approaches (bioremediation and ISCO) are better suited to address the impacts in this GAA.
- Multi-Phase Extraction (including Dual-Phase Extraction) is currently being implemented as an IM in GAA E. The Cell 5 system, as described in the *2023 Coke Oven Area Annual Interim Measures Report* (ARM, March 2024), has recovered approximately 2,404 pounds of hydrocarbon mass since beginning operation in early 2015. The system is slated to be removed, pending approval of this document. Wells across the broader GAA indicate downward trends for naphthalene and BEX (refer to **Appendix G**). This system was originally designed to intercept material before migration to the shoreline. The source was removed previously via the excavation completed at Cell 4 that included sampling of groundwater from the excavation area with results from August 2023 showing both

naphthalene and benzene below Final RGs (*Cell 4 DNAPL Excavation Report* dated January 31, 2024); therefore, the location of this system has limited mass removal potential. Additionally, the construction of the cap and revetment wall will further flatten the hydraulic gradient across this system, reducing again the amount of contaminant mass moving toward, and hence the mass recovery by, the system. The concrete cap of the revetment wall will further restrict contaminant flux towards surface water. This system is not necessary to mitigate onsite or offsite risks.

- Product Recovery (Skimmers) was previously conducted as an IM in GAA E. DNAPL recovery was performed via EFR and skimming pumps in the area of Cell 4 both prior to and during excavation activities. DNAPL removal and recovery is discussed in the *2023 Coke Oven Area Annual Interim Measures Report* (ARM, March 2024).
- Groundwater Pump and Treat was not selected as a process option for GAA E. A dual-phase extraction system is currently in operation at Cell 5, however, excavation in Cell 4 has previously removed the source and post excavation groundwater sampling indicated concentrations below the Final RGs for both benzene and naphthalene within the excavation area (*Cell 4 DNAPL Excavation Report* dated January 31, 2024). Post excavation, the naphthalene plume is not centralized with no remaining source; therefore, there is no location to place a GWPT system effective at removing sufficient mass and protecting downgradient receptors within GAA E. As trends indicate, concentrations of contaminants continue to decrease toward Final RGs including at shoreline wells for BEX and naphthalene (refer to **Appendix G**). Additionally, onsite and offsite receptors will be protected through the construction of the revetment wall and engineered cap to be completed during development.
- Enhanced aerobic bioremediation was not selected as a process option for GAA E due to the naturally reducing conditions of the aquifer in the area of contaminant impacts. Flipping redox conditions from reducing to oxidizing would present significant challenges, potentially making aerobic bioremediation ineffective in this environment.
- Biosparging was not selected as a process option for GAA E as redox conditions of the local aquifer favor anaerobic bioremediation, which was selected as a better suited process option.
- Thermal Conductance Heating was not selected as a process option for GAA E due to subsurface obstructions that would inhibit the ability to install heater wells in the spacing required to heat uniformly. The operation of heating wells at temperatures needed to volatize contaminants may cause soil desiccation, potentially impacting the area's structural stability. Additionally, TCH is typically used for high concentration source zones, which does not align with the conditions in this area after the completion of the Cell 4 excavation.
- A PRB was not selected as a process option for GAA E as the natural groundwater gradient in the area is extremely flat, potentially limiting the amount of treatment achieved via groundwater flow through a PRB. Additionally, the planned redevelopment of this area

includes paving and installation of a revetment wall that will further flatten the groundwater gradient. Installation of a PRB will likely provide no additional treatment due to the limited groundwater flow.

- Permitted Discharge is a process option that would have been utilized in conjunction with GWPT. As noted above, GWPT was not selected due to the timeframe for cleanup as compared to MNA.

The remaining remedial technologies and process options were combined to create a workable number of Corrective Measures Alternatives that provide comprehensive remedies, as discussed in **Section 8.6.3**, below.

8.6.3 Summary of Corrective Measures Alternatives for GAA E

Each of the preferred process options included in **Table 40A** was combined to form Corrective Measures Alternatives for GAA E. The Alternatives for GAA E are described in detail below. As highlighted in **Section 8.2.2**, the stratigraphy and heterogeneity of the native soil deposits pose significant engineering challenges for the implementation of an in-situ and ex-situ treatment technologies and would present difficulty for technologies requiring uniform injections or bulk extraction. Alternatives have been developed and evaluated with these engineering challenges in mind.

8.6.3.1 Alternative 1: No Action

The No Action Alternative is presented in order to define a baseline condition against which other alternatives are compared and typically refers to an absence of efforts to reduce contaminant mass or otherwise treat or contain contamination. The No Action Alternative considers no benefits from future redevelopment of the GAA. In the case of GAA E, source (i.e, DNAPL) removal was conducted as part of interim measures, as discussed in **Section 8.6.1**. Under Alternative 1, no efforts would be employed to reduce potential cross-media transfer of impacts to groundwater, nor would protections be implemented to prevent exposure to impacted groundwater. In addition, no activities would be conducted to evaluate the continuing groundwater trends or the ability of natural attenuation to reach Final RGs.

8.6.3.2 Alternative 2: Hot Spot Excavation (previous IM), Capping, Revetment Wall, MNA, and ECs/ICs

Alternative 2 includes corrective action activities that have already been implemented for GAA E, including source removal via excavation as discussed in **Section 8.6.2**, above.

Alternative 2 includes the construction of an impermeable and low permeability cap over the entirety of GAA E in the form of paved areas. All pavement installed will include a minimum of four inches of compacted aggregate base and a minimum of four inches of asphalt or concrete, which will prevent exposure to contaminated soil/slag and groundwater and prevent surface

stormwater from infiltrating through impacted material. Additionally, development of the wharf will include the construction of a revetment wall within the turning basin made up of at least 5.9-inches of concrete and 6-inches of bedding stone, immediately reducing the flux of contaminants from groundwater to surface water. Upon completion of construction activities, paved areas and the revetment wall will be subject to periodic inspections and ongoing maintenance requirements. Additionally, planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.

Alternative 2 also includes MNA, which would serve to monitor the reduction in concentration of contaminants in groundwater as a result of previously implemented IMs and natural processes. This option would involve sampling of selected monitoring well locations to evaluate the behavior of contaminants in groundwater at GAA E, including the overall stability of the plume with respect to migration and the trends in contaminant concentrations over time. The *Coke Point Area Sampling and Analysis Plan* will be designed to evaluate the effect of source control measures (i.e., capping) on groundwater concentrations. The sampling program will be designed to collect adequate data to assess contaminant concentrations and supplement existing data to identify the type(s) of natural attenuation processes active at the site, such that an estimate of the rate at which such processes will reduce contaminant concentrations to required levels can be developed.

In accordance with *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (USEPA, 1999), the monitoring program will specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and can attain remediation objectives. In addition, the monitoring program will be designed to accomplish the following:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes;
- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume(s) is not expanding (either downgradient, laterally or vertically);
- Verify no unacceptable impact to downgradient receptors;
- Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

The frequency of monitoring will be specified in order to detect, in a timely manner, the potential changes in site conditions. The *Coke Point Area Sampling and Analysis Plan* will be developed to

allow flexibility for adjusting the monitoring frequency and analyzed parameters over the life of the remedy.

Alternative 2 will also include the implementation of LUCs and ICs consisting of environmental covenants including land use restrictions (i.e., prohibitions on residential use), groundwater use restrictions (i.e., prohibiting potable and non-potable water use), inspection, O&M requirements associated with the engineering controls, and site use restrictions addressing intrusive activities with the potential to encounter impacted environmental media. Worker PPE requirements, waste handling and disposal requirements, and construction-specific tasks will be addressed in RADWPs prior to the commencement of work. Future building developments in this GAA will include soil gas sampling as part of a RADWP. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. Additional engineering controls will include signage and fencing, as needed, to prohibit unauthorized access to the property and prevent disturbance of the cap once it is in place.

8.6.3.3 Alternative 3: Hot Spot Excavation (previous IM), Bioremediation, Capping, Revetment Wall, MNA, and ECs/ICs

Alternative 3 includes all the components outlined in Alternative 2, plus groundwater treatment through bioremediation. The bioremediation corrective action would include injections of nutrients, pH buffer, and other applicable amendments where needed. These injections would likely occur prior to completion of the Container Terminal construction. Bioremediation would assist in the reduction of contaminant toxicity and volume. However, due to the elevated groundwater pH (10-12) in GAA E, treatment may be difficult and likely require the addition of a buffer or buffering agents. In addition, Changes in the natural pH of the area includes risk in driving changes in emplaced slag, potentially increasing mobility of slag-related contaminants. Additionally, the presence of low permeability lenses (clay and silt) presents challenges to bioremediation's ability to maintain contact with contaminants to drive destruction and prevent matrix diffusion rebound from the low permeability lenses.

8.6.3.4 Alternative 4: Hot Spot Excavation (previous IM), ISCO, Capping, Revetment Wall, MNA, and ICs/ECs

Alternative 4 includes all of the components outlined in Alternative 2, plus ISCO. ISCO would assist in the reduction of contaminant toxicity and volume. ISCO injections may be performed via oxidant to take advantage of the elevated pH in the areas of the contaminant plumes. The injections targeting the contaminant plumes would likely occur prior to completion of the Container Terminal construction. Additionally, the presence of low permeability lenses (clay and silt) presents challenges to ISCO's ability to maintain contact with contaminants to drive destruction and prevent matrix diffusion rebound from the low permeability lenses.

Due to the potential changes in geochemistry during remediation, ISCO may drive changes in emplaced slag potentially mobilizing or increasing concentrations of slag related contaminants. Additionally, although excavation recovered the majority of NAPL within GAA E the potential presence of residual NAPL may impact the effectiveness of ISCO by driving oxidant demand prohibitively high.

8.6.4 Evaluation of GAA E Alternative 1

Alternative 1 involves maintaining the current conditions and taking no additional corrective measures or interventions. The No Action alternative does not meet any threshold criteria and, therefore, is not evaluated against the balancing criteria.

8.6.4.1 Evaluation of Threshold Criteria for GAA E Alternative 1

Protection of Human Health and the Environment

The No Action Alternative would not be protective of human health and the environment. Under a No action Alternative, no effort would be made to control exposures to impacted groundwater through the implementation of ECs/ICs. In addition, there would be no additional protective systems preventing or mitigating vapor intrusion. Unacceptable exposure to impacted groundwater is possible under the No Action Alternative.

Achievement of Media Objectives

Concentrations of contaminants in groundwater are expected to decrease through natural attenuation processes. However, without continued monitoring, it will not be possible to confirm progress toward the achievement of Final RGs or to make a determination that natural attenuation will result in the achievement of CAOs.

Source Control

No actions would be implemented to further control potential sources to groundwater.

8.6.5 Evaluation of GAA E Alternative 2

Alternative 2 involves corrective action activities already implemented for GAA E, such as hot spot excavation, along with the construction of an impermeable and low permeability cap over the entirety of GAA E, the construction of a capped revetment wall in the turning basin, and the implementation of MNA, LUCs, and ECs/ICs.

8.6.5.1 Evaluation of Threshold Criteria for GAA E Alternative 2

Protection of Human Health and the Environment

Alternative 2 provides protection of human health through previous source removal via excavation and product recovery, and future capping of the area. Current development plans include

construction of a Container Terminal. In the event buildings are constructed in GAA E, a vapor barrier or venting system below the floor slabs to prevent vapor intrusion will be presumed but confirmed via soil gas surveys potentially completed over multiple seasons. Human exposure to contaminants in groundwater will be prevented in the short and long term, with long term groundwater concentrations decreasing due to natural attenuation, monitored per the *Coke Point Area Sampling and Analysis Plan*. LUCs will limit the use of the site and prevent exposure to contaminated media. Furthermore, the installation of a revetment wall during wharf development will minimize groundwater flux to surface water, providing an additional layer of protection. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. A HASP will also be developed for future construction, ensuring proper handling procedures for impacted material. This approach ensures protection of human health during the period required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 2 reduces the potential for migration of contaminants in groundwater by installation of the revetment wall during wharf development. This immediately reduces the flux of contaminants from groundwater to surface water and decreases the risks of impacts to pore water, thereby assisting in meeting CAOs in a shorter timeframe. This alternative includes previous removal of DNAPL via excavation and skimming, which has reduced the mass of contaminants present and the potential for migration to nearby surface water. Approximately 18,165 tons of soils were removed and disposed of between January and June 2023 as described in *2023 Coke Oven Area Annual Interim Measures Report* (ARM, March 4, 2024). The source removal included sampling of groundwater from the excavation area with results from August 2023 showing both naphthalene and benzene below Final RGs (*Cell 4 DNAPL Excavation Report* dated January 31, 2024), indicating cleaner groundwater is anticipated to continue to move downgradient. MNA provides a means of documenting and demonstrating reductions in groundwater concentrations and confirming that caps are effectively preventing additional impacts to groundwater. With this alternative, Final RGs are expected to be reached via natural contaminant degradation post Cell 4 source removal and plume stability through MNA and by preventing stormwater infiltration and migration of impacted groundwater through installation of the revetment wall and capping.

Over time, natural attenuation will drive COC concentrations toward Final RGs based on applicable half-life decay rates (assuming a first order decay relationship), dispersion, and adsorption. Previous case studies, laboratory experiments, and literature reviews were utilized to assess an applicable decay rate for benzo[a]pyrene, as this is one of the most recalcitrant COCs in GAA E due to its limited bioavailability and minimal solubility in water. For application to benzo[a]pyrene observed at CO24-PZM007, an average decay rate of 0.28 $year^{-1}$ was utilized (UC

Davis, 1995). Using the maximum measured concentration of benzo[a]pyrene, results of the analysis indicate that natural attenuation mechanisms should achieve the Final RG in approximately one decade. It is noted that due to limited available research, a soil decay rate was used for benzo[a]pyrene as most research focuses on soil attenuation due to the nature of benzo[a]pyrene to preferentially adsorb to soil. Elevated pH in groundwater, interbedded clays and silts, and nutrient availability in GAA E will also influence the time in which this Final RG can be achieved with Alternative 2.

Source Control

Alternative 2 includes previously completed DNAPL removal via excavation of the Cell 4 area and product recovery which has dramatically depleted the original source of releases to groundwater. A revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) will be installed within the turning basin, providing an added layer of protection and minimizing groundwater flux to surface water. Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. This approach helps to prevent the migration of contaminants into the groundwater and surface water, providing long term source control.

8.6.5.2 Evaluation of Balancing Criteria for GAA E Alternative 2

Long-Term Effectiveness

Alternative 2 would provide long-term effectiveness through previously implemented source removal and the implementation of the revetment wall during wharf redevelopment, reducing the migration of contaminants in groundwater to nearby surface water. Risks from residual contamination would be low, given the use of ICs and LUCs. MNA will document the reduction in concentrations of contaminants in groundwater and provide a means to analyze the long-term effectiveness of the remedy. Once controls are in place, the ongoing maintenance of capped areas will enhance the long-term effectiveness of reducing the impacts to surface water. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark. There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. Risks to human receptors from residual contamination will be managed throughout the attenuation period through the proper administration, monitoring, and maintenance of ICs and ECs.

Reduction of Toxicity, Mobility, and Volume

In Alternative 2, the reduction of mobility (past what was achieved via previously implemented IMs) will be achieved via the revetment wall, which will minimize migration of impacted groundwater to pore water. The revetment wall will include minimal weep holes designed to

equalize tidal fluctuations while limiting advective transport of contaminants. Reduction in the volume of groundwater contaminants was achieved by excavation, completed in 2023. Further reduction in volume will be achieved through natural attenuation, with the reduction of contaminant concentrations documented and analyzed via MNA. Reduction of volume of groundwater contaminants intercepting surface water will be achieved via dredging for installation of the revetment wall during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Short-Term Effectiveness

Alternative 2 provides short-term effectiveness by immediately isolating impacted media through construction of an engineered cap and a concrete revetment wall. These measures will limit potential exposure pathways by preventing contact with contaminated soil and reducing stormwater infiltration that could mobilize contaminants. While excavation previously addressed the primary source area, additional protections such as LUCs and ICs will further reduce exposure by restricting groundwater use and intrusive activities. The short-term effectiveness of this remedy will be assessed through routine inspections of engineering controls and early monitoring of groundwater conditions to confirm containment is functioning as intended. By stabilizing contaminant conditions and preventing further releases, these measures also lay the groundwork for achieving Final RGs over time.

Cost

Costs associated with installation and management of the capping system, any building vapor barriers, and revetment wall are considered under development programs and have not been included here. Capital costs consist of the installation of MNA monitoring wells. O&M costs include the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $16,000
- Present Worth of Annual O&M Costs: $182,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $209,000

Implementability

Alternative 2 is considered implementable with all process options implemented during and after planned development. An MNA performance monitoring program will be implemented using

current sampling technology. The *Coke Point Area Sampling and Analysis Plan* is provided with the CMS that includes regular sampling of select wells in GAA E.

Community Acceptance

Alternative 2 should have community acceptance as it is protective of human health, however, as natural attenuation will be relied upon to decrease concentrations, the effectiveness of natural attenuation may need to be demonstrated through long-term monitoring. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.6.6 Evaluation of GAA E Alternative 3

Alternative 3 involves corrective action activities already implemented for GAA E, such as hot spot excavation, along with the construction of an impermeable and low permeability cap over the entirety of GAA E in the form of paved areas, the construction of a capped revetment wall, groundwater treatment through bioremediation, and the implementation of MNA, LUCs, and ECs/ICs.

8.6.6.1 Evaluation of Threshold Criteria for GAA E Alternative 3

Protection of Human Health and the Environment

Alternative 3 provides protection of human health through previous source removal via excavation and skimming, and future capping of the area. Current development plans include construction of a Container Terminal. In the event buildings are constructed in GAA E, a vapor barrier or venting system below the floor slabs to prevent vapor intrusion will be presumed but confirmed via soil gas surveys potentially completed over multiple seasons. Human exposure to contaminants in groundwater will be prevented in the short and long term, with long-term groundwater concentrations decreasing due to natural attenuation, monitored per the current groundwater sampling program in the Coke Oven Area. LUCs will limit the use of the site and prevent exposure to contaminated media. Furthermore, the installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) during wharf development will minimize groundwater flux to surface water, providing an additional layer of protection. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark,

as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. A HASP will also be developed for future construction, ensuring proper handling procedures for impacted material. This approach ensures protection of human health during the period required to meet Final RGs through MNA.

Bioremediation injections will also be implemented to further reduce contaminant mass, aiding in the reduction of contaminant concentrations and minimizing potential risks to human health.

Achievement of Media Objectives

Alternative 3 reduces the potential for migration of contaminants in groundwater by installation of the revetment wall during wharf development. This immediately reduces the flux of contaminants from groundwater to surface water and decreases the risks of impacts to pore water, thereby assisting in meeting CAOs in a shorter timeframe. This alternative includes previous removal of DNAPL via excavation and skimming, which has reduced the mass of contaminants present and the potential for migration to nearby surface water. Approximately 18,165 tons of soils were removed and disposed of between January and June 2023 as described in *2023 Coke Oven Area Annual Interim Measures Report* (ARM, March 4, 2024). The source removal included sampling of groundwater from the excavation area with results from August 2023 showing both naphthalene and benzene below Final RGs (*Cell 4 DNAPL Excavation Report* dated January 31, 2024), indicating cleaner groundwater is anticipated to continue to move downgradient. Bioremediation will further support this process by enhancing the reduction of contaminant mass in groundwater. MNA provides a means of documenting and demonstrating reductions in groundwater concentrations and confirming that caps are effectively preventing migration to groundwater. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater. With this alternative, Final RGs are expected to be reached via enhanced degradation through bioremediation, supported by natural contaminant degradation and plume stability through MNA. Academic research disagrees on the effectiveness of bioremediation on high molecular weight PAHs, such as benzo[a]pyrene. Therefore, for purposes of this alternative it has been assumed that benzo[a]pyrene will decay at a similar rate as predicted in Alternative 2. The engineered cap and revetment wall will prevent stormwater infiltration and NAPL migration, contributing to overall containment and source control. This remedy is expected to reduce COC concentrations in groundwater over time until Final RGs are achieved.

Source Control

Alternative 3 includes previously completed DNAPL removal via excavation of the Cell 4 area and product recovery which has controlled releases to groundwater. The installation of a revetment

wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) further minimizes groundwater flux to surface water. Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soil. Bioremediation may address groundwater impacts, further supporting the reduction of contaminant mass in groundwater. This approach helps to prevent the migration of contaminants into the groundwater and surface water, providing long term source control.

8.6.6.2 Evaluation of Balancing Criteria for GAA E Alternative 3

Long-Term Effectiveness

Alternative 3 would provide long-term effectiveness through previously implemented source removal and the implementation of the revetment wall during wharf redevelopment, reducing the migration of contaminants in groundwater to nearby surface water. Risks from residual contamination would be low, given the use of ICs and LUCs. MNA will document the reduction in concentrations of contaminants in groundwater and provide a means to analyze the long-term effectiveness of the remedy. Once controls are in place, the ongoing maintenance of the revetment wall will enhance the long-term effectiveness of reducing the impacts to surface water. Active remediation of groundwater impacts through bioremediation will further increase the rate of destruction of contaminants, supporting the overall reduction in contamination. However, bioremediation would likely require injections for many years to reach Final RGs. Risks to human receptors from residual contamination will be managed throughout the attenuation period through the proper administration, monitoring, and maintenance of ICs (including LUCs) and ECs. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark. There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Reduction of Toxicity, Mobility, and Volume

In Alternative 3, the reduction of mobility (past what was achieved via previously implemented IMs) will be achieved via the revetment wall, which will minimize migration of impacted groundwater to pore water. The revetment wall will include minimal weep holes designed to equalize tidal fluctuations while limiting advective transport of contaminants. Reduction in volume of contaminants will be achieved through the degradation of contaminants via bioremediation and further by natural attenuation. The reduction of groundwater contamination will be documented and analyzed via MNA. Reduction of volume of groundwater contaminants intercepting surface water will be achieved via dredging for installation of the revetment wall during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There

were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Short-Term Effectiveness

Alternative 3 provides short-term effectiveness by isolating impacted media through capping and revetment wall construction, which will prevent exposure to contaminated soil. These measures, combined with the implementation of LUCs and ICs, will immediately limit exposure pathways and help prevent contaminant migration. The short-term effectiveness of bioremediation is limited due to site-specific challenges such as elevated pH, heterogeneous lithology, and low-permeability zones, which may delay the onset of treatment. However, containment measures will stabilize conditions while bioremediation is implemented. Routine inspections and groundwater monitoring will assess the performance of engineering controls and early remedy effectiveness. These short-term measures support progress toward achieving Final RGs over time.

Cost

Costs associated with installation and management of the capping system, any building vapor barriers, and revetment wall are considered under development programs and have not been included here. Capital costs consist of the installation of bioremediation injection wells and monitoring wells. O&M costs include implementation of semi-annual bioremediation injections for 1 year and the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $123,000
- Present Worth of Annual O&M Costs: $469,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $603,000

Implementability

This alternative is considered challenging to implement. Bioremediation would take place via injections on a regular basis to address contaminants. Development activities planned for this area may prevent access for the installation and operation of an active remediation system. Introduction of pH buffer would likely be required and may impact effectiveness as high pH is a major challenge. A pilot test would be required.

Community Acceptance

Alternative 3 should have community acceptance as it is protective of human health. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.6.7 Evaluation of GAA E Alternative 4

Alternative 4 involves corrective action activities already implemented for GAA E, such as hot spot excavation, along with the construction of an impermeable and low permeability cap over the entirety of GAA E in the form of paved areas, the construction of a capped revetment wall, ISCO injections, and the implementation of MNA, LUCs, and ECs/ICs.

8.6.7.1 Evaluation of Threshold Criteria for GAA E Alternative 4

Protection of Human Health and the Environment

Alternative 4 provides protection of human health through previous source removal via excavation and skimming, and future capping of the area. Current development plans include construction of a Container Terminal. In the event buildings are constructed in GAA E, a vapor barrier or venting system below the floor slabs to prevent vapor intrusion will be presumed but confirmed via soil gas surveys potentially completed over multiple seasons. Human exposure to contaminants in groundwater will be prevented in the short and long term, with long term groundwater concentrations decreasing due to natural attenuation, monitored per the current groundwater sampling program in the Coke Oven Area. The installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) during wharf development will minimize groundwater flux to surface water, providing an additional layer of protection. LUCs will limit the use of the site and prevent exposure to contaminated media. Additionally, ISCO will be used to reduce contaminant mass, thereby further reducing the potential for human exposure. A HASP will also be developed for future construction or utility workers, ensuring proper handling procedures for impacted material. This approach ensures protection of human health during the period required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 4 reduces the potential for migration of contaminants in groundwater by installation of the revetment wall during wharf development. This immediately reduces the flux of contaminants from groundwater to surface water and decreases the risks of impacts to pore water, thereby assisting in meeting CAOs in a shorter timeframe. This alternative includes previous removal of DNAPL via excavation and skimming, which has reduced the mass of contaminants present and

the potential for migration to nearby surface water. Approximately 18,165 tons of soils were removed and disposed of between January and June 2023 as described in *2023 Coke Oven Area Annual Interim Measures Report* (ARM, March 4, 2024). The source removal included sampling of groundwater from the excavation area with results from August 2023 showing both naphthalene and benzene below Final RGs (*Cell 4 DNAPL Excavation Report* dated January 31, 2024), indicating cleaner groundwater is anticipated to continue to move downgradient. ISCO will further reduce contaminant concentrations through destruction, accelerating the cleanup process. MNA provides a means of documenting and demonstrating reductions in groundwater concentrations and confirming that caps are effectively preventing additional impacts to groundwater. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater. With this alternative, Final RGs are expected to be reached via promoting natural contaminant degradation and plume stability through MNA, supported by active contaminant mass reduction through ISCO. ISCO is effective on treating high molecular weight PAHs, such as benzo[a]pyrene; however, exceedances of Final RGs for benzo[a]pyrene are limited to one well and targeted treatment of this COC would not greatly reduce risk or hazard. The engineered cap and revetment wall will prevent stormwater infiltration and NAPL migration, reducing contaminant mobility and enhancing long-term stability. This remedy is expected to reduce COC concentrations in groundwater over time until Final RGs are achieved.

Source Control

Alternative 4 includes previously completed DNAPL removal excavation of the Cell 4 area and product recovery which has controlled releases to groundwater. The installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) further minimizes groundwater flux to surface water. Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping of the area reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soil. ISCO may address groundwater impacts from contaminants by further reducing existing dissolved phase mass. This approach helps to prevent the migration of contaminants into the groundwater to expedite attenuation.

8.6.7.2 Evaluation of Balancing Criteria for GAA E Alternative 4

Long-Term Effectiveness

Alternative 4 would provide long-term effectiveness through previously implemented source removal and the implementation of the revetment wall during wharf redevelopment, reducing the migration of contaminants in groundwater to nearby surface water. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark. There were no exceedances in the deep sediment samples of the applicable ecological criteria, also

indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth. Risks from residual contamination would be low, given the use of ICs and LUCs. MNA will document the reduction in concentrations of contaminants in groundwater and provide a means to analyze the long-term effectiveness of the remedy. Once controls are in place, the ongoing maintenance of the revetment wall will enhance the long-term effectiveness of reducing the vadose zone to groundwater pathway. Additionally, active remediation of groundwater contaminants through ISCO will increase the rate of destruction of contaminants, further reducing risks. However, ISCO injections would likely require quarterly injections for many years to reach Final RGs. Risks to human receptors from residual contamination will be managed throughout the attenuation period through the proper administration, monitoring, and maintenance of ICs (including LUCs) and ECs.

Reduction of Toxicity, Mobility, and Volume

In Alternative 4, the reduction of mobility (past what was achieved via previously implemented IMs) will be achieved via the revetment wall, which will minimize migration of impacted groundwater to pore water. The revetment wall will include minimal weep holes designed to equalize tidal fluctuations while limiting advective transport of contaminants. Reduction in volume will be further enhanced by the destruction of contaminants through the application of ISCO, followed by continued natural attenuation. Reduction of groundwater contamination will be documented and analyzed via MNA. Reduction of volume of groundwater contaminants intercepting surface water will be achieved via dredging for installation of the revetment wall during wharf redevelopment. The future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment wall, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the *Coke Point Container Terminal RADWP* (ARM, 2024l). There were no exceedances in the deep sediment samples of the applicable ecological criteria, also indicating that site groundwater impacts are not impacting the sediment at the proposed new channel depth.

Short-Term Effectiveness

Alternative 4 provides short-term effectiveness through immediate containment of impacted media via capping and revetment wall construction, which will limit exposure to contaminated soil and groundwater. LUCs and ICs will be implemented early to prevent exposure and restrict groundwater use and intrusive activities. While ISCO is intended to actively reduce contaminant mass, its short-term effectiveness may be limited by site conditions such as elevated pH, low-permeability zones, and the potential for increased oxidant demand due to residual NAPL. In the short term, the containment components of the remedy will stabilize site conditions and limit further migration. Routine inspections and groundwater monitoring will be used to evaluate containment performance and early remedy effectiveness. These early actions contribute to long-term Final RG attainment.

Cost

Costs associated with installation and management of the capping system, any building vapor barriers, and revetment wall are considered under development programs and have not been included here. Capital costs consist of the installation of ISCO injection wells and monitoring wells. O&M costs include implementation of semi-annual ISCO injections for 1 year and the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $123,000
- Present Worth of Annual O&M Costs: $513,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $647,000

Implementability

This alternative is considered challenging to implement, particularly if ISCO takes place after the completion of surface paving. ISCO would involve injections on a regular basis to address contaminants in the groundwater. The naturally high pH observed at many wells within this GAA may require the use of an oxidant specifically selected to ensure the best chances of success. Development activities planned for this area may limit access and influence the operation of an active remediation system. The presence of low permeability zones may make treatment more difficult in certain areas. The average SOD was measured at other areas on Coke Point and observed at 5.5 g/kg soil, with a range of 0.6-15 g/kg soil. These factors may complicate the implementation of ISCO as part of the remediation strategy.

Community Acceptance

Alternative 4 should have community acceptance as it is protective of human health via contaminant mass reduction by ISCO injection. However, injection of an oxidant may be less appealing to the community due to its reactive nature. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.6.8 Comparative Analysis of Remedial Alternatives

This section compares the remedial alternatives to one another against each of the threshold and balancing criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each alternative. The four remedial alternatives compared are:

- Alternative 1: No Action
- Alternative 2: Hot Spot Excavation (previous IM), Revetment Wall, Capping, MNA, ICs/ECs
- Alternative 3: Hot Spot Excavation (previous IM), Bioremediation, Revetment Wall, Capping, MNA, ECs/ICs
- Alternative 4: Hot Spot Excavation (previous IM), ISCO, Revetment Wall, Capping, MNA, ECs/ICs

8.6.8.1 Comparative Analysis of Threshold Criteria

Protection of Human Health and the Environment

While Alternative 1 does not provide protection of human health, Alternatives 2, 3, and 4 do. Alternatives 2, 3, and 4 provide protection of human health using ICs and ECs, which prevent human exposure to contaminants identified in GAA E. Alternatives 2, 3, and 4 also provide protection of human health and the environment via surface capping and a future revetment wall. Alternative 4 requires transportation and handling of oxidants which may increase risk to human health via potential for community and worker exposure. Sufficient protection of human health and the environment can be provided via ICs, ECs, revetment wall, capping, and MNA.

Achievement of Media Objectives

Although it is expected that natural attenuation of contaminants in groundwater will occur under Alternative 1, the lack of performance monitoring will preclude the ability to evaluate progress toward achievement of the CAOs and Final RGs. Implementation of Alternatives 2, 3, and 4 would provide the data needed to evaluate the effect of the source removal and containment activities conducted at GAA D and confirm that natural attenuation is effectively reducing groundwater contaminant concentrations. These alternatives include engineered controls such as capping and a revetment wall, which will limit stormwater infiltration and reduce the potential for migration of impacted groundwater, supporting progress toward achieving Final RGs. Alternatives 2, 3, and 4 are designed to ultimately achieve Final RGs by reducing concentrations of contaminants in groundwater. Alternative 2 relies primarily on natural attenuation supported by previous source removal and pathway reduction via construction of the revetment wall, which offers a reliable, long-term approach to achieving Final RGs. Alternatives 3 and 4 include active remediation technologies, bioremediation and ISCO, that accelerate contaminant reduction. However, site-specific challenges, including high groundwater pH, subsurface heterogeneity, and oxidant demand may limit their effectiveness and overall benefit. While Alternatives 3 and 4 could offer a

shorter timeframe to achieve Final RGs, there are no risks to onsite or offsite receptors in the short or long term.

Source Control

All of the alternatives provide a substantial form of source control through the previously implemented removal of a large mass of contaminants contained within DNAPL. Alternatives 2, 3, and 4 include installation of a concrete revetment wall which reduces the pathway between groundwater and surface water, effectively containing impacted groundwater. Alternatives 3 and 4 address the potential source via direct destruction; however, contaminants in GAA E appear to be naturally attenuating after implementation of IMs (refer to trend analysis completed in **Appendix G**) and further active remediation in this area is not needed to control any potentially remaining source.

8.6.8.2 Comparative Analysis of Balancing Criteria

Long-Term Effectiveness

Alternatives 2, 3, and 4 all provide long-term effectiveness through the previous removal of DNAPL, as well as a future revetment wall, and future surface paving/capping. Alternative 2 will require a significant amount of time to reach Final RGs; however, exposure and risk are mitigated. The local geochemistry and geology, characterized by high pH and lenses of low permeability zones, may pose challenges to the long-term effectiveness of Alternatives 3 and 4. The challenges of treating high pH aquifers with low permeability zones will require significant engineering efforts that may not be successful. Implementation of an in-situ remedy, such as bioremediation or ISCO, includes a low risk of increased contaminant migration.

Reduction of Toxicity, Mobility, and Volume

Toxicity, mobility, and volume of contaminants will be reduced through Alternatives 2, 3, and 4. Alternatives 2, 3, and 4 include previous removal of DNAPL mass through the previously implemented excavation and product skimming, and future revetment wall to reduce mobility of the contaminants from groundwater to surface water. Alternatives 3 and 4 include active injection of amendment to drive destruction (volume and toxicity reduction) of contaminants. Injection of material within a plume may increase the mobility of the non-slag and slag related contaminants. Additionally, Alternatives 3 and 4 include biological and chemical changes driven within the subsurface that may influence the mobility and concentration (toxicity) of the slag related contaminants in this GAA.

Short-Term Effectiveness

Alternatives 2, 3, and 4 provide immediate short-term effectiveness through construction of an engineered cap and revetment wall, which reduce exposure by limiting stormwater infiltration and the pathway between impacted soil and groundwater. These physical controls help stabilize site conditions and prevent contaminant migration. LUCs and ICs implemented under each alternative

provide additional protection by restricting groundwater use and limiting intrusive activities. While Alternatives 3 and 4 include active groundwater treatment technologies (bioremediation and ISCO), these approaches require time to take effect and face challenges due to site-specific conditions such as redevelopment schedules, high groundwater pH, heterogeneous subsurface lithology, and low-permeability zones. All three alternatives provide similar short-term protection by reducing exposure pathways through physical controls, with Alternative 2 offering the most reliable and readily implementable approach to short-term effectiveness. Each of the alternatives supports progress toward achieving Final RGs over time; however, Alternative 2 is expected to offer the most predictable performance and least implementation uncertainty in the near term.

Cost

Alternative 2 provides the most cost-effective option to reach the CAOs. Alternatives 3 and 4 require increased amounts of capital and operational costs making these options the least cost-effective.

Implementability

Alternatives 3 and 4 will require treatability studies and / or pilot scale installations to establish feasibility in high pH groundwater and low permeability lenses. Due to these challenges related to Alternatives 3 and 4, it may be possible that they will not expedite attenuation or shorten the timeframe in which Final RGs are met. Alternative 2 can be implemented in concert with the development schedule for this area.

Community Acceptance

Alternatives 2, 3, and 4 should have community acceptance as they are all protective of human health. Alternative 4 may be less acceptable due to the transportation and use of oxidant. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.6.9 **Preferred Remedial Alternative**

Based on the results of the threshold and balancing analysis, GAA E Alternative 2: Hot Spot Excavation (previous IM), Revetment Wall, Capping, MNA, and ECs/ICs is recommended as the

preferred remedial alternative to achieve Site CAOs in GAA E. The following reasons are presented for the selection of Alternative 2:

- Hot Spot Excavation was previously conducted as an IM in GAA E. Excavation was identified as the best suited technology due to the presence of DNAPL impacted soils and groundwater. No additional NAPL has been observed as remaining in this assessment area, suggesting that additional source removal is not necessary. The source was removed previously via the excavation completed at Cell 4 that included sampling of groundwater from the excavation area with results from August 2023 showing both naphthalene and benzene below Final RGs (*Cell 4 DNAPL Excavation Report* dated January 31, 2024).
- Dredging will remove existing shoreline impacts. Installation of a revetment wall (minimum of 5.9-inch-thick concrete and 6-inches of bedding stone) along the eastern shoreline during wharf development will occur based on the work described in the Container Terminal RADWP and will provide protection of off-site receptors.
- Alternative 2 will immediately address existing offshore exposures and risks to ecological receptors.
- The capping of a significant portion of GAA E will occur based on the work described in the Container Terminal RADWP. Capping of this area will provide protection of human health through prevention of human exposure to contaminants and reduce the timeframe needed to reach Site CAOs by mitigating infiltration through the vadose zone. Development plans for this area do not currently include permanent structures; however, planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.
- Since the completion of the mass excavation of the primary source of contamination (Cell 4), this alternative is expected to achieve Final RGs over time through natural attenuation of groundwater contaminants. The reduction in infiltration and contaminant mobility achieved by the cap and revetment wall will mitigate contaminant migration during the timeframe expected for natural attenuation to achieve Final RGs. Performance monitoring will track progress toward Final RGs.
- Implementation of LUCs and ICs in this area and across the site provide protection of human health.
- Alternative 2 is the most implementable and cost-effective approach of the alternatives. Alternatives 3 and 4 pose significant implementability challenges that introduce uncertainty about effectiveness.
- Alternative 2 provides protection of human health and the environment while best facilitating redevelopment and reuse of the GAA.

8.6.10 Contingency Remedial Criteria

Alternative 2 will be implemented in GAA E with sampling completed as described in the *Coke Point Area Sampling and Analysis Plan*. Following recommendations from USEPA's *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (April 1999), contingency measures are identified as part of the preferred alternative. Despite the observance of largely decreasing or stable contaminant concentrations in groundwater, specific criteria are established in the event that the expected trends in contaminant concentrations are not observed.

The *Coke Point Area Sampling and Analysis Plan* includes identification of monitoring wells within GAA E that will be regularly sampled to determine the effect of the source control remedies implemented at GAA E. The data collected from these wells will undergo statistical analysis to identify trends in contaminant concentrations. The statistical methods used to develop trends and subsequent data interpretation and reporting are further discussed in the *Coke Point Area Sampling and Analysis Plan*. The results of the statistical trend analysis will inform the need for additional evaluation. Specifically, the following USEPA identified triggers will be applied to the results of the statistical analysis:

- Statistically significant increasing trends not originally predicted during remedy selection; and
- Contaminants identified in a statistically significant increasing trend at wells where there was previously a decreasing trend or no trend.

If any of the triggers are met, further evaluation will occur, potentially involving more sampling, evaluation of geochemical and biological conditions, reassessment of remediation timelines, or further site investigation to pinpoint the potential new sources causing rising concentrations. Similarly, the statistical analysis will be used to help determine when Site CAOs are met and sampling can cease.

Given the current data available for GAA E, a contingency approach will be identified based on this alternative analysis. However, additional field tests and evaluations will be necessary to inform the new contingency alternative.

8.7 Development of Corrective Measures for GAA F

8.7.1 Applicability Evaluation for Identified Process Options

The process for development and evaluation of Corrective Measures Alternatives outlined in **Section 8.1** was implemented for GAA F. Process options were evaluated for applicability with GAA F conditions, as outlined in **Table 41A**. Several technologies were eliminated from further consideration during screening; the technologies were identified as not applicable to GAA F due to the nature of the contaminants or specific conditions at GAA F, as detailed below.

- Multi-Phase Extraction – This removal technology was eliminated from consideration based on the localized occurrence of NAPL at well B11-026-MWS. No NAPL has been identified in delineation piezometers B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ. As a result, implementation of an MPE system would not provide any additional benefit over the planned excavation of residual NAPL at B11-026-MWS. Excavation is now the primary remedial action for addressing the remaining NAPL, replacing the need for continued product recovery methods such as those previously implemented.
- Soil Flushing - This removal technology was eliminated from consideration based on the localized occurrence of NAPL at well B11-026-MWS. No NAPL has been identified in delineation piezometers B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ. As a result, implementation of a soil flushing remedy would not provide any additional benefit over the planned excavation of residual NAPL at B11-026-MWS. Excavation is now the primary remedial action for addressing the remaining NAPL, eliminating the need for further soil flushing.
- Stabilization / Solidification - This removal technology was eliminated from consideration based on the localized occurrence of NAPL at well B11-026-MWS. No NAPL has been identified in delineation piezometers B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ. As a result, implementation of a stabilization/solidification remedy would not provide any additional benefit over the planned excavation of residual NAPL at B11-026-MWS. Excavation is now the primary remedial action for addressing the remaining NAPL, making further stabilization/solidification unnecessary.
- In Situ Chemical Reduction – ISCR was eliminated as a potential treatment technology since it is not suitable for treating the non-slag related contaminants within GAA F. ISCR is most applicable for CVOCs, PCBs, and Chromium VI.
- Low Temperature thermal treatment / stripping – Low temperature thermal treatment was eliminated as a potential treatment technology as it is not applicable to dissolved phase contaminants in this GAA F and no soil impacted NAPL has been observed.
- Electrical Resistance Heating – ERH was eliminated as a potential treatment technology because it would require the installation of electrodes adjacent to the CPLF. Subsurface obstructions would inhibit the ability to install electrodes in the spacing required to heat uniformly.
- On-Site or Off-Site Disposal / Landfilling –This removal technology was eliminated from consideration, as impacted soils have not been observed during reclamation activities. Excavation was eliminated from consideration due to the localized occurrence of NAPL at well B11-026-MWS, which is currently removed via absorbent sock, bailer, or EFR. Additionally, excavation in the vicinity of the CPLF may not be feasible due to subsurface obstructions.
- On-Site Disposal (CAMU) - A CAMU was eliminated as a disposal option for excavated material due to the lack of available space in GAA F.

8.7.2 Evaluation of Preferred Process Options for Development of Corrective Measures Alternatives for GAA F

Process options that were not eliminated due to inapplicability were retained for consideration as components of a comprehensive alternative. The summary of the retained process options is included in **Table 41A**. The COCs identified to exceed Final RGs in GAA F include benzene, naphthalene, and bis(2-ethylhexyl)phthalate. Recent sampling at wells CP16-PZM035 and CP19R-PZM008 reported non-detect results for bis(2-ethylhexyl)phthalate; however, the detection limit of 3 µg/L exceeds the COC's Final RG of 1.0 µg/L. Exceedances of bis(2-ethylhexyl)phthalate were previously observed at these two wells based on 2023 sampling. Naphthalene exceedances are observed in one well (CP19R-PZM008) with an exceedance frequency of 4.9%. Benzene is the primary COC in GAA F, with exceedances identified in five wells during multiple sampling events (refer to **Table 33A**). The detection frequency (79%) and exceedance frequency (33%) of benzene show it is the most widespread COC in this GAA. Refer to **Table 33C** for COC statistics. Remedial options were focused on addressing benzene and naphthalene in this GAA and were developed to focus on reducing concentrations over time. No single process option or approach will satisfactorily mitigate risk and hazard. Accordingly, remedial alternatives were developed by combining potentially applicable technologies and process options with the best potential for achieving CAOs, as shown in **Table 41B**.

The presented alternatives for GAA F include ICs and ECs in combination with MNA, excavation, impermeable and low permeability capping, biosparging, and ISCO. These process options were identified as the best suited technologies based on GAA F specific conditions.

- Excavation was identified as a preferred process option for residual NAPL in GAA F. While no NAPL has been identified in delineation piezometers B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ, the NAPL at B11-026-MWS has been difficult to recover due to its high viscosity, and recovery methods such as absorbent socks, bailers, or EFR have been used intermittently. The well B11-026-MWS has now been abandoned, and an excavation to remove the residual NAPL is proposed, as outlined in the *Well Abandonment Request Letter for Parcels B1, B10, and B12 (ARM, 2024h)*. This excavation is intended to effectively address the remaining NAPL contamination in the area.
- Impermeable and low permeability capping was identified as a preferred process option for preventing vertical migration of contaminants from soil to underlying groundwater. Installation of an impermeable and low permeability cap will prevent vertical contaminant migration by preventing infiltration of surface water into the subsurface. The presumptive remedy for landfills is containment, which in the scenario at the CPA would consist of low permeability capping. This is a preferred process option for CPLF adjacent areas in GAA F.
- MNA was identified as a preferred process option to assess the effectiveness of the other proposed remedies. MNA will provide data to confirm that contaminant concentrations in

groundwater are reduced due to natural processes after the source is addressed via capping and/or excavation activities.

- Biosparging was identified as a preferred process option based on the applicability to dissolved phase contaminants in GAA F. Historically, aerobic biodegradation has worked successfully on BTEX and naphthalene contaminants. Additionally, biosparging could be applicable to both shallow and intermediate zones if necessary. Naturally reducing geochemical conditions and elevated pH within the shallow aquifer of GAA F may introduce challenges for the implementation of this approach.
- ISCO was identified as a preferred process option based on the sustained elevated pH in the area of the contaminant exceedances. Introduction of an ISCO amendment may be able to utilize the elevated pH conditions for activation.
- Product Recovery (Absorbent/Skimmers) has already been implemented at GAA F and is retained as a preferred process option as an IM. NAPL removal at B11-026-MWS is performed via bailer or absorbent sock as needed (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]). B11-026-MWS has been abandoned, and the area will be excavated in coordination with site preparation activities in advance of capping the area.

During this step in the process, several process options were not selected as part of a comprehensive alternative (Corrective Measures Alternative) due to GAA F specific conditions, as discussed below.

- Hydraulic containment was not selected as a process option for the GAA F, as attenuation of contaminant impacts is observed between the source area and surface water. Based on the *Coke Point and Greys Landfill Groundwater Monitoring Report (2014),* dissolved phase contaminant impacted wells showcase stable concentrations. Thus, the potential for offsite migration of contaminants is insignificant, and remedial options should be focused on potential source areas.
- Containment via sheet piling or slurry wall was not selected as a process option for the GAA F due to the process option's tendency to redirect groundwater flow. The contaminants plumes are attenuating before reaching surface water, and changes in hydraulic conditions may influence the attenuation area. The potential for off-site migration of contaminants is insignificant and remedial options should be focused on potential source areas.
- Air sparging/soil vapor extraction was not selected as a process option for GAA F based on the concentration of contaminants within the source area. Due to its low vapor pressure naphthalene would not strip using air sparging, and biosparging was selected as a more effective approach for GAA F area contaminants.
- Groundwater Pump and Treat was not selected as a process option for the GAA F due to rebound and/or recontamination of the groundwater from vadose-zone contaminants. Benzene trends at shoreline wells indicate statistically significant decreases in

concentration, suggesting the plume is attenuating. Naphthalene and bis(2-ethylhexyl)phthalate exceedance magnitudes do not warrant an active remedial system.

- Bioremediation was not selected as a preferred process option in GAA F because the primary COCs in this area are benzene and naphthalene, which are both more effectively treated via biosparging. Unlike other GAAs where bioremediation was considered to address persistent PAH exceedances, GAA F does not have PAH exceedances requiring more aggressive amendment loading or injection strategies.
- Thermal Conductance Heating was not selected as a process option for the GAA F due to its proximity to Cokes Point Landfill. Subsurface obstructions would inhibit the ability to install heater wells in the spacing required to heat uniformly. Soil temperatures during TCH operation can reach as high as 900°C, at which soil desiccation occurs, possibly impacting the structural integrity of the soils/slag in the area.
- A Permeable Reactive Barrier was not selected as a process option for the GAA F, due to attenuation of contaminant impacts observed between the source area and the property boundary or surface water. The potential for off-site migration of contaminants is insignificant and remedial options should be focused on potential source areas.
- Permitted Discharge was not selected as a process option for GAA F. This process option would have been utilized in conjunction with GWPT.

The remaining remedial technologies and process options were combined to create a workable number of Corrective Measures Alternatives that provide comprehensive remedies, as discussed in **Section 8.7.3**, below.

8.7.3 Summary of Corrective Measures Alternatives for GAA F

Each of the preferred process options included in **Table 41A** was combined to form Corrective Measures Alternatives for GAA F. The Alternatives for GAA F are described in detail below. As highlighted in **Section 8.2.2**, the stratigraphy and heterogeneity of the native soil deposits pose significant engineering challenges for the implementation of an in-situ and ex-situ treatment technologies and would present difficulty for technologies requiring uniform injections or bulk extraction. Alternatives have been developed and evaluated with these engineering challenges in mind.

8.7.3.1 Alternative 1: No Action

The No Action Alternative is presented in order to define a baseline condition against which other alternatives are compared and typically refers to an absence of efforts to reduce contaminant mass or otherwise treat or contain contamination. The No Action Alternative considers no benefits from future redevelopment of the GAA. In the case of GAA F, source removal has not yet been conducted. Under Alternative 1, no efforts would be employed to reduce potential cross-media transfer of impacts to groundwater, nor would protections be implemented to prevent exposure to

impacted groundwater. In addition, no activities would be conducted to evaluate the continuing groundwater trends or the ability of natural attenuation to reach Final RGs.

8.7.3.2 Alternative 2: Excavation, Capping, MNA, and ECs/ICs

Alternative 2 includes the construction of an impermeable and low permeability cap over the entirety of GAA F in the form of paved areas. All pavement installed will include a minimum of four inches of compacted aggregate base and a minimum of four inches of asphalt or concrete, which will prevent exposure to contaminated soil/slag and groundwater and prevent surface stormwater from infiltrating through impacted material. Upon completion of construction activities, paved areas will be subject to periodic inspections and ongoing maintenance requirements. Additionally, planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies. In addition to the capping, source excavation will be performed to remove residual NAPL identified at well B11-026-MWS. This excavation will address the contamination at its source and further reduce the potential for NAPL migration. The excavation will focus on removing contaminated soil and NAPL from the site, enhancing the overall remedial effectiveness. Post-excavation monitoring will ensure the continued success of the cleanup efforts and the stability of the cap.

Alternative 2 also includes MNA, which would serve to monitor the reduction in concentration of contaminants in groundwater via natural processes. This option would involve sampling of selected monitoring well locations to evaluate the behavior of contaminants in groundwater at GAA F, including the overall stability of the plume with respect to migration and the trends in contaminant concentrations over time. The *Coke Point Area Sampling and Analysis Plan* will be designed to evaluate the effect of source control measures on groundwater concentrations. This sampling will remain consistent with the current semi-annual sampling. The sampling program will be designed to collect adequate data to assess contaminant concentrations and supplement existing data to identify the type(s) of natural attenuation processes active at the site, such that an estimate of the rate at which such processes will reduce contaminant concentrations to required levels can be developed.

In accordance with *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (USEPA, 1999), the monitoring program will specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and can attain remediation objectives. In addition, the monitoring program will be designed to accomplish the following:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions (e.g., hydrogeologic, geochemical, microbiological, or other changes) that may reduce the efficacy of any of the natural attenuation processes;
- Identify any potentially toxic and/or mobile transformation products;

- Verify that the plume(s) is not expanding (either downgradient, laterally or vertically);
- Verify no unacceptable impact to downgradient receptors;
- Detect new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy;
- Demonstrate the efficacy of institutional controls that were put in place to protect potential receptors; and
- Verify attainment of remediation objectives.

The frequency of monitoring will be specified in order to detect, in a timely manner, the potential changes in site conditions. The *Coke Point Area Sampling and Analysis Plan* will be developed to allow flexibility for adjusting the monitoring frequency and analyzed parameters over the life of the remedy.

Alternative 2 will also include the implementation of LUCs and ICs consisting of environmental covenants including land use restrictions (i.e., prohibitions on residential use), groundwater use restrictions (i.e., prohibiting potable and non-potable water use), inspection, operation and maintenance requirements associated with the engineering controls, and site use restrictions addressing intrusive activities with the potential to encounter impacted environmental media. Worker PPE requirements, waste handling and disposal requirements, and construction-specific tasks will be addressed in RADWPs prior to the commencement of work. Future building developments in this GAA will include soil gas sampling as part of a RADWP. Additional engineering controls will include signage and fencing, as needed, to prohibit unauthorized access to the property and prevent disturbance of the cap once it is in place.

8.7.3.3 Alternative 3: Excavation, Biosparging, Capping, MNA, and ECs/ICs

Alternative 3 includes all the components outlined in Alternative 2, plus biosparging. The biosparging option would include the installation of injection wells that introduce air below the water table to stimulate aerobic degradation of hydrocarbons. These injections will occur near the areas of maximum contaminant concentrations. Biosparging would assist in the reduction of contaminant toxicity and volume. However, due to the naturally reducing environment and high pH in groundwater of GAA F, treatment may be less effective. Additionally, changes in the geochemistry of the area includes some risk in driving changes in emplaced slag, potentially increasing mobility of slag-related contaminants. The presence of low permeability lenses (clay and silt) may present challenges to biosparging's ability to treat contaminants in these low permeability lenses.

8.7.3.4 Alternative 4: Excavation, ISCO, Capping, MNA, and ECs/ICs

Alternative 4 includes all of the components outlined in Alternative 2, plus ISCO. ISCO would assist in the reduction of contaminant toxicity and volume. ISCO injections would target the contaminant plumes adjacent to the CPLF. Performance monitoring would be conducted to

evaluate the effectiveness of the ISCO injections. ISCO may drive changes in groundwater pH that may impact emplaced slag, potentially mobilizing or increasing concentrations of slag related contaminants.

8.7.4 Evaluation of GAA F Alternative 1

Alternative 1 involves maintaining the current conditions and taking no additional corrective measures or interventions. The No Action alternative does not meet any threshold criteria and, therefore, is not evaluated against the balancing criteria.

8.7.4.1 Evaluation of Threshold Criteria for GAA F Alternative 1

Protection of Human Health and the Environment

The No Action Alternative would not be protective of human health and the environment. Under a No action Alternative, no effort would be made to control exposures to impacted groundwater through the implementation of ECs/ICs. In addition, there would be no additional protective systems preventing or mitigating vapor intrusion. Unacceptable exposure to impacted groundwater is possible under the No Action Alternative.

Achievement of Media Objectives

Concentrations of contaminants in groundwater are expected to decrease through natural attenuation processes. However, without continued monitoring, it will not be possible to confirm progress toward the achievement of Final RGs or to make a determination that natural attenuation will result in the achievement of CAOs.

Source Control

No actions would be implemented to further control potential sources to groundwater.

8.7.5 Evaluation of GAA F Alternative 2

Alternative 2 involves excavation, the construction of an impermeable and low permeability cap over the entirety of GAA F in the form of paved areas and the implementation of MNA, LUCs, and ECs/ICs.

8.7.5.1 Evaluation of Threshold Criteria for GAA F Alternative 2

Protection of Human Health and the Environment

Alternative 2 provides protection of human health by capping GAA F to prevent exposure of future occupants to contaminated soil and prevent downward surface and stormwater infiltration, thereby reducing infiltration and minimizing migration of dissolved phase contamination. Human exposure to aromatic contaminants in groundwater will be prevented in the short and long term through LUCs and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil

gas testing program to be submitted to and approved by the Agencies. Long term groundwater concentrations may decrease due to natural attenuation, monitored per the current semi-annual landfill sampling program. LUCs and ICs protect human health through limiting use of the Site and preventing, and/or limiting exposure to onsite media. Additionally, the development of a HASP for future utility workers or construction workers mitigates exposure risks by providing proper handling procedures for impacted material. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 2 reduces the potential for impacted soil to act as a continuing source to groundwater through a combination of hot spot removal and installation of an impermeable and low permeability cap. This also expedites natural attenuation in groundwater of aromatic VOCs and SVOCs, helping meet CAOs in a shorter timeframe. MNA provides a route to documenting and demonstrating reductions in groundwater concentrations, and confirmation that caps are successfully inhibiting additional impacts to groundwater. With this alternative, Final RGs are expected to be achieved through natural contaminant degradation following removal of NAPL impacted soils, plume stabilization through MNA, and reduction of vadose zone leaching by installation of an impermeable and low-permeability cap. This remedy is expected to reduce benzene and naphthalene concentrations in groundwater over time until Final RGs are met.

Source Control

Alternative 2 includes capping of the area which reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. In addition to capping, excavation of residual NAPL in GAA F will further reduce contaminant sources and enhance the overall effectiveness of the remedy.

8.7.5.2 Evaluation of Balancing Criteria for GAA F Alternative 2

Long-Term Effectiveness

Alternative 2 would provide long-term effectiveness through source capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. Risks from residual contamination would be low given ICs and LUCs. MNA will document the reduction in concentrations of the non-slag related contaminants in groundwater and provides a way to analyze the long-term effectiveness of ECs and ICs. Once controls are installed, the continued maintenance of capped areas will increase the long-term effectiveness of reductions in vadose zone soil to groundwater pathways. Risks to human receptors from residual contamination would be managed during the attenuation period through properly administered, monitored, and maintained ICs (including LUCs) and ECs. Removal of NAPL impacted soils will likely decrease migration of NAPL but may take a significant amount of time to completely stop this from occurring.

Reduction of Toxicity, Mobility, and Volume

In Alternative 2, the reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Additionally, excavation of residual NAPL in GAA F will further reduce the source contamination. Reduction in volume of groundwater contaminants will be achieved via natural attenuation and will be subsequently documented and analyzed via MNA.

Short-Term Effectiveness

Alternative 2 provides short-term effectiveness by removing NAPL impacted soil and constructing a cap that limits migration of COCs and potential exposure to surface soil. These measures immediately reduce the pathway for contaminant migration from soil to groundwater and lower risk to human and ecological receptors. Implementation of LUCs and ICs will further reduce potential exposure by restricting groundwater use and limiting intrusive activities. The short-term effectiveness of the remedy will be evaluated through inspections of the cap and monitoring of groundwater to confirm that contaminant concentrations are stable or decreasing. By controlling contaminant mobility and stabilizing source areas, this remedy supports progress toward meeting Final RGs over time.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of MNA monitoring wells. O&M costs include the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $38,000
- Present Worth of Annual O&M Costs: $182,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $231,000

Implementability

Alternative 2 is considered implementable with all process options implemented during and after planned development. An MNA performance monitoring program can be implemented using current sampling technology. The *Coke Point Area Sampling and Analysis Plan* is provided with the CMS that includes regular sampling of select wells in GAA F.

Community Acceptance

This alternative should have community acceptance as it is protective of human health. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.7.6 Evaluation of GAA F Alternative 3

Alternative 3 involves excavation, the construction of an impermeable and low permeability cap over the entirety of GAA F in the form of paved areas, biosparging, and the implementation of MNA, LUCs, and ECs/ICs.

8.7.6.1 Evaluation of Threshold Criteria for GAA F Alternative 3

Protection of Human Health and the Environment

Alternative 3 provides protection of human health by capping GAA F to prevent exposure of future occupants to contaminated soil and prevent downward surface and stormwater infiltration, thereby reducing infiltration and minimizing migration of dissolved phase contamination. Human exposure to aromatic contaminants in groundwater will be prevented in the short and long term through LUCs and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.

Contaminant mass of SVOCs and VOCs will be reduced via biosparging, thereby reducing the potential for human exposure. Additionally, long-term groundwater concentrations may decrease due to natural attenuation, monitored per the current semi-annual landfill sampling program. LUCs and ICs protect human health through limiting use of the Site and preventing, and/or limiting exposure to onsite media. The development of a HASP for future utility workers or construction workers mitigates exposure risks by providing proper handling procedures for impacted material. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA.

Achievement of Media Objectives

Alternative 3 reduces the potential for impacted soil to act as a continuing source to groundwater through a combination of hot spot removal and installation of an impermeable and low permeability cap. This also expedites natural attenuation in groundwater of aromatic VOCs and SVOCs, helping meet CAOs in a shorter timeframe. Additionally, biosparging can decrease non-slag related contaminant concentrations in groundwater via destruction to expedite cleanup timeframe. MNA provides a route to documenting and demonstrating reductions in groundwater

concentrations, and confirmation that caps are successfully inhibiting additional impacts to groundwater. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater. With this alternative, Final RGs are expected to be reached via promoting contaminant degradation through biosparging and plume stability through MNA. The engineered cap will prevent stormwater infiltration, contributing to overall reduction of benzene and naphthalene concentrations in groundwater over time.

Source Control

Alternative 3 includes capping of the area which reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. In addition to capping, excavation of residual NAPL in GAA F will further reduce contaminant sources and enhance the overall effectiveness of the remedy. Additionally, biosparging can decrease non-slag related contaminant concentrations in GW.

8.7.6.2 Evaluation of Balancing Criteria for GAA F Alternative 3

Long-Term Effectiveness

Alternative 3 would provide long-term effectiveness through source capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. Biosparging will increase the rate of destruction of non-slag related contaminants. Biosparging would likely require injections for many years to reach Final RGs. Risks from residual contamination would be low given ICs and ECs. MNA will document the reduction in concentrations of the non-slag related contaminants in groundwater and provides a way to analyze the long-term effectiveness of ECs and ICs. Once controls are installed, the continued maintenance of capped areas will increase the long-term effectiveness of reductions in vadose zone soil to groundwater pathways. Risks to human receptors from residual contamination would be managed during the attenuation period through properly administered, monitored, and maintained ICs (including LUCs) and ECs. Removal of NAPL impacted soils will likely decrease migration of NAPL but may take a significant amount of time to completely stop this from occurring.

Reduction of Toxicity, Mobility, and Volume

Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Excavation of residual NAPL in GAA F will further reduce the source contamination. Additionally, reduction in toxicity and volume will be achieved via degradation of contaminants with the application of biosparging, and subsequent natural attenuation. Reduction of groundwater contamination will be documented and analyzed via MNA.

Short-Term Effectiveness

Alternative 3 provides short-term effectiveness by removing source material through targeted excavation, which reduces contaminant mass and minimizes the potential for continued leaching to groundwater. Additional short-term benefit is achieved through construction of an engineered cap, which immediately limits infiltration and reduces the pathway between the vadose zone and groundwater, helping to prevent mobilization of contaminants. Implementation of LUCs and ICs further reduces potential exposure by restricting groundwater use and limiting intrusive activities. Although biosparging may improve remediation timeframe and enhance long-term contaminant reduction by stimulating aerobic degradation of COCs such as benzene and naphthalene, it faces implementability challenges due to low permeability soil lenses, naturally reducing groundwater conditions, and elevated pH levels. The short-term effectiveness of the remedy will be assessed through routine inspections of engineering controls and early groundwater monitoring to confirm that excavation, capping, and other controls are functioning as intended. These actions will stabilize site conditions and support progress toward achieving Final RGs over time.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of biosparge injection wells and monitoring wells. O&M costs include implementation of biosparge for 5 years and the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $336,000
- Present Worth of Annual O&M Costs: $674,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $1,021,000

Implementability

This alternative is considered challenging to implement. Biosparging will face significant challenges related to elevated pH, dissolved oxygen demand, and development schedule. Development activities planned for this area may prevent access for the installation and operation of an active remediation system. Low permeability zones may be difficult to address. Introduction of a pH buffer may be required due to the high pH in the groundwater.

Community Acceptance

This alternative should have community acceptance as it is protective of human health. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.7.7 Evaluation of GAA F Alternative 4

Alternative 4 involves excavation, the construction of an impermeable and low permeability cap over the entirety of GAA F in the form of paved areas, ISCO injections, and the implementation of MNA, LUCs, and ECs/ICs.

8.7.7.1 Evaluation of Threshold Criteria for GAA F Alternative 4

Protection of Human Health and the Environment

Alternative 4 provides protection of human health by capping GAA F to prevent exposure of future occupants to contaminated soil and prevent downward surface and stormwater infiltration, thereby reducing infiltration and minimizing migration of dissolved phase contamination. Human exposure to aromatic contaminants in groundwater will be prevented in the short and long term through LUCs and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.

Contaminant mass of SVOCs and VOCs will be reduced via ISCO, thereby reducing the potential for human exposure. Additionally, long-term groundwater concentrations may decrease due to natural attenuation, monitored per the current semi-annual landfill sampling program. LUCs and ICs protect human health through limiting use of the Site and preventing, and/or limiting exposure to onsite media. Additionally, the development of a HASP for future utility workers or construction workers mitigates exposure risks by providing proper handling procedures for impacted material. LUCs and ICs will provide protection of human health during the time required to meet Final RGs through MNA. Manganese is a slag related contaminant and is addressed in the TI Waiver.

Achievement of Media Objectives

Alternative 4 reduces the potential for impacted soil to act as a continuing source to groundwater through a combination of hot spot removal and installation of an impermeable and low permeability cap. This containment also expedites natural attenuation in groundwater of aromatic VOCs and SVOCs, helping meet CAOs in a shorter timeframe. ISCO can decrease concentrations of contaminants in groundwater via destruction to expedite cleanup timeframe. MNA provides a route to documenting and demonstrating reductions in groundwater concentrations, and

confirmation that caps are successfully inhibiting additional impacts to groundwater. MNA monitoring (to occur after completion of active remediation) will provide a route to document and demonstrate reductions in groundwater contaminant concentrations and confirm that the cap is successfully inhibiting additional impacts to groundwater. With this alternative, Final RGs are expected to be reached via direct contaminant destruction through ISCO and natural contaminant degradation through MNA. The engineered cap will reduce the potential for ongoing contaminant migration, supporting overall source control and long-term attainment of Final RGs.

Source Control

Alternative 4 includes capping of the area which reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. In addition to capping, excavation of residual NAPL in GAA F will further reduce contaminant sources and enhance the overall effectiveness of the remedy. ISCO may address contaminant groundwater impacts.

8.7.7.2 Evaluation of Balancing Criteria for GAA F Alternative 4

Long-Term Effectiveness

Alternative 4 would provide long-term effectiveness through source capping, substantially reducing potential exposure and the potential for migration of contaminants to groundwater. ISCO would increase the rate of destruction of non-slag related contaminants. ISCO injections would likely require quarterly injections for many years to reach Final RGs. Risks from residual contamination would be low given ICs and LUCs. MNA will document the reduction in concentrations of the non-slag related contaminants in groundwater and provides a way to analyze the long-term effectiveness of ECs and ICs. Once controls are installed, the continued maintenance of capped areas will increase the long-term effectiveness of reductions in vadose zone soil to groundwater pathways. Risks to human receptors from residual contamination would be managed during the attenuation period through properly administered, monitored, and maintained ICs (including LUCs) and ECs. Removal of NAPL impacted soils will decrease migration of NAPL.

Reduction of Toxicity, Mobility, and Volume

Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Excavation of residual NAPL in GAA F will further reduce the source contamination. Additionally, reduction in toxicity and volume will be achieved via degradation of contaminants with the application of ISCO, and subsequent natural attenuation. Reduction of groundwater contamination will be documented and analyzed via MNA.

Short-Term Effectiveness

Alternative 4 provides short-term effectiveness by removing source material through targeted excavation, which reduces contaminant mass and minimizes the potential for continued leaching to groundwater. Additional short-term benefit is achieved through construction of an engineered

cap, which immediately limits infiltration and reduces the pathway between the vadose zone and groundwater, helping to prevent mobilization of contaminants. Implementation of LUCs and ICs further reduces potential exposure by restricting groundwater use and limiting intrusive activities. ISCO will enhance short-term contaminant reduction by directly oxidizing COCs such as benzene and naphthalene in the subsurface, its long-term effectiveness may be limited by implementation challenges associated with the presence of low-permeability zones that restrict oxidant distribution. Additionally, ISCO may alter local geochemistry in ways that mobilize slag-related constituents. The short-term effectiveness of the remedy will be assessed through routine inspections of engineering controls and early groundwater monitoring to confirm that excavation, capping, and other controls are functioning as intended. These actions will stabilize site conditions and support progress toward achieving Final RGs over time.

Cost

Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of ISCO injection wells and monitoring wells. O&M costs include implementation of semi-annual ISCO injections for 2 years and the MNA sampling plan and will be adjusted based on edits to the *Coke Point Area Sampling and Analysis Plan*. An itemized breakdown of the cost estimates can be found in **Appendix I**.

- Capital Costs: $144,000
- Present Worth of Annual O&M Costs: $647,000
- Present Worth of Periodic Costs: $11,000
- Total Present Worth: $802,000

Implementability

This alternative is considered challenging to implement. ISCO would take place via injections on a regular basis to address the contaminant plumes. Development activities planned for this area may prevent access for the installation and operation of an active remediation system. Low permeability zones may be difficult to address. The average SOD was measured at other areas on Coke Point and observed at 5.5 g/kg soil, with a range of 0.6-15 g/kg soil. Introduction of a pH buffer may be required due to the high pH in the groundwater.

Community Acceptance

This alternative should have community acceptance as it is protective of human health via contaminant mass reduction by ISCO injection. However, injection of oxidant may be less appealing to the community due to its reactive nature. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site investigation and redevelopment process. Several of the proposed LUCs (including ICs and ECs) are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.7.8 Comparative Analysis of Remedial Alternatives

This section compares the remedial alternatives to one another against each of the threshold and balancing criteria. The purpose of this comparison is to identify the relative advantages and disadvantages of each alternative. The four remedial alternatives compared are:

- Alternative 1: No Action
- Alternative 2: Excavation, Capping, MNA, and ECs/ICs
- Alternative 3: Excavation, Biosparging, Capping, MNA, and ECs/ICs
- Alternative 4: Excavation, ISCO, Capping, MNA, and ECs/ICs

8.7.8.1 Comparative Analysis of Threshold Criteria

Protection of Human Health and the Environment

While Alternative 1 does not provide protection of human health, Alternatives 2, 3, and 4 do. Alternatives 2, 3, and 4 provide protection of human health using ICs (including LUCs) and ECs, which prevent human exposure to contaminants identified in GAA F. Alternatives 2, 3, and 4 also provide protection of human health via capping, which mitigates on-site human exposure. Capping also prevents stormwater infiltration and contaminant mobilization from the vadose zone, decreasing the timeframe for MNA and reducing risk of off-site contaminant migration. Alternative 2 relies on natural attenuation of contaminants in groundwater, while reducing and eliminating ways in which humans or the environment (nearby surface waters) may be exposed to contaminants during the attenuation period. Alternatives 3 and 4 achieve similar human health protections as Alternative 2, however at higher cost, potentially longer implementation timelines, and increased worker risks. Protection of human health and the environment via ICs (including LUCs), ECs, capping, and MNA will likely be sufficient.

Achievement of Media Objectives

Although it is expected that natural attenuation of contaminants in groundwater will occur under Alternative 1, the lack of performance monitoring will preclude the ability to evaluate progress toward achievement of the CAOs and Final RGs. The implementation of Alternatives 2, 3, and 4 will achieve media objectives through targeted source removal via excavation and installation of

an impermeable cap, which will reduce the potential for impacted soil and residual NAPL to act as continuing sources to groundwater. These measures will help stabilize the plume and support natural attenuation of COCs, particularly benzene and naphthalene, the primary drivers of groundwater impacts in GAA F. These alternatives include monitoring that will provide the data necessary to evaluate progress toward reducing COC concentrations and confirm the effectiveness of engineering and institutional controls. Alternative 2 is designed to ultimately achieve Final RGs by reducing groundwater contaminant concentrations through a combination of source control and MNA. Alternatives 3 and 4 incorporate active remediation (biosparging and ISCO) to enhance contaminant reduction. Local challenges, including subsurface heterogeneity, elevated pH, and reducing groundwater conditions may limit the effectiveness and implementability of these technologies. While Alternatives 3 and 4 may potentially accelerate the timeframe to meet Final RGs, Alternative 2 offers a remedy in which achievement of media objectives are more possible under the existing site conditions.

Source Control

Alternatives 2, 3, and 4 provide a form of source control through capping and excavation. This will reduce the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. Statistical analysis of groundwater contaminant concentrations (*Coke Point and Greys Landfill Groundwater Monitoring Report*, 2014) showcases stable contaminant concentrations over time in GAA F, suggesting limited mobility of contaminant plumes. Thus, capping will assist in natural attenuation rates by preventing recharge of contaminants sourced from the vadose zone. Alternatives 3 and 4 may address the potential source via direct destruction; however, contaminants in GAA F are already attenuating toward surface water and active remediation in this area will likely not significantly decrease the timeframe to reach site CAOs, past what MNA can achieve.

8.7.8.2 Comparative Analysis of Balancing Criteria

Long-Term Effectiveness

Alternatives 2, 3, and 4 provide long-term effectiveness due to the installation of impermeable and low permeability capping and minimization of subsurface disturbance. The local geology, characterized by lenses of low permeability zones, may pose challenges to the long-term effectiveness of Alternatives 3 and 4. Challenges associated with pH and redox conditions of the local aquifer may result in extraneous costs and timing impacts, ultimately impacting the long-term effectiveness of Alternatives 3 and 4.

Reduction of Toxicity, Mobility, and Volume

Toxicity, mobility, and volume of contaminants will be reduced through Alternatives 2, 3, and 4. These alternatives include impermeable and low permeability capping and excavation within the GAA F to reduce mobility of the contaminants from the vadose zone to groundwater. Implementation of biosparge or ISCO may increase the mobility of the non-slag and slag related

contaminants. Alternatives 3 and 4 include biological and chemical changes driven within the subsurface that may influence the mobility and concentration (toxicity) of the slag related contaminants in GAA F.

Short-Term Effectiveness

Alternatives 2, 3, and 4 provide immediate protection through the removal of residual NAPL via excavation and the construction of a low permeability cap, which together reduce exposure. These measures stabilize site conditions and help prevent further contaminant migration during remedy implementation. All three alternatives include LUCs and ICs to further restrict potential exposures by limiting intrusive activities and groundwater use. Alternative 2 offers the most immediately implementable approach, with minimal additional short-term risk. Alternatives 3 and 4 include active treatment components (biosparging and ISCO) that may also require sufficiently long timeframes to reach Final RGs and will likely face short-term implementation challenges due to subsurface heterogeneity, elevated groundwater pH, and potential geochemical shifts. While these technologies aim to enhance long-term performance, they do not significantly increase short-term effectiveness. All three alternatives are designed to initiate conditions that support progress toward achieving Final RGs by reducing contaminant mass, limiting mobilization, and promoting attenuation.

Cost

Alternative 2 provides the most cost-effective option to reach the CAOs. Alternatives 3 and 4 require extensive amounts of capital and operational costs making these options the least cost-effective.

Implementability

Alternatives 3 and 4 will require treatability studies and / or pilot scale installations to establish feasibility in high pH groundwater and low permeability lenses. It is likely that Alternatives 3 and 4 will not achieve Site CAOs in a shorter timeframe than Alternative 2. Alternative 2 can be implemented in concert with the development schedule for this area.

Community Acceptance

Alternatives 2, 3, and 4 should have community acceptance as they are all protective of human health. Alternative 4 may be less acceptable due to the transportation and use of oxidant. Selected alternatives will be included in a public comment period to enable meaningful community involvement.

State Acceptance

All corrective measures will be implemented under Agency-approved plans, proper permits, will comply with MDE VCP criteria, and meet water quality standards. The Agencies have been involved throughout the Site Investigation and redevelopment process. Several of the ICs (including LUCs) and ECs are already committed at specific parcels and are generally recognized as commonly employed measures for long-term stewardship. Ultimately, the Agencies' support

will be based on professional judgement and the evaluation of the relevant information received during the review period.

8.7.9 Preferred Remedial Alternative

Based on the results of the threshold and balancing analysis, GAA F Alternative 2: Excavation, Capping, MNA, and ECs/ICs is recommended as the preferred remedial alternative to achieve Site CAOs in GAA F. The following reasons are presented for the selection of Alternative 2:

- Capping of GAA F will occur via development. The cap will prevent exposure to onsite receptors. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via a soil gas testing program to be submitted to and approved by the Agencies.
- Excavation of residual NAPL at B11-026-MWS in GAA F will further reduce contaminant source, complementing the capping and enhancing overall contaminant control.
- Semi-annual sampling of wells noted in the Coke Point and Greys Landfill Groundwater Monitoring Report since 2014 has consistently shown no sign of statistically significant increasing trends of contaminants. This supports that these plumes are stable and MNA is an appropriate remedial approach for residual groundwater contamination following proposed excavation of NAPL.
- Progress toward Final RGs is expected under Alternative 2 through a combination of source reduction, reducing cross-media transfer from soil to groundwater via capping, and MNA of groundwater contaminants.
- Implementation of ICs (including LUCs) and ECs in this area and across the site provide protection of human health.
- Alternative 2 is the most implementable and cost-effective approach of the alternatives. Alternatives 3 and 4 pose significant implementability challenges that introduce uncertainty about effectiveness.
- Alternative 2 provides protection of human health and the environment while best facilitating redevelopment and reuse of the GAA.

8.7.10 Contingency Remedial Criteria

Alternative 2 will be implemented in GAA F with sampling completed as described in the *Coke Point Area Sampling and Analysis Plan*. Following recommendations from USEPA's *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites* (April 1999), contingency measures are identified as part of the preferred alternative. Despite the observance of largely decreasing or stable contaminant concentrations in groundwater, specific criteria are established in the event that the expected trends in contaminant concentrations are not observed.

The *Coke Point Area Sampling and Analysis Plan* includes identification of monitoring wells within GAA F that will be regularly sampled to determine the effect of the source control remedies

implemented at GAA F. The data collected from these wells will undergo statistical analysis to identify trends in contaminant concentrations. The statistical methods used to develop trends and subsequent data interpretation and reporting are further discussed in the *Coke Point Area Sampling and Analysis Plan*. The results of the statistical trend analysis will inform the need for additional evaluation. Specifically, the following USEPA identified triggers will be applied to the results of the statistical analysis:

- Statistically significant increasing trends not originally predicted during remedy selection; and
- Contaminants identified in a statistically significant increasing trend at wells where there was previously a decreasing trend or no trend.

If any of the triggers are met, further evaluation will occur, potentially involving more sampling, evaluation of geochemical and biological conditions, reassessment of remediation timelines, or further site investigation to pinpoint the potential new sources causing rising concentrations. Similarly, the statistical analysis will be used to help determine when Site CAOs are met and sampling can cease.

Given the current data available for GAA F, a contingency approach will be identified based on this alternative analysis. However, additional field tests and evaluations will be necessary to inform the new contingency alternative.

9.0 TECHNICAL IMPRACTICABILITY OF REMEDIATING SLAG FILL

Although the slag fill described in **Section 2.1.3** is unrelated to releases from the RCRA regulated units or SWMUs, slag-related conditions in soil and groundwater have been investigated and defined at the site. The impacts related to the slag fill have been incorporated into this CMS for evaluation as a background condition.

USEPA policy for groundwater cleanup at RCRA Corrective Action facilities is to return usable groundwater to its maximum beneficial use in a timeframe that is reasonable given the circumstances of the site. A determination of maximum beneficial use is based on how groundwater is used or could be used and should also be based on the hydrogeologic and geochemical characteristics of the groundwater aquifer. As discussed in **Section 3.0**, the USEPA concluded in its 2018 memo (included in **Appendix A**) that drinking water use can be excluded when developing groundwater cleanup levels for the Site. This determination was based on several factors, including excess TDS levels, both low and high pH in groundwater, hydrogeologic limitations, the presence of non-natural slag fill contributing cobalt, iron, manganese, and vanadium, and saltwater intrusion leading to elevated chloride concentrations. The USEPA indicated in the 2018 memo that maximum beneficial use of shallow and intermediate groundwater at Sparrows Point is limited to industrial / commercial use, including dewatering, testing, observation and monitoring.

As discussed in **Section 2.1.4**, there is no ongoing use of groundwater beneath the site, extraction occurs only for construction or remedial purposes. All other onsite groundwater uses will be prohibited under an Environmental Covenant, which will be recorded as part of the Final Comprehensive No Further Action letter from the MDE. **Section 3.6** summarizes the Final RGs developed for the site, which are based on hypothetical exposure pathways, estimated cumulative non-cancer hazard and cancer risk, and the restoration of groundwater.

The uppermost stratigraphic unit at the Site consists entirely of slag fill. Based on the horizontal and vertical extent and the substantial volume of slag fill at the Site, there are limited GRAs that can be practicably implemented to address slag-related impacts. Due to these limitations, this TI evaluation was conducted to develop an alternative remedial strategy for addressing exceedances of Final RGs for slag-related constituents in groundwater at the site.

This TI evaluation was conducted in accordance with USEPA's *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action* (2004) and the *Guidance for Evaluating the Technical Impracticability of Groundwater Restoration* (USEPA 1993). These guidance documents provide a recommended framework for technically justifying restoration limitations and focusing remediation resources on protective alternative remedial strategies.

9.1 NATURE AND EXTENT OF SLAG

As discussed in **Section 2**, slag fill was used extensively on the TPA Property beginning in the early 1900s and continuing until the 1980s to make new land, reclaim land, raise existing

elevations, and create level grades. The Site is a man-made peninsula in the southwestern portion of the TPA Property, includes Parcels B10, B11, B12, and B18, and consists of approximately 344.8 acres. The Site defined in this CMS covers only a portion of the Slag-Fill Unit that exists on the larger TPA Property. The Slag-Fill Units extends across the 3100-acre property and exhibits the same variable composition across the property. Boring logs show the thickness of the slag fill in the CPA to vary significantly, but on average is approximately 20 to 30 feet. Using the Slag Fill Isopach Map previously produced by CH2M Hill (refer to **Appendix H-1**), the low range estimated volume of slag on the CPA alone is approximately 12 million cubic yards. For purposes of this discussion, a 20% bulking factor has been added to estimate a high range for excavation purposes, providing a slag estimate of 12 million to 15 million cubic yards. Using a similar method, it is estimated that the larger TPA Property includes 49 million to 59 million cubic yards of slag fill. Although this CMS strictly covers the Coke Point Area, it should be noted that the Slag-Fill Unit present on the CPA peninsula is the same unit covering most of Sparrows Point.

This fill extends beyond the shoreline of the current extent of the property into surrounding surface water bodies. Through cross-referencing the following sources, slag is estimated to extend up to 0.3 miles beyond the current shoreline: 2012 Nautical Charts showing filled areas, observations recorded of hard and soft sediment bottoms during pore water sampling in 2019 (ARM, 2019a), observations and cross sections recorded by Key during offshore sampling (Key, 2009). Although detailed estimates of the extent of slag fill have not been generated for the entire shoreline, it is anticipated that slag extends into surface water to a comparable extent in areas where slag was used to make or reclaim land area. Slag fill is in direct communication with surface water and groundwater, pore water and sediments in surrounding water bodies.

The primary groundwater COC, specific to the CPA, related to slag fill is iron. Iron is commonly detected in environmental media across the CPA due to the widespread presence of slag material that was used for made land. Iron was detected in 88% of groundwater samples collected for the CPA CMS and analyzed for metals. These data are inclusive of Gap Analysis samples collected in 2025. The screening evaluation described in Section 3 identified two shoreline wells, CP22-MWI and CO30-PZM060, where iron concentrations exceeded ecological screening levels and the Final RG of 22,500 µg/L, with maximum concentrations of 205,000 µg/L and 50,100 µg/L, respectively. The Final RG for iron is based on the potential for detrimental ecological effects resulting from groundwater discharge to sediment pore water, which serves as the point of compliance. While iron only exceeds the Final RG at two locations, the widespread presence of slag fill (the source of iron impacts) makes targeted treatment impracticable.

In addition, the slag fill has resulted in impact to the pH of the groundwater in the shallow and intermediate zones, resulting in significant areas of the site characterized by groundwater at pH of over 10 standard units (**Figures 6 and 7**). Additional details regarding the distribution of slag-related contaminants are located in **Section 9.2**.

9.2 Site-Specific Conditions Contributing to Impracticability of Groundwater Restoration

The 2004 USEPA Guidance Document lists two primary factors that support regulatory approval of a TI request. Reasons for TI generally fall into one of two categories:

1. Contaminant-related factors; or
2. Hydrogeologic factors.

Table 42 presents a Generalized Remediation Difficulty Scale adapted from Figure 1 of *Guidance for Evaluating the Technical Impracticability of Groundwater Restoration* (USEPA, 1993). The table presents a high-level summary of the site-specific factors which limit the effectiveness of subsurface remediation and critically limit restoration potential. Additional detail regarding these factors is presented in **Sections 9.2.1** and **9.2.2**, below.

9.2.1 Contaminant-Related Factors

9.2.1.1 Site Use

The Site is located in the southwestern portion of the TPA Property and comprises Parcels B10, B11, B12, and B18. **Figure 2** shows the location and boundaries of the CPA. This CPA CMS Report addresses groundwater impacts identified on the Site and excludes the larger Sparrows Point and historical offshore impacts. In total, the area covered by this CPA CMS is approximately 344.8 acres. As discussed in **Section 2.1**, the CPA has an extensive history of heavy industrial use.

The Site is currently undergoing assessment and remediation for redevelopment as a logistical intermodal facility. The Master Plan for the facility involves the construction of a container terminal and warehouses each covering approximately 2,000,000 square feet. Various ancillary structures will also be constructed to support operations. The redevelopment on the CPA is anticipated to begin in 2025.

As noted, residential land use will be precluded under future land use scenarios. Groundwater underlying the Site is unsuitable for use, and all other onsite groundwater uses will be prohibited under an Environmental Covenant.

9.2.1.2 Contaminant Distribution

The widespread distribution of metals within the extensive volume of slag fill across the TPA property is the primary contaminant-related factor limiting the technical practicability of restoring groundwater throughout the area. Sampling at the facility has identified impacts from slag in groundwater at concentrations exceeding Final RGs for iron (refer to **Figure 31I**). Additionally, iron has been detected in soil at concentrations exceeding SSLs for migration to groundwater (refer to **Figure 32D**). Other slag-related metals, including manganese, cobalt, and vanadium, are also common in shallow and intermediate groundwater across the TPA property. For groundwater

samples with metals analysis included in this CPA CMS (inclusive of 2025 Gap Analysis samples), manganese was detected in 93% of samples, vanadium in 47%, and cobalt in 38%. Although Final RGs have not been established for these other metals, the high detection frequencies highlight the extensive and widespread impact of slag fill on groundwater quality throughout the CPA. Soil sampling indicates there is no discrete area on the CPA in which slag-related metals are concentrated.

Iron in Soil/Slag Fill

For the CPA, potential corrective actions for soil and slag fill are limited to addressing potential cross-media contamination (i.e., impact to groundwater by leaching of contaminants and subsequent migration to sediments, pore water, and surface water). As shown on **Figure 32D**, most soil samples collected on the western portion of the Site contain concentrations of iron exceeding SSLs for migration to groundwater (10 times the calculated SSL). A comparison of the analytical data for iron in soil against the SSLs is provided in **E-Attachment #2**.

Iron in Groundwater and Pore Water

As shown on **Figure 31I**, slag-related metal exceedances in groundwater on the CPA are associated with iron. The exceedances of Final RGs reflect locations in which iron exceeds ecological standards. Iron was detected in 88% of groundwater samples collected for the evaluation of metals, indicating that iron is widely and spatially distributed. In July 2025, pore water sampling was conducted in Coke Point Cove at four locations offshore of wells that had previously exceeded the Final RG for iron in groundwater, which is based on potential ecological effects. Iron concentrations in three of the four pore water samples exceeded the U.S. EPA Region 4 Biological Technical Assistance Group (BTAG) marine surface water benchmark of 300 µg/L, with results of 446 µg/L, 7,910 µg/L, and 806 µg/L, respectively. All results are included in the *Supplemental Sampling of Iron in Pore Water in the Coke Point Area* (EA, 2025c); the report is included in **E-Attachment #7**. These data demonstrate that slag-related impacts are related to the large extent of slag which is known to extend offshore of the CPA. The extensive distribution of slag significantly increases the volume of slag that would need to be remediated to meet Final RGs in pore water as the material extends beyond the CPA.

The distribution of analytical detections of slag-related metals throughout the CPA is consistent with historical placement of the extensive distribution of slag fill used to extend the peninsula, fill in historical estuaries, raise grades, and level the ground elevation for prior steel making operations**.**

Alkaline pH in Groundwater

As discussed in **Section 2.1.3**, groundwater with elevated pH concentrations is encountered throughout the CPA. The pH values in the shallow zone are indicative of the groundwater being present in slag fill within a substantial portion of the CPA (i.e., pH greater than 10). The general pH concentration in the intermediate zone is within the acceptable range for groundwater use (between 4 and 10). **Figures 6 and 7** illustrate the pH values in the shallow and intermediate

aquifers, respectively. A summary of groundwater field parameters observed during groundwater sampling, including pH measurements, is provided in **E-Attachment #4**.

9.2.1.3 Chemical Properties

The chemical form of inorganic constituents influences its solubility, mobility, and toxicity in groundwater. Unlike many organic contaminants in groundwater, the inorganic constituents associated with slag fill cannot be destroyed through biotic or abiotic processes, which limits the viable technologies available for restoration of the groundwater. The mobility of metals in groundwater systems is hindered by reactions that cause metals to adsorb or precipitate, or geochemistry that tends to keep metals associated with the solid phase and prevent them from dissolving into the groundwater. The sorption potential for metals in groundwater is largely dependent on pH and reduction/oxidation (REDOX) conditions. In general, acidic conditions in the groundwater tend to allow for more dissolution of metals, while alkaline conditions inhibit dissolution. Further, dissolved metals generally tend to be more prevalent in reducing environments, as opposed to an oxidizing environment. Collectively, these mechanisms can retard the movement of metals and provide a long-term source of metal contaminants (NRC, 1994). While the various metals undergo similar reactions in a number of aspects, the extent and nature of these reactions varies depending on particular conditions.

The pH of groundwater is alkaline because of the use of extensive quantities of lime during the steel-making process. The large volume of slag fill source material makes pH adjustment in the groundwater infeasible. Further, natural organic soils common along shorelines resulting in largely reducing conditions within the groundwater make the adjustment of REDOX conditions technically challenging. Permanent modification of geochemical conditions in the groundwater is impractical as long as organic material, which has likely been present in the area since before the original filling that coincided with the development of the property as a steel mill in the early 20th century, remains present in quantities sufficient to maintain a reducing environment in the uppermost aquifer.

9.2.2 **Hydrogeologic Factors**

9.2.2.1 Geology

The second category of factors that support TI determinations is hydrogeologic factors. The hydrogeologic factor impacting the ability to effectively restore the aquifer via treatment of the groundwater is the heterogeneous nature of the soils within the slag fill unit, as well as the native soil units located amongst and immediately beneath the slag fill. This unit has been identified in historical reports as the Talbot Formation. The Talbot Formation features a wide range of soil textures, from sand to finer silty clay, which contrasts with the coarser texture of the slag fill. The slag fill typically contains a significant proportion of gravel mixed with finer materials. This heterogeneous texture contributes to the wide range of hydraulic conductivity observed in

historical testing of wells and piezometers screened in the slag fill, with values ranging from 10^{-2} to 10^{-5} cm/sec (URS, 2005). More recent analysis has identified hydraulic conductivity at 10^{-8} cm/sec.

The lateral and vertical extent, combined with the stratigraphy and heterogeneity of the slag fill and native soil deposits, presents significant engineering challenges for implementing in-situ and ex-situ treatment technologies. These challenges include difficulties in achieving uniform injection of reactants or bulk groundwater extraction. For example, addressing extreme pH conditions or managing inconsistent radii of influence for injection/extraction wells can complicate design and limit the effectiveness of such technologies across a large area. Additionally, the success of in-situ treatments or extraction relies on overcoming the challenge of identifying and accessing discontinuous sand, silt, and clay stringers inherent to the interbedded and heterogeneous hydrogeologic settings at Sparrows Point.

9.2.2.2 Hydraulic Flow

Groundwater flow in the uppermost aquifer is described in the CSM (refer to **Section 3**). The magnitude of a theoretical capture zone will increase the difficulty of GWPT technologies when applying these technologies over an extremely large area.

Excavating and removing the slag fill source material on a large scale, including substantial quantities extending more than 10 feet below the water table, would require extensive dewatering and treatment activities. Additionally, geotechnical engineering would be necessary to source and place structural fill to replace the excavated material. Hydraulic conductivity testing of the slag fill, ranging from 10^{-2} cm/sec to 10^{-8} cm/sec, highlights the heterogeneity of these soils. The highly conductive layers, coupled with the need for extensive drawdown exceeding 10 feet, would make lowering the water table and properly compacting structural backfill both energy- and cost-intensive.

9.3 Regulatory Framework for TI Decisions

In accordance with USEPA TI guidance, the basis for TI decisions discussed in this guidance are provided in the Proposed Subpart S rule for the RCRA program. The primary considerations for determining the TI of achieving cleanup levels for site-specific COCs are based on:

1) Engineering feasibility; and
2) Reliability.

This determination involves a consideration of the "engineering feasibility and reliability" of attaining media cleanup standards, as well as situations where remediation may be "technically possible," but the "scale of the operations required might be of such a magnitude and complexity that the alternative would be impracticable."

The engineering feasibility and reliability of various remedial technologies was evaluated in accordance with the RCRA General Standards for Remedies (USEPA, 1993), which includes:

1) Overall protection of human health and the environment
2) Attainment of media cleanup standards
3) Source control
4) Compliance with waste management standards

A detailed evaluation of the GRAs and evaluation of potential remedial technologies and process options for the slag fill is presented in **Table 43**. As shown on **Table 43,** most response actions were ruled out at this stage of the evaluation due to the site-specific conditions outlined in **Table 42** and discussed above.

It is clear based on the contaminant-related and hydrogeologic factors that it is technically impracticable to meet the Final RGs for iron, as well as pH and salinity conditions. Identified resource restoration cleanup levels should not apply and the alternative remedial strategy should be to mitigate risk by implementing institutional controls to prevent hypothetical and unexpected groundwater use, and to select remedial alternatives that will address the risk associated with other identified potential exposures.

9.4 Extent of TI Zone

Given the extensive footprint over which the slag fill has been placed, the spatial area over which the TI decision would apply will include the entirety of the CPA which has been impacted by slag fill, including onsite and shoreline areas where slag fill has been placed. Based on review of geological cross sections (refer to **Figures 26D–H**), the vertical extent of the TI zone encompasses the underlying water-bearing units to which it is hydraulically connected. Slag fill is present across the CPA, ranging from approximately +11 to –42 feet AMSL, and varies by location (averages +10 to -20 feet AMSL). The shallow groundwater zone is generally in direct contact with the slag fill and ends at approximately –20 feet AMSL. Direct contact between the slag fill and the intermediate groundwater zone occurs only in limited areas (observed at CO181-MWI, CO38-PZM043, and COA-MWI-011). In these areas, the direct hydraulic connection provides a pathway for slag-related constituents to enter the intermediate zone. Therefore, for purposes of the TI evaluation, the vertical extent is defined from the ground surface (top of slag) to the base of the intermediate groundwater zone, which occurs at approximately –50 feet AMSL.

9.5 Development of Alternative Remedial Strategy

EPA's TI guidance (1993) outlines three types of strategies to consider during the development of alternative remedial strategies: prevention of exposure to contaminated groundwater; remediation of contamination sources, and remediation of aqueous contaminant plumes.

9.5.1 Source Control

EPA notes that sources should be treated or removed where feasible and where significant risk reduction will result. As discussed in **Table 43**, the slag material cannot feasibly be removed or treated due to the massive scale of the slag material, direct communication with groundwater,

surface water, pore water and sediments in surrounding water bodies. There may be some incidental benefit obtained from capping of soils containing RCRA-related COCs that may limit infiltration and further leaching of slag related constituents from the vadose zone; however, this benefit is limited due to the presence of slag fill in the saturated zone.

9.5.2 Aqueous Plume Remediation

In accordance with USEPA guidance, remediation of the aqueous plume is the third major technical concern of an alternative remedial strategy. As discussed in **Section 9.2**, several contaminant and hydrogeologic factors make active remediation of the aqueous plume technically impracticable. Although exceedances of the Final RGs for groundwater are minimal on the CPA there are significant exceedances of the slag-related groundwater criteria on the larger TPA property, a portion of which is located hydraulically upgradient of the CPA. In addition, the extensive volume of slag fill source material, located both within the vadose and upper saturated zone on the CPA and the larger TPA property, cannot reasonably be removed or contained to prevent migration of the COC to groundwater, remediation of the aqueous plume via an active technology is also impracticable. Leachable concentrations of iron are expected to deplete over time, enabling natural attenuation in groundwater; however, this cannot be guaranteed. Due to the large volume of source material, slow groundwater movement, and the gradual nature of attenuation processes like sorption and precipitation, it is uncertain but likely that this process will take decades or longer.

9.5.3 Cost Considerations for Slag Excavation

To support evaluation of remedial alternatives, a theoretical cost estimate for excavation and replacement of slag fill on the CPA has been developed. The volume of slag material on the CPA is estimated to be approximately 12 to 15 million cubic yards and defined in **Section 9.1**. The excavation cost was calculated using a rate of $15 per cubic yard, resulting in a total excavation cost of approximately $180 million to $225 million. In addition, the cost to import and place clean fill material to replace the excavated slag was estimated at $35 per cubic yard, with a total import cost of approximately $420 million to $525 million. Finally, an estimated cost for disposal of the slag fill, based on a unit rate of $40 per cubic yard, is approximately $480 million to $600 million. Combining these figures, the overall preliminary cost for slag removal and replacement is estimated to be $1,080 million to $1,350 million.

This cost estimate provides an understanding of the financial implications associated with slag removal and replacement and assists in evaluating the infeasibility of complete excavation and replacement of the slag on the CPA.

9.6 Technical Impracticability Determinations at Similar Sites

To further support this TI Evaluation, a search was performed to identify other comparable sites where similar technical impracticability determinations were granted. The USEPA's comprehensive document, "*Summary of Technical Impracticability Waivers at National Priorities*

List Sites", provides an overview of TI waivers issued under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This report compiled historical data on 91 TI waivers approved between 1988 and 2011 for groundwater or surface water at 85 National Priorities List (NPL) sites.

Section 3.0 of the referenced USEPA document highlights "site-specific conditions" as the third most common justification for TI waivers. Page 4 notes that 12 waivers were granted due to the presence of "a large source that could not be removed." Similarly, the extensive quantity of source material (slag fill) is a critical factor supporting this TI evaluation.

A remediation site in nearby New Jersey was referenced to support this TI Evaluation for the Site:

- Quanta Resources Superfund Site, Edgewater, NJ.

Quanta Resources - Edgewater, NJ

The "*Record of Decision (ROD), Operable Unit 1, Quanta Resources Corporation Site, Edgewater Borough, Bergan County, New Jersey*" issued by USEPA Region 2 in September 2011, highlights the evaluation of groundwater restoration alternatives to meet Applicable or Relevant and Appropriate Requirements (ARARs). USEPA concluded that no practicable alternatives could be implemented and invoked an ARAR waiver for the groundwater due to TI. This site, located in northern New Jersey along the banks of the Hudson River, encompasses low-lying tidal wetlands and estuaries significantly altered by extensive human development during the 19th century. The uppermost unconsolidated geology at the Quanta Resources site is comprised of up to 35 feet of non-native fill, including gravel, sand, silt, brick, wood, concrete fragments, coal, cinders, and slag. Elevated concentrations of arsenic and other metals are widespread in the fill material. These anthropogenic deposits were used to raise the topographic elevation of the tidal wetlands that dominated this area along the Hudson River until the mid-1800s. Like the CPA and larger TPA property, the Quanta Resources site features a substantial volume of fill material (including slag) used to raise the terrain, leading to inorganic impacts on groundwater.

The primary inorganic constituent of concern at the Quanta site was arsenic. While higher concentrations of metals were encountered near the former pyrite roasting areas associated with the acid plant, elevated metal concentrations consistently exceeded screening criteria across the site. These concentrations were attributed to the heterogeneous anthropogenic fill material, which included slag, coal, and cinders.

The ROD states that permanent restoration of groundwater conditions would require either removal of the fill material or control of site-wide geochemistry. However, the massive volume of fill material and extensive infrastructure made soil removal impracticable. Similarly, permanent modification of geochemical conditions was deemed infeasible due to the presence of organic material, including naturally occurring peat, which maintains a chemically reducing environment. Similar limitations exist at the CPA and larger TPA property, where elevated pH, reducing

conditions, and saltwater intrusion pose significant challenges to manipulating geochemical conditions.

Summary

The Quanta Resources site presents a precedent for granting a TI waiver where extensive slag and industrial fill caused widespread inorganic impacts. Like the CPA, the site contained thick, heterogeneous fill that included slag. USEPA determined groundwater restoration was impracticable due to the volume of fill and persistent geochemical conditions. At the CPA, while iron is the only slag-related COC, similar site conditions, including widespread slag fill and challenging groundwater chemistry, limit the feasibility of restoration.

9.6.1 Recommended Alternative Remedial Strategy

Given the engineering feasibility and reliability considerations, there are no options available for developing an alternative(s) for groundwater remedial strategy to address iron. The presence of slag along the property boundary and extending beyond the shoreline limits the ability to control potential migration of slag-related constituents in groundwater, as surface water and sediments are in direct contact with the slag fill. Given the exceedances of Final RGs for iron are related to ecological standards, the use of institutional or engineering controls is not applicable.

9.6.2 Point of Compliance

USEPA (2004) defines the point of compliance for groundwater as "where a facility should monitor groundwater quality and/or achieve specified cleanup levels to meet facility-specific goals." Under RCRA (40 CFR 264.95), the point of compliance is the point "at which the groundwater protection standard of Sec. 264.92 applies and at which monitoring must be conducted. The point of compliance is a vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units."

At the CPA, the point of compliance is pore water in adjacent sediments, which represents the location where compliance with standards based on potential ecological effects is assessed. Since slag fill extends into surrounding surface water bodies and groundwater remains within the slag fill up to the shoreline, pore water is impacted by slag-related constituents. This is evidenced in part by the challenges observed in collection of pore water samples located offshore of the CPA in which hardened sediment has been encountered, preventing the collection of usable pore water samples. It is not reasonably anticipated that compliance with Final RGs for iron in pore water can be achieved within the extent of slag fill at onshore and offshore locations of the CPA. Additionally, the cove area is not a critical habitat requiring remedial measures. Therefore, pore water located further out in the River is assumed to be unimpacted by slag-related iron and will act as the point of compliance for this TI.

10.0 REFERENCES

ARM Group, LLC (ARM) (2017). *Sitewide Groundwater Study Report.* August 11, 2017.

ARM (2018). *Assessment of Current Groundwater to Surface Water Discharges from the Coke Point Area*. October 12, 2018.

ARM (2019a). *Supplemental Offshore Investigation Work Plan, Revision 2*. July.

ARM (2019b). *Former Coke Oven Area Interim Measures Supplemental Investigation Report*. Revision 0 – August 2, 2019.

ARM (2020a). *No. 10 Tank Area Investigation Report, Area B: Parcel B18*. January 6, 2020.

ARM (2020b). *Phase II Investigation Report, Area B: Parcel B18*. Revision 0 – August 30, 2020.

ARM (2020c). *Phase II Investigation Report, Area B: Parcel B11*. Revision 0 – December 22, 2020.

ARM (2021a). *Coke Point Area Corrective Measures Study Investigation Report*. Revision 2 – February 23, 2021.

ARM (2021b). *NAPL Delineation Completion Report, B11-026-PZ*. April 27, 2021.

ARM (2021c). *Former Coke Oven Area Northeast Delineation Letter Report.* Revision 1. December 9, 2021.

ARM (2022a). *Parcel B18 Lead Excavation Work Plan*. January 20.

ARM (2022b). *COA Cell 6 Hotspot Excavation Work Plan***.** December 12.

ARM (2023a). *Parcel B18 Lead Excavation Completion Report, Revision 2*. August 1.

ARM (2023b). *COA Cell 6 Pilot Test Work Plan, Revision 1***.** October 25.

ARM (2023c). *CPA Combined Delineation Interim Report (Revision 1).* November 30.

ARM (2024a). *Coke Point Container Terminal Interim Status Updates*. January 4.

ARM (2024b). *COA Cell 6 Pilot Test Status Update – Revision 1***.** January 9.

ARM (2024c). *Coke Point Container Terminal Phase II Investigation Report*. January 18.

ARM (2024d). *Cell 4 DNAPL Excavation Report.* January 31.

ARM (2024e). *Coke Point Container Terminal Interim Status Updates*. February 21.

ARM (2024f). *Cell 6 Expanded Pilot Test Report (Revision 1).* April 16.

ARM (2024g). *Parcel B18 Lead Excavation Letter, Revision 0*. April 18.

ARM (2024h). *Coke Point Container Terminal Interim Status Updates*. May 10.

ARM (2024i). *Well Abandonment Request Letter for Parcels B1, B10, and B12*. August 9.

ARM (2024j). *Cell 6 Hotspot Removal / Treatment Final Report.* August 16.

ARM (2024k). *CPA Delineation Final Report.* August 28.

ARM (2024l). *Parcel B18 Lead Excavation Stockpile Letter, Revision 0*. August 28.

ARM (2024m). *Cell 4 Semi-Annual Groundwater Sampling Report (2nd and 3rd Quarter 2024)*. September 30.

ARM (2024n). *Container Terminal RADWP.* October 17.

ARM (2024o). *Parcel B18 Lead Excavation Stockpile Treatment Letter, Revision 0*. November 6.

ARM (2024p). *B10 West Phase II Investigation Report.* November 22.

ARM (2025a). *Coke Point Landfill Semi-Annual Groundwater Monitoring Report, Fall 2024*. January 27.

ARM (2025b). Coke Point Area CMS – Southern Shoreline Risk. February 4.

ARM (2025c). *CPA CMS – Data Gap Sampling Work Plan*. February 7.

ARM (2025d). *Coke Oven Area 2024 Annual Interim Measures Progress Report*. April.

ASTM International (2002). *ASTM E 1739-95 (Reapproved 2002) – Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*.

Bianchin, M., L. Smith, and R. Beckie (2010). *Quantifying hyporheic exchange in a tidal river using temperature time series*, Water Resources Research, Volume 46, W07507, doi:10.1029/2009WR008365.

CH2MHill (2002). *Site-Wide Investigation Release Site Characterization Study*. December.

CH2MHill (2001). *Groundwater Study Report*. December.

Code of Maryland Regulations (2024). *26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Salt Water – Chronic* (updated May 2024). https://dsd.maryland.gov/regulations/Pages/26.08.02.03-2.aspx

EA Engineering, Science, and Technology (EA) (2009). *Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point.* November.

EA (2025a). *Proposed Sampling Plan for Supplemental Sampling of Coke Point Area Sediment, Surface Water, and Pore Water*. January.

EA (2025b). *Supplemental Sampling of Coke Point Area Sediment, Surface Water, and Pore Water Results*. March.

EA (2025c). *Supplemental Sampling of Iron in Pore Water in the Coke Point Area*. August.

Key Environmental, Inc. (2009). *Site Assessment for Proposed Coke Point Dredged Material Containment Facility at Sparrows Point*. November.

Key Environmental, Inc. (2015). *Coke Point Pre-Design Investigation Summary Report, Former Coke Oven Area.* October 9.

State of Maryland, Department of the Environment (2018). *Cleanup Standards for Soil and Groundwater, Interim Final Guidance*. October 2018.

NOAA (2008). *Screening Quick Reference Tables (SQuiRTs), Marine Surface Water – Chronic*. https://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf

Rust Environment & Infrastructure (1998). *Description of Current Conditions Sparrows Point, Maryland*. January.

UC Davis (1995). Intermedia Transfer Factors for Contaminants Found at Hazardous Waste Sites, Benzo[a]pyrene. Department of Environmental Toxicology, University of California, Davis. March 1995.URS Corporation (URS). 2005. *Site Wide Investigation, Report of Nature and Extent of Releases to Groundwater from the Special Study Areas*. January.

USEPA (2018). *Region 4 Ecological Risk Assessment Supplemental Guidance*. March 2018.

USEPA (2017). *Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic Contaminants*. October 2017.

USEPA (2014a). *National Recommended Water Quality Criteria (NRWQCs) for ecological risk (Saltwater Aquatic Life Continuous Criterion Concentration)*. https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

USEPA (2014b). *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors*. February.

USEPA (2012). *A Citizen's Guide to Bioremediation*. September.

USEPA (2011). *Exposure Factors Handbook: 2011 Edition*. September.

USEPA (2004). *Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action.*

USEPA (2004). *Risk Assessment Guidance for Superfund: Volume I – Human Health Evaluation Manual*. July.

USEPA (2002). *Role of Background in the CERCLA Cleanup Program*. April.

USEPA (1999). *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*.

USEPA (1993). *Guidance for Evaluating the Technical Impracticability of Groundwater Restoration*.

USEPA Region III (July 2006a). *BTAG Marine Screening Benchmarks*. https://www.epa.gov/sites/production/files/2015-09/documents/r3_btag_marine_benchmarks_07-06.pdf

USEPA Region III (July 2006b). *BTAG Freshwater Screening Benchmarks*. https://www.epa.gov/sites/production/files/2015-09/documents/r3_btag_fw_benchmarks_07-06.pdf

Weaver (2014). *Phase I Environmental Site Assessment, Former RG Steel Facility*.

FIGURES

Site Boundary

Parcel Boundaries

Private Property

Parcel A9
Parcel A5
Parcel A13
Parcel A7
Parcel A14
Parcel A11
Parcel A8
Parcel A12
Parcel A2
Parcel A15
Parcel A17
Parcel A18
Parcel A16
Parcel A6
Parcel A4
Parcel A10
Parcel A3
Parcel A1
Parcel B6
Parcel B8
Parcel B14
Parcel B22
Parcel B16
Parcel B21
Parcel B15
Parcel B24
Parcel B23
Parcel B25
Parcel B7
Parcel B1
Parcel B2
Parcel B3
Parcel B17
Parcel B19
Parcel B4
Parcel B5
Parcel B9
Parcel B18
Parcel B10
Parcel B13
Parcel B20
Parcel B11
Parcel B12

Tradepoint Atlantic
Site Location Map

January 15, 2021

Figure
1

N

ARM Group LLC
Engineers and Scientists

0 500 1,000 2,000
Feet

Tradepoint Atlantic

Sparrows Point

Baltimore County, MD

Area A: Project 200101
Area B: Project 200102
Sitewide GW: Project 20010304

LEGEND
CPA CMS Boundary
Parcel Boundary

Shipyard

Graving Dock

Parcel B1

Parcel B4

Parcel B5

Parcel B18

Parcel B10

Parcel B11

Parcel B12

Coke Point Area CMS
Site Location Map

March 17, 2025

Figure
2

ARM Group LLC
Engineers and Scientists

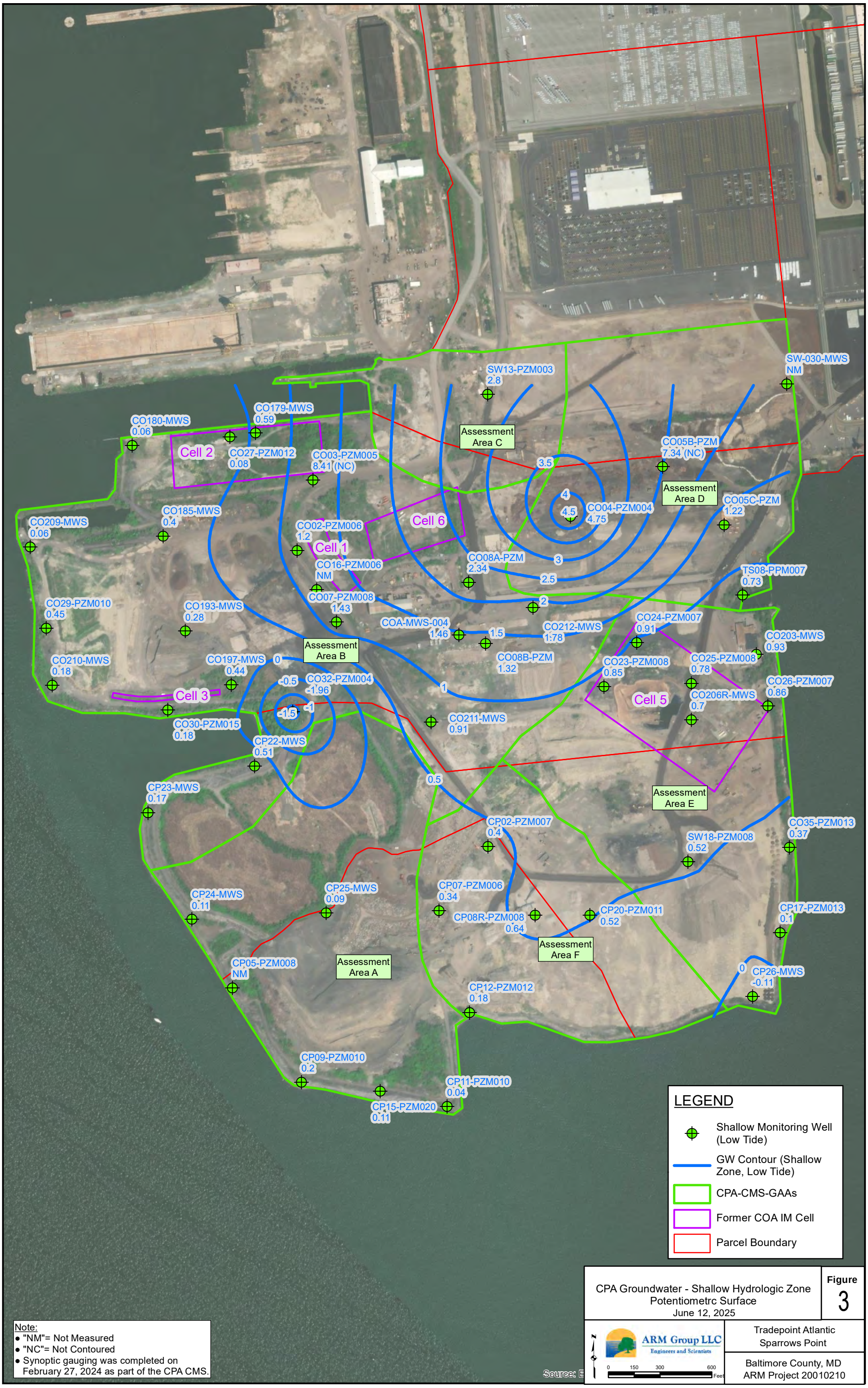
0 500 1,000 2,000
Feet

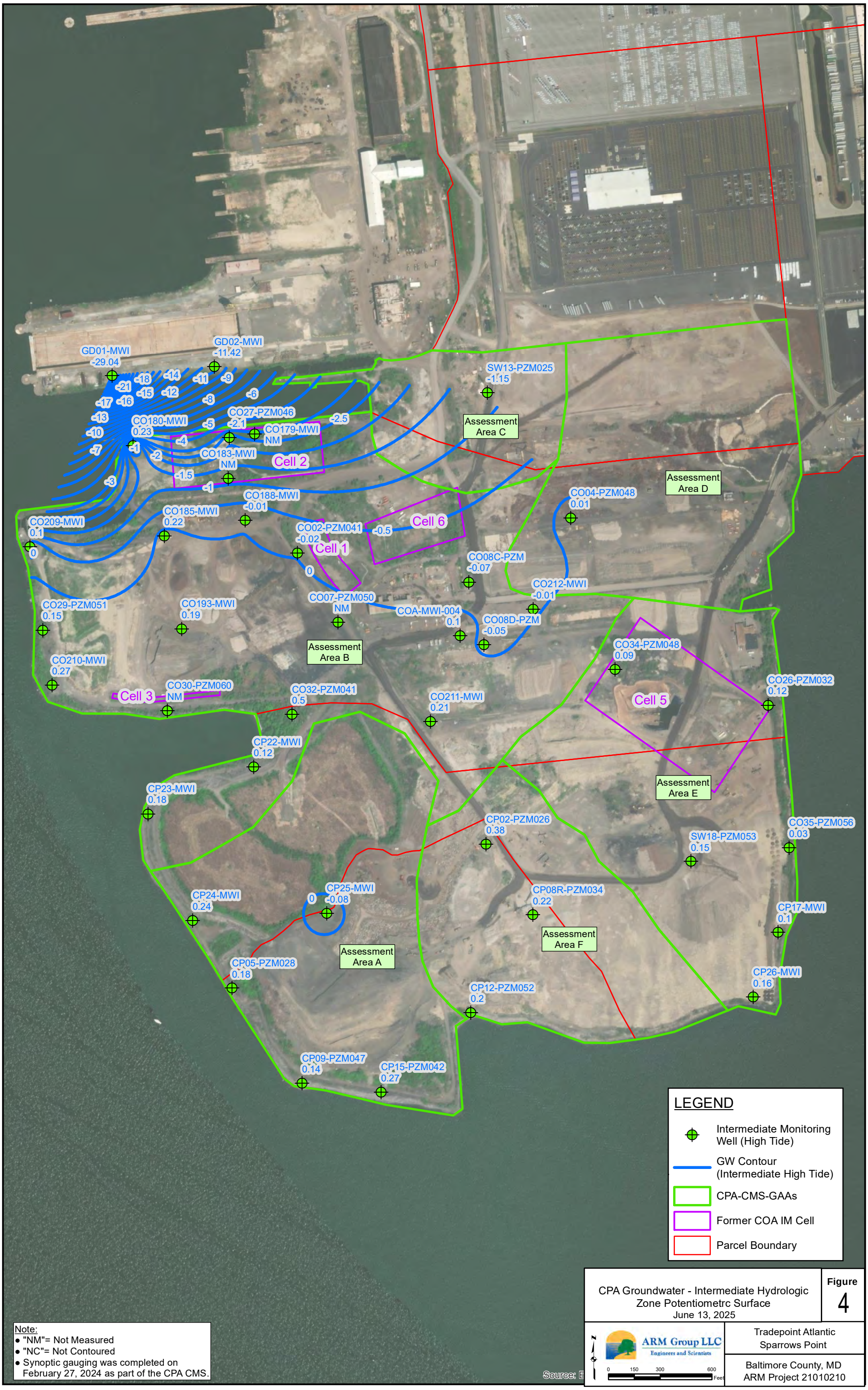
Tradepoint Atlantic

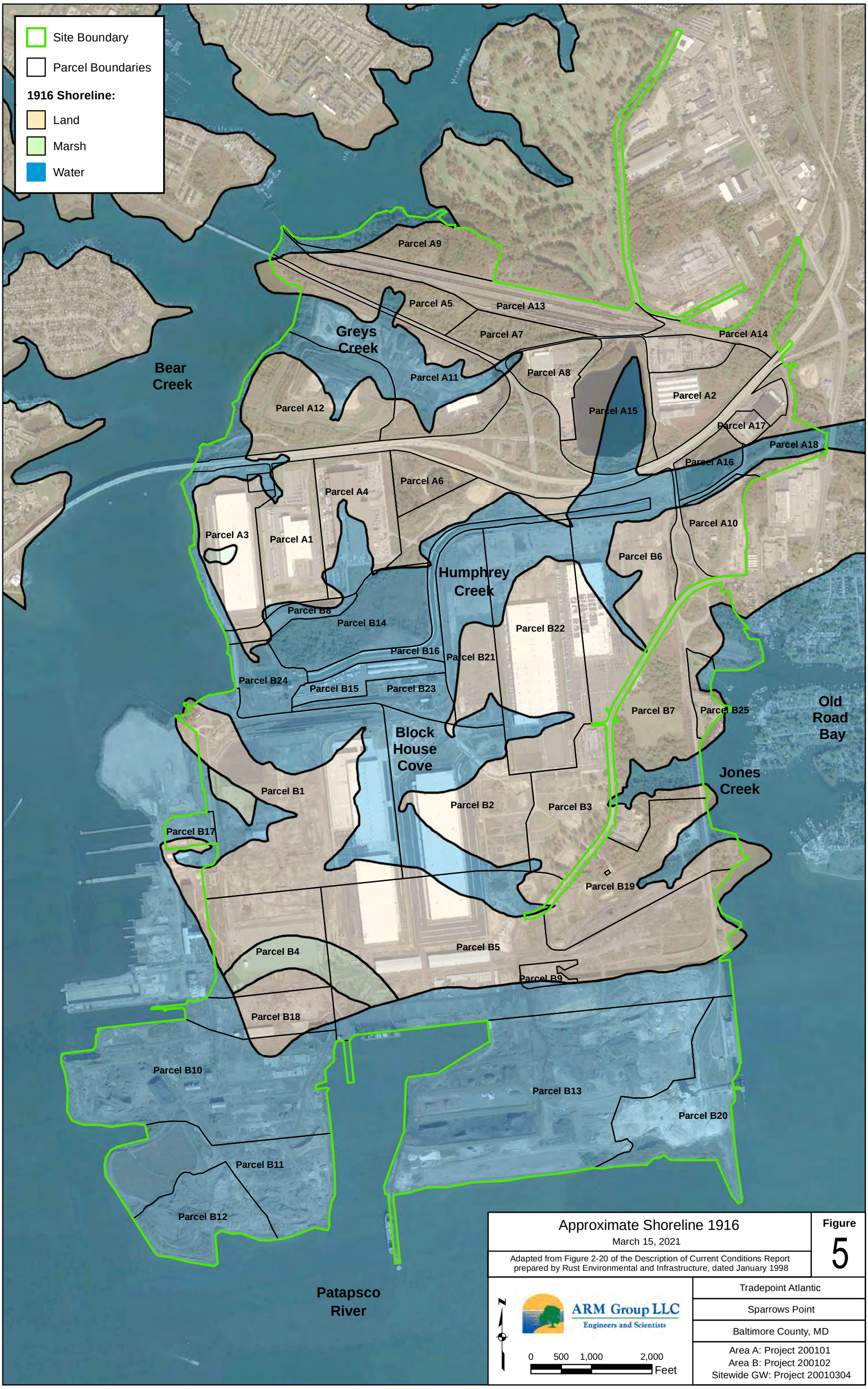
Sparrows Point

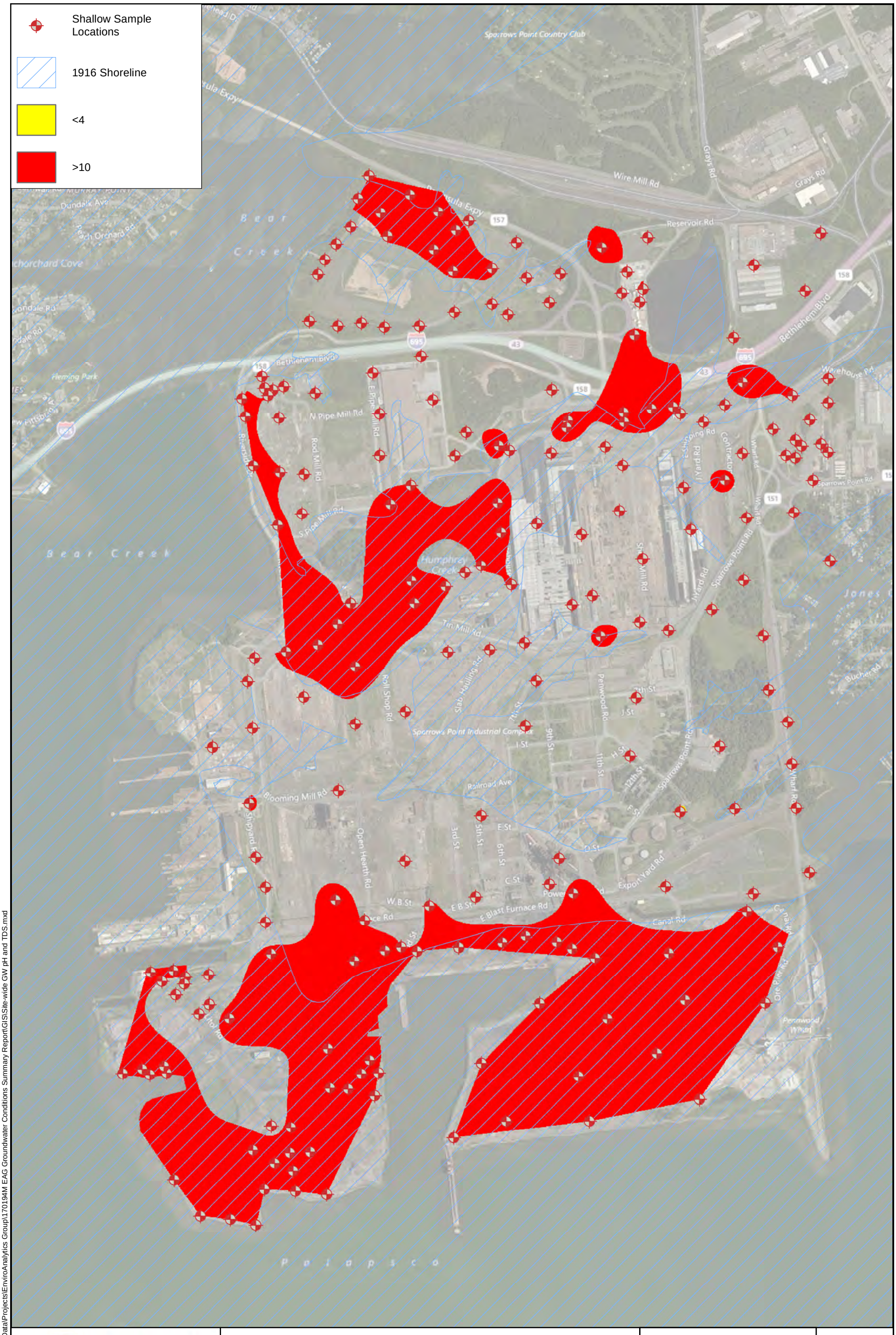
Baltimore County, MD

ARM Project 21010306


CO180-MWS
0.06
CO179-MWS
0.59
Cell 2
CO27-PZM012
0.08
CO03-PZM005
8.41 (NC)
SW13-PZM003
2.8
Assessment
Area C
SW-030-MWS
NM
CO05B-PZM
7.34 (NC)
3.5
Assessment
Area D
CO05C-PZM
1.22
CO04-PZM004
4.75
4
4.5
CO209-MWS
0.06
CO185-MWS
0.4
CO02-PZM006
1.2
Cell 1
Cell 6
CO16-PZM006
NM
CO08A-PZM
2.34
3
2.5
TS08-PPM007
0.73
CO07-PZM008
1.43
2
CO29-PZM010
0.45
CO193-MWS
0.28
COA-MWS-004
1.46
1.5
CO212-MWS
1.78
CO24-PZM007
0.91
CO203-MWS
0.93
Assessment
Area B
CO08B-PZM
1.32
CO23-PZM008
0.85
CO25-PZM008
0.78
CO210-MWS
0.18
CO197-MWS
0.44
0
-0.5
CO32-PZM004
-1.96
1
CO26-PZM007
0.86
Cell 3
-1
-1.5
Cell 5
CO206R-MWS
0.7
CO30-PZM015
0.18
CO211-MWS
0.91
CP22-MWS
0.51
0.5
CP23-MWS
0.17
Assessment
Area E
CP02-PZM007
0.4
CO35-PZM013
0.37
SW18-PZM008
0.52
CP24-MWS
0.11
CP25-MWS
0.09
CP07-PZM006
0.34
CP08R-PZM008
0.64
CP20-PZM011
0.52
CP17-PZM013
0.1
Assessment
Area F
CP05-PZM008
NM
Assessment
Area A
0
CP26-MWS
-0.11
CP12-PZM012
0.18
CP09-PZM010
0.2
CP11-PZM010
0.04
CP15-PZM020
0.11
LEGEND
Shallow Monitoring Well (Low Tide)
GW Contour (Shallow Zone, Low Tide)
CPA-CMS-GAAs
Former COA IM Cell
Parcel Boundary
Note:
• "NM"= Not Measured
• "NC"= Not Contoured
• Synoptic gauging was completed on February 27, 2024 as part of the CPA CMS.
Source: E
CPA Groundwater - Shallow Hydrologic Zone
Potentiometrc Surface
June 12, 2025
Figure
3
ARM Group LLC
Engineers and Scientists
0 150 300 600
Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 20010210
P:\EnviroAnalytics Group\160443M EAG_TPA Redevelopment\GIS\Container Terminal Synoptic GW.mxd


GD01-MWI
-29.04
GD02-MWI
-11.42
SW13-PZM025
-1.15
CO180-MWI
0.23
CO27-PZM046
-2.1
CO179-MWI
NM
CO183-MWI
NM
Cell 2
Assessment Area C
Assessment Area D
CO188-MWI
-0.01
CO185-MWI
0.22
CO209-MWI
0.1
CO02-PZM041
-0.02
Cell 1
Cell 6
CO04-PZM048
0.01
CO08C-PZM
-0.07
CO212-MWI
-0.01
CO29-PZM051
0.15
CO193-MWI
0.19
CO07-PZM050
NM
COA-MWI-004
0.1
CO08D-PZM
-0.05
Assessment Area B
CO34-PZM048
0.09
CO210-MWI
0.27
CO30-PZM060
NM
Cell 3
CO32-PZM041
0.5
CO211-MWI
0.21
CO26-PZM032
0.12
Cell 5
CP22-MWI
0.12
Assessment Area E
CP23-MWI
0.18
CP02-PZM026
0.38
CO35-PZM056
0.03
SW18-PZM053
0.15
CP24-MWI
0.24
CP25-MWI
-0.08
CP08R-PZM034
0.22
CP17-MWI
0.1
Assessment Area F
Assessment Area A
CP05-PZM028
0.18
CP26-MWI
0.16
CP12-PZM052
0.2
CP09-PZM047
0.14
CP15-PZM042
0.27
LEGEND
Intermediate Monitoring Well (High Tide)
GW Contour (Intermediate High Tide)
CPA-CMS-GAAs
Former COA IM Cell
Parcel Boundary
Note:
• "NM"= Not Measured
• "NC"= Not Contoured
• Synoptic gauging was completed on February 27, 2024 as part of the CPA CMS.
Source: E
CPA Groundwater - Intermediate Hydrologic Zone Potentiometrc Surface
June 13, 2025
Figure 4
ARM Group LLC
Engineers and Scientists
0 150 300 600 Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010210
P:\EnviroAnalytics Group\160443M EAG_TPA Redevelopment\GIS\Container Terminal Synoptic GW.mxd


Site Boundary
Parcel Boundaries
1916 Shoreline:
Land
Marsh
Water
Parcel A9
Parcel A5
Parcel A13
Parcel A7
Parcel A14
Greys Creek
Bear Creek
Parcel A11
Parcel A8
Parcel A2
Parcel A12
Parcel A15
Parcel A17
Parcel A18
Parcel A16
Parcel A6
Parcel A4
Parcel A3
Parcel A1
Parcel A10
Parcel B6
Humphrey Creek
Parcel B8
Parcel B14
Parcel B22
Parcel B16
Parcel B21
Parcel B24
Parcel B15
Parcel B23
Parcel B7
Parcel B25
Old Road Bay
Block House Cove
Jones Creek
Parcel B1
Parcel B2
Parcel B3
Parcel B17
Parcel B19
Parcel B4
Parcel B5
Parcel B9
Parcel B18
Parcel B10
Parcel B13
Parcel B20
Parcel B11
Parcel B12
Patapsco River
Approximate Shoreline 1916
March 15, 2021
Adapted from Figure 2-20 of the Description of Current Conditions Report prepared by Rust Environmental and Infrastructure, dated January 1998
Figure
5
ARM Group LLC
Engineers and Scientists
0 500 1,000 2,000
Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
Area A: Project 200101
Area B: Project 200102
Sitewide GW: Project 20010304



\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd

ARM Group LLC
Engineers and Scientists

0 500 1,000 2,000
Feet

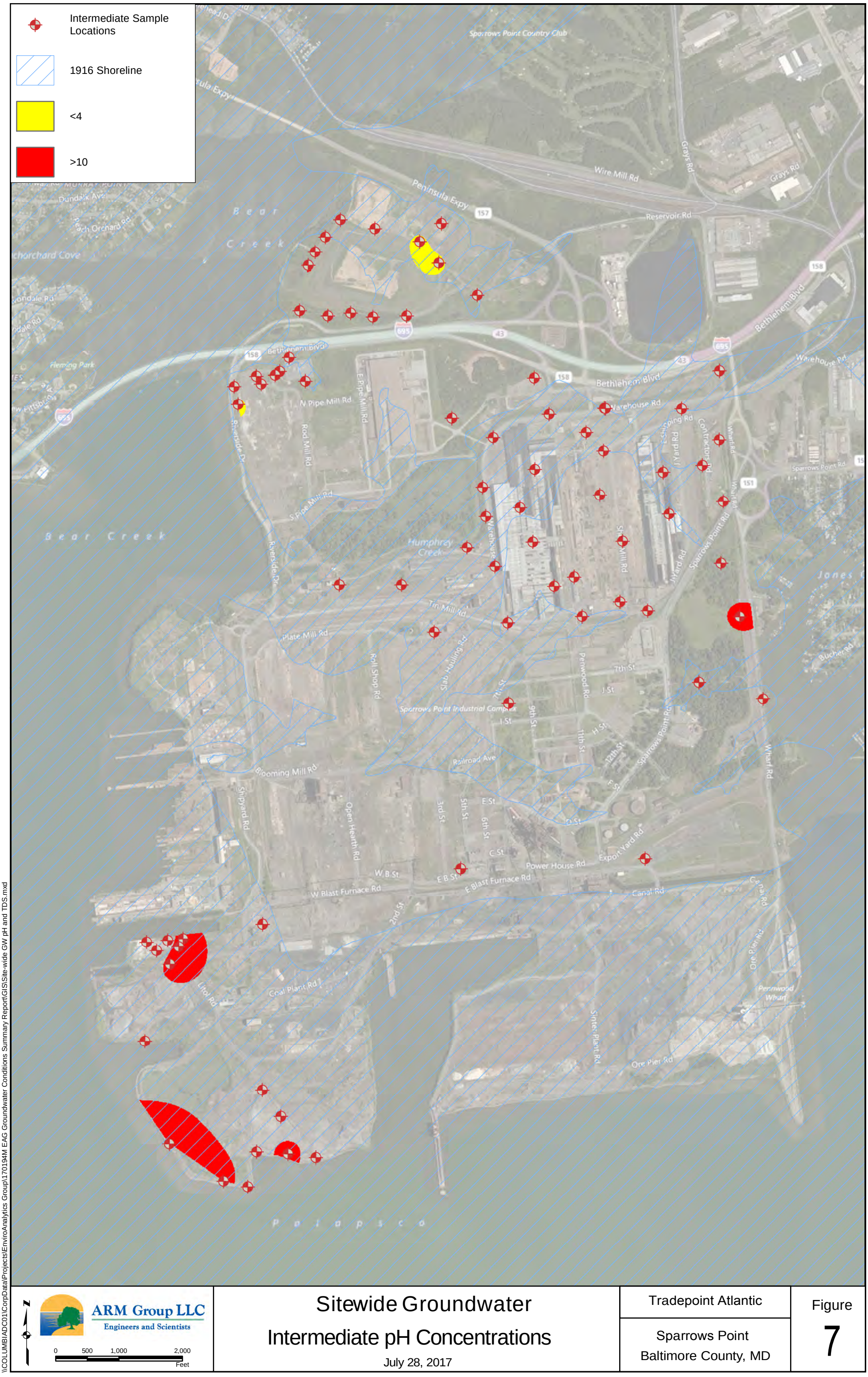
Sitewide Groundwater
Shallow pH Concentrations

July 28, 2017

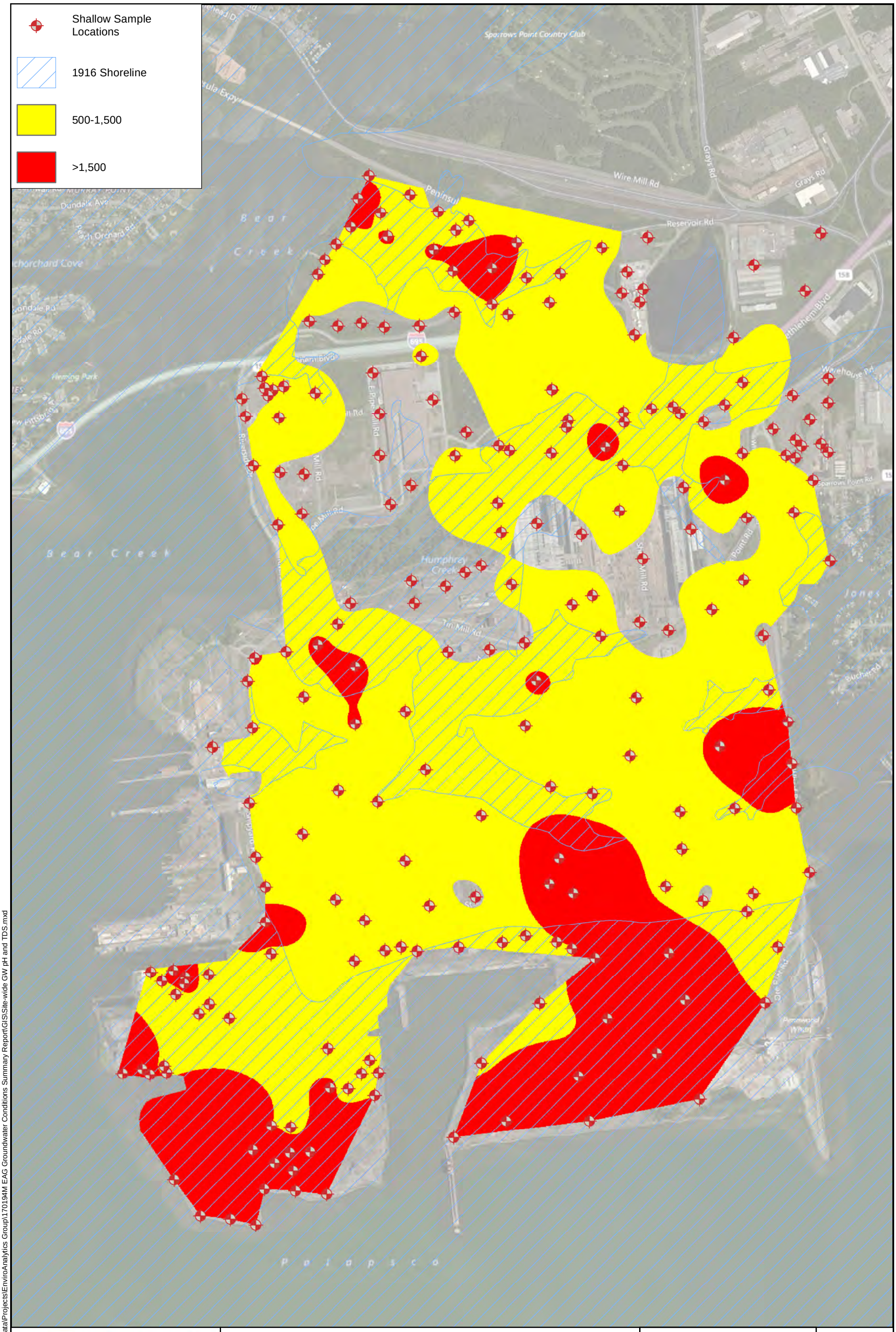
Tradepoint Atlantic

Sparrows Point
Baltimore County, MD

Figure
6



\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd



ARM Group LLC
Engineers and Scientists

0 500 1,000 2,000
Feet

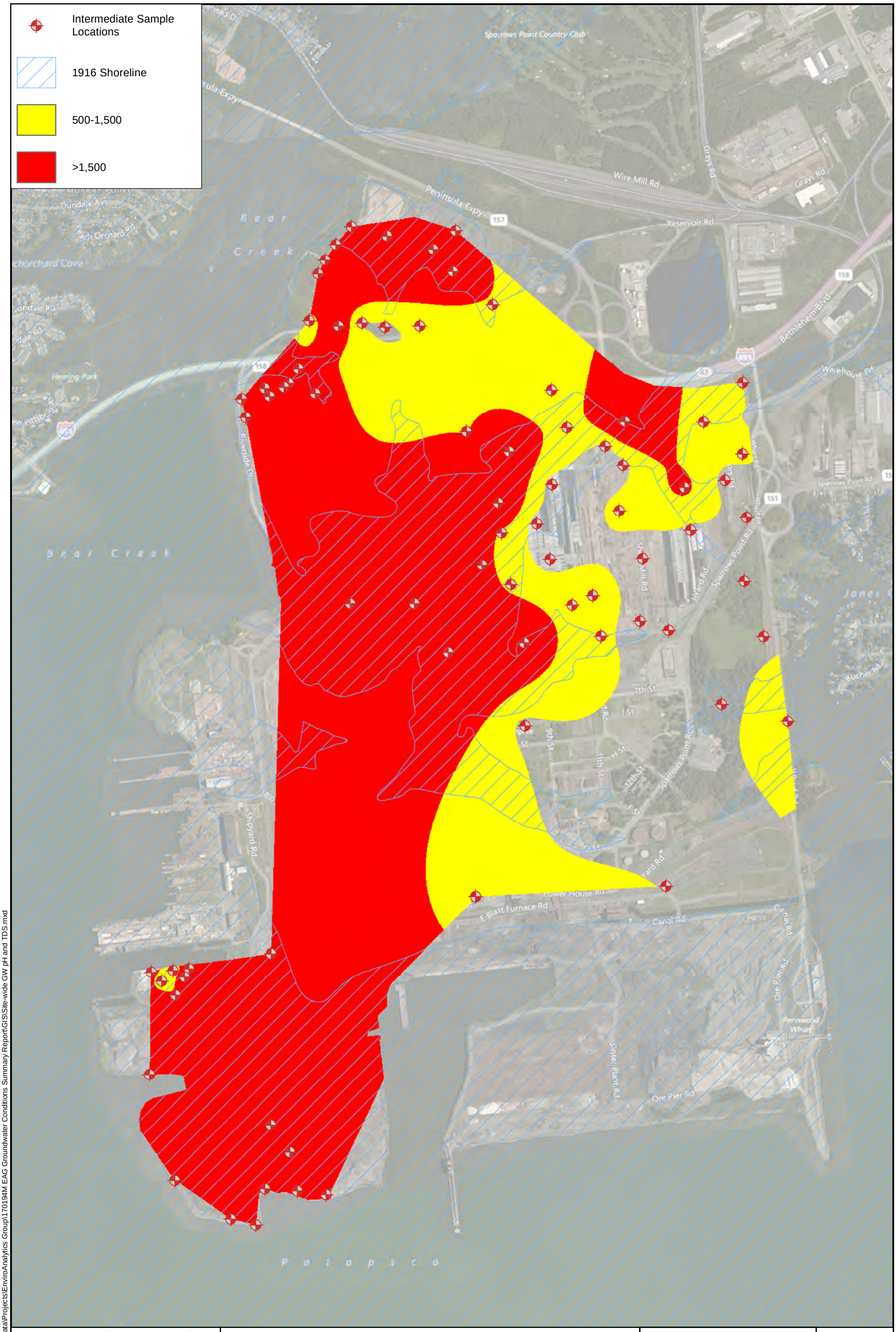
Sitewide Groundwater
Shallow TDS Concentrations (mg/L)
July 28, 2017

Tradepoint Atlantic

Sparrows Point
Baltimore County, MD

Figure
8

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd



\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd

ARM Group LLC
Engineers and Scientists

0 500 1,000 2,000
Feet

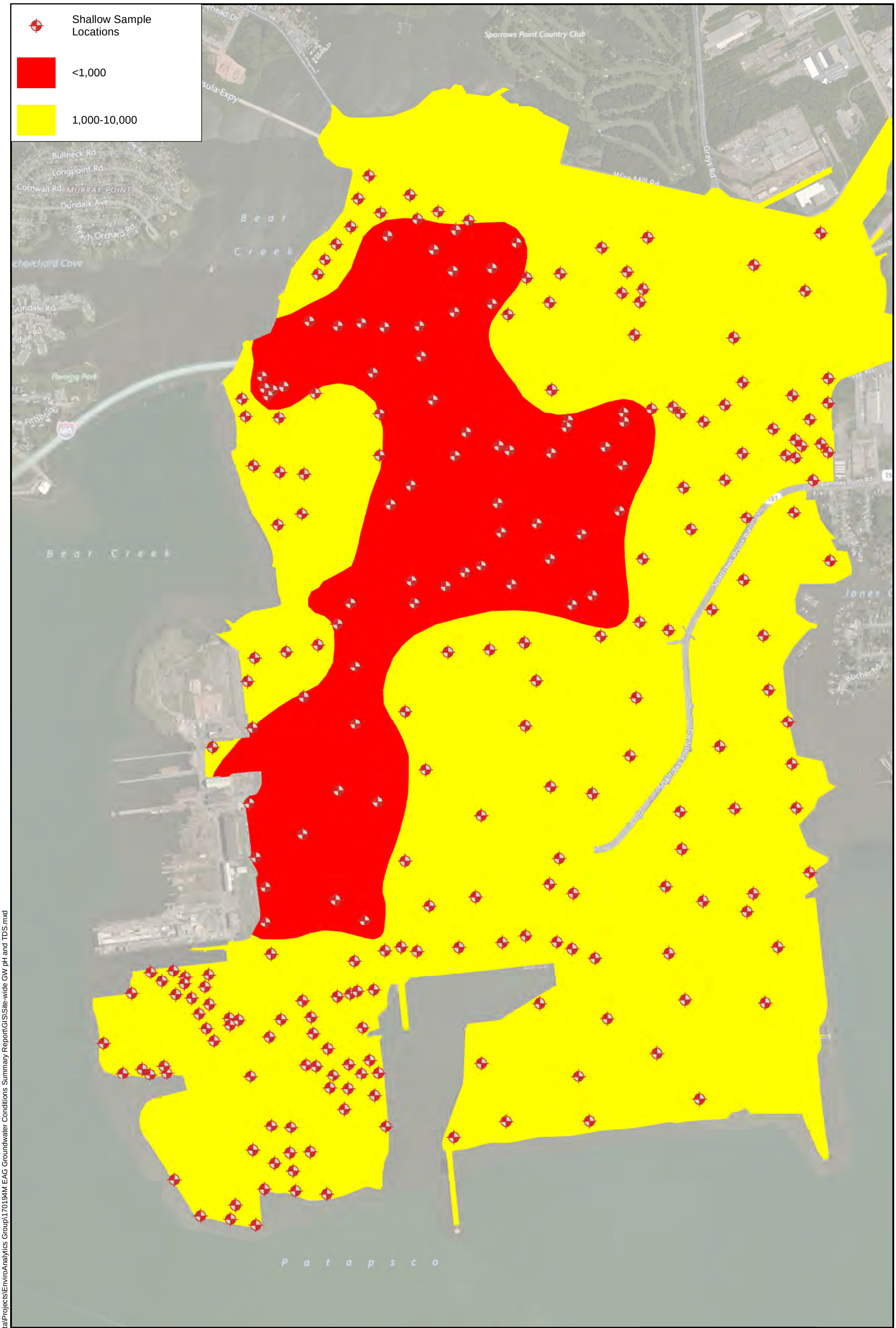
Sitewide Groundwater
Intermediate TDS Concentrations (mg/L)

July 28, 2017

Tradepoint Atlantic

Sparrows Point
Baltimore County, MD

Figure
9



\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd

ARM Group LLC
Engineers and Scientists

0 500 1,000 2,000
Feet

Sitewide Groundwater Shallow Aquifer Transmissivity (g/d/ft)

July 28, 2017

Tradepoint Atlantic

Sparrows Point
Baltimore County, MD

Figure
10

Intermediate Sample Locations

<1,000

1,000-10,000

>10,000

Sparrows Point Country Club

Bear Creek

Fleming Park

Patapsco

0 500 1,000 2,000 Feet

ARM Group LLC
Engineers and Scientists

Sitewide Groundwater Intermediate Aquifer Transmissivity (g/d/ft)

July 28, 2017

Tradepoint Atlantic

Sparrows Point
Baltimore County, MD

Figure
11

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd

Parcel Boundary

Unusable GW Area

Unusable GW Area (Extrapolated)

Groundwater Sample Locations

NOTES:
Unusable groundwater area determined using data from the 2017 Groundwater Conditions Report.

Parcel A9
Parcel A5
Parcel A13
Parcel A7
Parcel A11
Parcel A8
Parcel A14
Parcel A12
Parcel A2
Parcel A15
Parcel A17
Parcel A18
Parcel A16
Parcel A6
Parcel A4
Parcel A10
Parcel A3
Parcel A1
Parcel B6
Parcel B8
Parcel B14
Parcel B21
Parcel B16
Parcel B22
Parcel B24
Parcel B15
Parcel B23
Parcel B25
Parcel B7
Parcel B1
Parcel B2
Parcel B3
Parcel B17
Parcel B19
Parcel B4
Parcel B5
Parcel B9
Parcel B18
Parcel B13
Parcel B10
Parcel B20
Parcel B11
Parcel B12

P:\EnviroAnalytics Group\20010304 EAG Sitewide Groundwater\Site-Wide GW CMS\GIS\Sitewide Unusable Area.mxd

N

ARM Group LLC
Engineers and Scientists

1 inch = 1,400 feet

0 650 1,300 Feet

Sitewide Groundwater
Unusable Groundwater Areas
Shallow Zone

Figure 12



LEGEND

- Cell Boundaries
- Former Coke Oven Area Boundary

N

ARM Group LLC
Engineers and Scientists

1 inch = 500 feet

0 250 500 Feet

Coke Point Area CMS
Coke Oven Area Interim Measure
Cell Locations
Date: 2/28/2025

Figure 13

P:\EnviroAnalytics Group\Coke Oven\GIS\Coke Oven 8.5x11.mxd

B18-070-PZ
B18-070R-MWS
B18-071-PZ
B18-072-PZ
SW-030-MWS
GD02-MWI
GD01-MWI
B18-080-PZ
B18-079-PZ
B18-083-PZ
BA-81-7945
B18-077-PZ
SW13-PZM111
CO47-PZM046
SW-085-MWS
B18-044-PZ
BA-81-7946
SW13-PZM003
SW13-PZM025
SW-086-MWS
SW14-PZM004
CO178-MWI
CO178-MWS
CO179-MWI
CO179-MWS
CO45-PZM047
CO177-MWI
CO177-MWS
CO37-PZM003
CO121-PZM
COA-MWI-007
B18-081-PZ
B18-078-PZ
B18-082-PZ
B18-046-PZ
COA-MW-001
B18-061-PZ
CO37-PZM038
CO36-PZM043
CO180-MWI
CO36-PZM008
CO46-PZM047
CO48-PZM044
CO42-PZM004
B18-074-PZ
CO27-PZM046
CO43-PZM048
CO27-PZM012
CO39-PZM007
COA-MW-002
B18-076-PZ
B18-075-PZ
CO180-MWS
CO182-MWI
CO39-PZM042
B18-007-PZ
CO05B-PZM
CO181-MWI
CO181-MWS
CO44-PZM048
CO38-PZM006
CO183-MWI
CO40-PZM008
CO38-PZM043
CO03-PZM005
COA-012-MWS
CO216-MWS
CO28-PZM048
CO28-PZM010
CO186-MWS
CO215-RIW
COA-013-MWS
COA-MWI-006
CO05-PZM006
CO184-MWI
CO41-PZM036
CO15-PZM005
CO213-RIW
CO167-PZM
CO04-PZM048
CO05A-PZM
CO41-PZM001
CO188-MWI
CO187-MWS
CO214-RIW
CO152-PZM
CO05C-PZM
CO79-PZM
CO18-PZM006
CO159-PZM
CO185-MWS
CO189-MWS
CO185-MWI
CO190-MWS
CO100-PZM
CO209-MWS
CO209-MWI
CO02-PZM041
CO02-PZM006
CO20-PZM004
CO93-PZM
CO19-PZM004
CO88-PZM
CO192-MWS
CO191-MWS
CO08C-PZM
CO08A-PZM
CO212A-PZM
CO10-PZM006
CO16-PZM006
CO09-PZM007
CO212-MWI
CO08-PZM036
CO08-PZM005
CO212-MWS
CT-037-GW-41
CT-037-GW-12.5
CO07-PZM050
CO07-PZM008
CO29-PZM051
CO29-PZM010
CO193-MWI
CO193-MWS
COA-MWI-004
COA-MWS-004
CO24-PZM007
CO08B-PZM
CO08D-PZM
COA-MWI-009
COA-MW-003
CO203-MWS
CO34-PZM048
CO60-PZP001
CO195-MWS
CO196-MWS
CO25-PZM008
CO205-MWS
CO103-PZM
CO102-PZM
CO197-MWS
CO23-PZM046
CO23-PZM008
CO204-MWS
CO210-MWS
CO210-MWI
CO71-PZM006
CO72-PZM005
CO194-MWS
CO56-PZP001
CO26-PZM032
CO104-PZM
CO198-MWS
CO101-PZM
CO13-PZM008
CO206R-MWS
CO26-PZM007
CO202-MWS
CO13-PZM030
CO70-PZM005
CO32-PZM004
CO199-MWS
CO200-MWS
CO201-MWS
TS06-PPM008
CO211-MWS
CO211-MWI
CO107-PZM
CO69-PZM005
CO118-PZM007
CO67-PZM006
CO68-PZM005
CO207-MWS
CO32-PZM041
COA-MWI-011
CO30-PZM015
CO30-PZM060
CO114-PZM002
CO112-PZM
CO66-PZM005
CO55-PZM000
CO113-PZM004
CO120-PZM009
CO65-PZM005
CO64-PZM006
CO59-PZP002
CO63-PZM007
CO58-PZM001
CO62-PZM007
CO61-PZM007
CP22-MWS
CP22-MWI
CO208-MWS
CO57-PZP002
CP23-MWS
CP23-MWI
CP02-PZM026
CP02-PZM007
CP21-PZM004
CO35-PZM056
CO35-PZM013
SW18-PZM008
SW18-PZM053
CP07-PZM006
CP08R-PZM034
CP08R-PZM008
CP20-PZM011
CP25-MWS
CP25-MWI
CP24-MWS
CP24-MWI
CP17-MWI
CP19R-PZM008
CP17-PZM013
CP18R-PZM009
CP05-PZM028
CP05-PZM008
CP05-PZM019
CP26-MWS
CP26-MWI
CP12-PZM052
CP12-PZM012
CP16-PZM008
CP14-PZM009
CP16-PZM035
CP14-PZM062
CP10-PZM008
CP09-PZM010
CP09-PZM047
CP15-PZM020
CP15-PZM042
CP11-PZM010

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- Former COA IM Cell
- CPA-CMS-GAAs

Note: Only monitoring wells with groundwater analytical results are shown.

Coke Point Area CMS
Sitewide Wells and Piezometers
June 10, 2025

Figure 14

ARM Group LLC
Engineers and Scientists

0 100 200 400 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

Environmental Group Used as a Tool for Decision Making by CPA, CSC, & Its Vast Consulting Team

GD01-MWI
GD02-MWI
SW-085-MWS
SW-086-MWS
CO37-PZM003
CO179-MWI
CO121-PZM
COA-MWI-007
CO177-MWI
CO47-PZM046
CO177-MWS
CO178-MWS
CO36-PZM008
CO180-MWI
CO37-PZM038
CO180-MWS
CO36-PZM043
CO44-PZM048
CO179-MWS
CO48-PZM044
CO43-PZM048
CO178-MWI
CO27-PZM012
CO181-MWI
CO181-MWS
CO28-PZM048
CO28-PZM010
CO209-MWI
CO209-MWS
CO10-PZM006
CO29-PZM051
CO29-PZM010
CO203-MWS
CO60-PZP001
CO210-MWI
CO210-MWS
CO205-MWS
CO200-MWS
CO101-PZM
CO104-PZM
CO199-MWS
CO26-PZM032
CO26-PZM007
CO198-MWS
CO30-PZM060
CO202-MWS
TS06-PPM008
CO30-PZM015
CO201-MWS
COA-MWI-011
CO207-MWS
CP22-MWS
CP22-MWI
CO58-PZM001
CO208-MWS
CP23-MWS
CP23-MWI
CO35-PZM056
CO35-PZM013
CP24-MWS
CP24-MWI
CP17-PZM013
CP17-MWI
CP05-PZM028
CP05-PZM008
CP26-MWS
CP26-MWI
CP05-PZM019
CP12-PZM052
CP12-PZM012
CP16-PZM008
CP16-PZM035
CP14-PZM062
CP14-PZM009
CP09-PZM047
CP09-PZM010
CP15-PZM042
CP15-PZM020
CP11-PZM010

LEGEND

GW_Full_Shoreline

Groundwater Monirotng Location (Intermediate)

Groundwater Monitoring Location (Intermediate)

Former COA IM Cell

CPA-CMS-GAAs

Note: Only monitoring wells with groundwater analytical results are shown.

Coke Point Area CMS
Shoreline Wells and Piezometers
June 12, 2025

Figure
15

ARM Group LLC
Engineers and Scientists

N

0 100 200 400
Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

P:\Enviro\Analytics Group\160443M EAG_TPA Redevelopment\GIS\CPA CMS All Wells Simplified 3.mxd

B18-043-SB
B18-041-SB
B18-042-SB
B18-027-SB
B18-028-SB
B18-039-SB
B18-060-SB
B18-069-SB
B18-047-SB
B18-040-SB
B18-068-SB
B18-057-SB
B18-030-SB
B18-059-SB
B18-077-SB
B18-029-SB
B18-033-SB
B18-034-SB
B18-058-SB
B18-031-SB
B18-017-SB
B18-048-SB
B18-009-SB
B18-032-SB
B18-037-SB
B18-038-SB
B18-018-SB
B18-010-SB
B18-046-SB
B18-026-SB
B18-049-SB
B18-050-SB
B18-025-SB
B18-061-SB
B10-013-SB
B18-008-SB
B18-007-SB
Cell 2
B10-007-SB
B10-008-SB
B10-014-SB
B10-020-SB
B10-021-SB
B10-022-SB
B10-010-SB
B10-015-SB
Cell 6
B10-019-SB
B10-018-SB
B10-005-SB
B10-001-SB
B10-003-SB
Cell 1
B10-011-SB
B10-016-SB
B10-002-SB
B10-004-SB
B10-006-SB
B10-012-SB
B10-017-SB
B10-009-SB
Cell 3
B11-033-SB
B11-032-SB
B11-031-SB
B11-030-SB
B11-027-SB
B11-029-SB
B11-028-SB
B18-021-SB
B18-053-SB
B18-070-SB
B18-019-SB
B18-015-SB
B18-020-SB
B18-067-SB
B18-022-SB
B18-054-SB
B18-071-SB
B18-016-SB
B18-052-SB
B18-055-SB
B18-023-SB
B18-013-SB
B18-066-SB
B18-051-SB
B18-056-SB
B18-072-SB
B18-014-SB
B18-024-SB
B18-035-SB
B18-036-SB
B18-073-SB
CT-001-SB
B18-012-SB
B18-011-SB
B18-001-SB
B18-005-SB
B18-003-SB
B18-002-SB
B18-004-SB
B18-074-SB
B18-006-SB
B18-076-SB
B18-075-SB
CT-007-SB
CT-006-SB
CT-002-SB
CT-004-SB
CT-005-SB
CT-003-SB
CT-013-SB
CT-014-SB
CT-011-SB
CT-012-SB
CT-015-SB
CT-016-SB
CT-019-SB
CT-009-SB
B10-017-SB
CT-008-SB
CT-010-SB
CT-017-SB
CT-018-SB
CT-020-SB
Cell 5
CT-021-SB
B11-007-SB
B11-011-SB
B11-010-SB
B11-009-SB
B11-013-SB
B11-025-SB
B11-005-SB
B11-012-SB
B11-006-SB
B11-008-SB
B11-015-SB
B11-014-SB
B11-019-SB
B11-026-SB
B11-004-SB
B11-003-SB
B11-018-SB
CT-022-SB
B11-016-SB
B11-017-SB
B11-002-SB
B11-001-SB
B11-020-SB
CT-023-SB
B11-022-SB
B11-021-SB
CT-024-SB
B11-024-SB
B11-023-SB

LEGEND
Soil Sample Locations
Former COA IM Cell

Coke Point Area CMS
Soil Boring Locations
June 12, 2025

Figure
16

ARM Group LLC
Engineers and Scientists

0 105 210 420
Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Document Path: G:\GIS_Projects\Environmental\Sparrows Point\Coke Point\Soil Boring Locations\Coke Point Soil Boring Locations.aprx

B18-070R-MWS
COA-MWI-007
COA-MW-001
COA-MW-002
COA-012-MWS
COA-MWI-006
COA-013-MWS
COA-MWS-004
COA-MWI-004
COA-MWI-009
COA-MW-003
COA-MWI-011

LEGEND

New Monitoring Wells

CPA-CMS-GAAs

Note: COA-012-MWS and COA-013-MWS were installed as NAPL wells; no groundwater samples were collected

Coke Point Area CMS
New Monitoring Wells (2024)

June 10, 2025

Figure
17

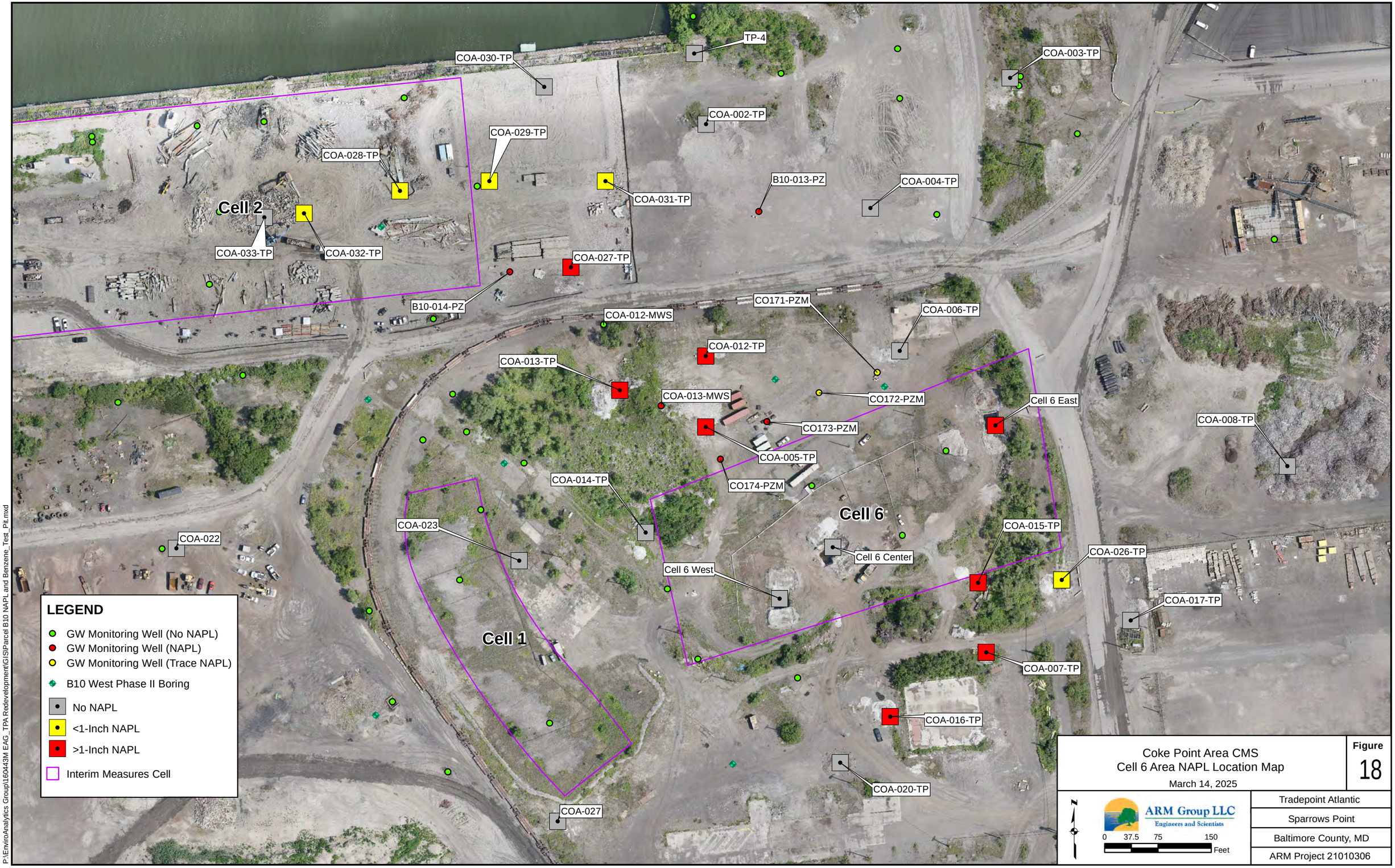
ARM Group LLC
Engineers and Scientists

0 105 210 420
Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Environmental Group Records Cafe, Inc. Representing Coke Point Wells.mxd



Coke Point Area CMS
Cell 6 Area NAPL Location Map
March 14, 2025

Figure
18

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306

P:\EnviroAnalytics Group\160443M EAG_TPA Redevelopment\GIS\Parcel B10 NAPL and Benzene_Test_Plt.mxd



Note:
White Label: Existing Well
Yellow Label: Abandoned / Destroyed Well

Note:
Refer to Appendix B for dates of the most recent sampling eventfor each location and parameter set.

LEGEND

- VOCs
- SVOCs
- BTEX + Naphthalene
- Metals
- Former COA IM Cell
- CPA-CMS-GAAs

Coke Point Area CMS
Sampled Groundwater Parameters
June 12, 2025

Figure 19

ARM Group LLC
Engineers and Scientists

0 120 240 480 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

G:\Projects\Tradepoint\GIS\CPA CMS JR Well.mxd



Notes:
1. Included results are from the most recent sampling event.
2. If the parameter was not detected in a monitoring well, then the detection limit was used for contouring purposes.

Coke Point Area
Shallow Benzene Concentrations and Isocontours (ug/L)
June 9, 2025

Figure 20

ARM Group LLC Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010306



LEGEND

- Sample Location (Intermediate Zone)
- Sample Location (Intermediate Zone)
- COA IM Cell

Benzene (ug/L)

- 0 - 6.93
- 6.93 - 69.3
- 69.3 - 693
- 693 - 6,930
- 6,930 - 69,300
- 69,300 - 693,000

Notes:
1. Included results are from the most recent sampling event.
2. If the parameter was not detected in a monitoring well, then the detection limit was used for contouring purposes.

Coke Point Area
Intermediate Benzene Concentrations and Isocontours (ug/L)
June 9, 2025

Figure 21

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010306



LEGEND

- Sample Location (Shallow Zone)
- Groundwater Assesment Area
- Former COA IM Cell

Naphthalene (ug/L)

- 0 - 7.86
- 7.86 - 78.6
- 78.6 - 786
- 786 - 7,860
- 7,860 - 78,600
- 78,600 - 786,000
- 786,000 - 7,860,000

Note:
1. Included results are from the most recent sampling event.
2. If the parameter was not detected in a monitoring well, then the detection limit was used for contouring purposes.

Coke Point Area
Shallow Naphthalene Concentrations and Isocontours (ug/L)
June 10, 2025

Figure 22

ARM Group LLC
Engineers and Scientists

0 80 160 320 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306



Coke Point Area
Intermediate Naphthalene
Concentrations and Isocontours (ug/L)
June 27, 2025

Figure 23

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Note:
1. Included results are from the most recent sampling event.
2. If the parameter was not detected in a monitoring well, then the detection limit was used for contouring purposes.

Parcel B4
Parcel B5
Parcel B18
Parcel B10
Parcel B11
Parcel B12
Assessment Area C
Assessment Area D
Assessment Area B
Assessment Area E
Assessment Area A
Assessment Area F
Cell 1
Cell 2
Cell 3
Cell 4
Cell 5
Cell 6
GD01-MWI
GD02-MWI
B18-080-PZ
B18-079-PZ
B18-083-PZ
BA-81-7945
B18-077-PZ
SW13-PZM111
SW13-PZM003
SW13-PZM025
B18-044-PZ
BA-81-7946
SW-085-MWS
SW-086-MWS
B18-081-PZ
B18-078-PZ
B18-046-PZ
B18-082-PZ
B18-061-PZ
COA-MW-001
COA-MW-002
B18-007-PZ
B18-070-PZ
B18-070R-MWS
B18-071-PZ
B18-072-PZ
SW-030-MWS
SW14-PZM004
B18-074-PZ
B18-076-PZ
B18-075-PZ
CO05B-PZM
CO47-PZM046
CO178-MWS
CO178-MWI
CO179-MWI
CO179-MWS
CO45-PZM047
CO177-MWI
CO177-MWS
CO37-PZM003
CO121-PZM
COA-MWI-007
CO36-PZM043
CO37-PZM038
CO48-PZM044
CO180-MWI
CO180-MWS
CO36-PZM008
CO46-PZM047
CO42-PZM004
CO43-PZM048
CO27-PZM046
CO27-PZM012
CO39-PZM007
CO39-PZM042
CO182-MWI
CO181-MWS
CO181-MWI
CO44-PZM048
CO38-PZM043
CO38-PZM006
CO183-MWI
CO40-PZM008
CO03-PZM005
COA-012-MWS
CO28-PZM048
CO28-PZM010
CO186-MWS
COA-013-MWS
CO215-RIW
COA-MWI-006
CO184-MWI
CO41-PZM001
CO41-PZM036
CO15-PZM005
CO213-RIW
CO188-MWI
CO187-MWS
CO214-RIW
CO167-PZM
CO152-PZM
CO159-PZM
CO79-PZM
CO18-PZM006
CO185-MWS
CO185-MWI
CO189-MWS
CO190-MWS
CO100-PZM
CO209-MWS
CO209-MWI
CO02-PZM041
CO02-PZM006
CO93-PZM
CO19-PZM004
CO88-PZM
CO192-MWS
CO191-MWS
CO16-PZM006
CO08C-PZM
CO08A-PZM
CO212A-PZM
CO20-PZM004
CO10-PZM006
CO09-PZM007
CO08-PZM036
CO08-PZM005
CO212-MWI
CO212-MWS
CT-037-GW-41
CT-037-GW-12.5
CO07-PZM050
CO07-PZM008
CO193-MWI
CO193-MWS
CO29-PZM051
CO29-PZM010
COA-MWS-004
COA-MWI-004
CO08B-PZM
CO08D-PZM
CO24-PZM007
COA-MW-003
CO203-MWS
COA-MWI-009
CO34-PZM048
CO60-PZP001
CO25-PZM008
CO23-PZM008
CO204-MWS
CO205-MWS
CO71-PZM006
CO72-PZM005
CO56-PZP001
CO26-PZM007
CO26-PZM032
CO70-PZM005
CO206R-MWS
CO69-PZM005
CO67-PZM006
CO68-PZM005
CO207-MWS
CO55-PZM000
CO66-PZM005
CO64-PZM006
CO65-PZM005
CO63-PZM007
CO62-PZM007
CO61-PZM007
CO58-PZM001
CO59-PZP002
CO208-MWS
CO57-PZP002
CO35-PZM056
CO35-PZM013
SW18-PZM008
SW18-PZM053
CO216-MWS
CO05-PZM006
CO04-PZM048
CO05A-PZM
CO05C-PZM
CO103-PZM
CO195-MWS
CO196-MWS
CO197-MWS
CO102-PZM
CO194-MWS
CO101-PZM
CO104-PZM
CO198-MWS
CO202-MWS
CO32-PZM004
CO127-WS
CO199-MWS
CO200-MWS
CO201-MWS
TS06-PPM008
CO32-PZM041
COA-MWI-011
CO30-PZM015
CO30-PZM060
CO211-MWS
CO211-MWI
CP22-MWS
CP22-MWI
CP23-MWS
CP23-MWI
CP02-PZM026
CP02-PZM007
CP21-PZM004
CP07-PZM006
CP08R-PZM034
CP08R-PZM008
CP20-PZM011
CP19R-PZM008
CP18R-PZM009
CP17-MWI
CP17-PZM013
CP25-MWS
CP25-MWI
CP24-MWS
CP24-MWI
CP05-PZM028
CP05-PZM008
CP05-PZM019
CP12-PZM052
CP12-PZM012
CP16-PZM008
CP16-PZM035
CP14-PZM062
CP14-PZM009
CP26-MWS
CP26-MWI
CP10-PZM008
CP09-PZM047
CP09-PZM010
CP15-PZM042
CP15-PZM020
CP11-PZM010

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Note: Only monitoring wells with groundwater analytical results are shown.

Coke Point Area CMS Groundwater Assessment Areas

March 2025

Figure 24

ARM Group LLC
Engineers and Scientists

0 62.5 125 250 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

E:\Projects\Projects_Group\Tradepoint\GIS\MXD\CPA GIS\CPA CMS GAAs.mxd

CP24-MWS
CP24-MWI
CP25-MWS
CP25-MWI
Groundwater Assessment Area A
CP05-PZM028
CP05-PZM008
CP05-PZM019
CP10-PZM008
CP09-PZM010
CP09-PZM047
CP15-PZM020
CP15-PZM042
CP11-PZM010

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Notes:
Only monitoring wells with groundwater analytical results are shown.

GAA - Groundwater Assesment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study

Coke Point Area CMS
Groundwater Assessment Area A

June 12, 2025

Figure
25A

ARM Group LLC
Engineers and Scientists

0 25 50 100 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

CP24-MWI
2/28/2020

CP24-MWS
2/28/2020

CP25-MWI
3/16/2020
Naphthalene: 564

CP25-MWS
3/16/2020

Groundwater Assessment Area A

CP05-PZM028
10/2/2024

CP05-PZM008
10/2/2024

CP05-PZM019
10/2/2024

CP10-PZM008
10/28/2021
Naphthalene: 391

CP09-PZM047
10/2/2024

CP09-PZM010
10/2/2024

CP15-PZM042
10/3/2024

CP15-PZM020
10/3/2024

CP11-PZM010
10/3/2024

CPA CMS COCs	Final Remedial Goals - Sitewide (µg/L)
Arsenic	40
1,1-Biphenyl	100
2-Methylnaphthalene	400
Benz[a]anthracene	1.0
Benzo[a]pyrene	0.16
Benzo[b]fluoranthene	1.0
Bis(2-Ethylhexyl)phthalate	1.0
Dibenz[a,h]anthracene	0.16
Indeno[1,2,3-c,d]pyrene	1.0
Naphthalene	115
Benzene	100
Ethylbenzene	100
Toluene	10,000
Xylenes	1,000

Notes:
1. Only Exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. All results shown in µg/L.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal Exceedances
(Sitewide) - GAA A

June 12, 2025

Figure
25B

ARM Group LLC
Engineers and Scientists

0 25 50 100 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

CP24-MWI
2/28/2020

CP24-MWS
2/28/2020

Groundwater Assessment Area A

CP05-PZM028
10/2/2024

CP05-PZM008
10/2/2024

CP05-PZM019
10/2/2024

CP09-PZM047
10/2/2024

CP09-PZM010
10/2/2024

CP15-PZM042
10/3/2024

CP15-PZM020
10/3/2024

CP11-PZM010
10/3/2024

CPA CMS COCs	Final Remedial Goals - Shoreline (µg/L)
Iron	22,500
Benzo[a]pyrene	0.16
Dibenz[a,h]anthracene	0.16
Pyrene	13
Toluene	735

Note: Based on the most recent sampling event, there were no exceedances of the applicable Shoreline Final Remedial Goals in GAA A.

GAA: Groundwater Assessment Area
IM: Interim Measure
CPA CMAS: Coke Point Area Corrective Measures Study
COC: Contaminants of Concern

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal
Exceedances (Shoreline) - GAA A

June 12, 2025

Figure
25C

ARM Group LLC
Engineers and Scientists

0 25 50 100 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

CO178-MWS
CO178-MWI
CO177-MWS
CO27-PZM046
CO47-PZM046
CO46-PZM047
CO43-PZM048
CO179-MWS
CO177-MWI
CO37-PZM003
CO36-PZM043
CO179-MWI
CO36-PZM008
COA-MWI-007
CO180-MWI
CO37-PZM038
CO121-PZM
CO180-MWS
CO48-PZM044
CO42-PZM004
CO27-PZM012
CO39-PZM007
CO44-PZM048
CO182-MWI
CO181-MWI
CO38-PZM043
CO39-PZM042
CO45-PZM047
CO181-MWS
CO38-PZM006
CO40-PZM008
CO03-PZM005
CO183-MWI
CO186-MWS
CO215-RIW
CO28-PZM048
CO41-PZM036
COA-MWI-006
CO15-PZM005
CO213-RIW
CO167-PZM
CO28-PZM010
CO184-MWI
CO41-PZM001
CO188-MWI
CO187-MWS
CO214-RIW
CO152-PZM
CO185-MWS
CO185-MWI
CO79-PZM
CO18-PZM006
CO159-PZM
CO189-MWS
CO209-MWI
CO190-MWS
CO100-PZM
CO209-MWS
CO002-PZM006
CO002-PZM041
CO93-PZM
CO19-PZM004
CO88-PZM
CO192-MWS
CO191-MWS
CO08C-PZM
CO08A-PZM
CO16-PZM006
CO09-PZM007
CO212-MWS
CO212-MWI
CO08-PZM036
CO193-MWI
CO07-PZM050
CO07-PZM008
CO08-PZM005
CO29-PZM051
CO29-PZM010
CO193-MWS
COA-MWS-004
COA-MWI-004
CO08B-PZM
COA-MWI-009
CO08D-PZM
COA-MW-003
CO196-MWS
CO102-PZM
CO195-MWS
CO210-MWI
CO197-MWS
CO210-MWS
CO194-MWS
CO103-PZM
CO202-MWS
CO104-PZM
CO32-PZM041
CO32-PZM004
CO200-MWS
CO198-MWS
CO101-PZM
CO211-MWS
CO211-MWI
COA-MWI-011
CO199-MWS
CO30-PZM015
CO201-MWS
TS06-PPM008
CO30-PZM060
CP22-MWS
CP22-MWI
CP23-MWS
CP23-MWI

Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

Notes:
Only monitoring wells with groundwater analytical results are shown.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- Quay Wall
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Groundwater Assessment Area B
August 8, 2025

Figure 26A

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

0 50 100 200 Feet

Source: E

B10-028-SB
B10-025-SB
Cell 2
B10-026-SB
B10-029-SB
B10-027-SB
B10-023-SB
Cell 6
B10-024-SB
Cell 1
Cell 3
Cell 5

LEGEND

- Soil Boring
- COA Cell Boundaries
- GAA Boundaries

Coke Point Area CMS
New Soil Borings (2024)
June 13, 2025

Figure
26B

ARM Group LLC
Engineers and Scientists

0 80 160 320
Feet

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306

Z:\ARM Group LLC Projects\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B10 West AOC B Alternative Borings.mxd



Z:\ARM Group LLC Projects\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B10 West AOC B Alternative Borings.mxd

Coke Point Area CMS
Cross Section Plan View
June 13, 2025

Figure
26C

ARM Group LLC
Engineers and Scientists

0 90 180 360
Feet

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306

A (west)

A' (east)

CO181-MWS
CO181-MWI
B10-025-SB
CO38-PZM006
CO38-PZM043
CO182-MWI
B10-026-SB
B10-029-SB
B10-008-SB
COA-MWI-008
B10-013-SB

ELEVATION (feet)

20
10
0
-10
-20
-30
-40
-50

0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 26D

CPA CMS

Cross Section A-A'

ARM Group LLC
Engineers and Scientists

LEGEND

Slag
Sand
Clay

Shallow Groundwater Elevation
Intermediate Groundwater Elevation

Note: No well was installed at COA-MWI-008 becasue no sand unit was observed in the soil boring.

12-10-2024 Z:\ARM Group LLC Projects\EnviroAnalytics Group\20010302 Coke Point Area CMS\Documents\Cross Sections\A-A'.cro

B (north)

B' (south)

CO177-MWS
CO177-MWI
Quay Wall
CO44-PZM048
B10-025-SB
CO184-MWI
CO185-MWS
CO185-MWI
CO124-SB073
SW17-PZM113
COA-MWI-009
COA-MWI-011
CP23-MWS
CP23-MWI

ELEVATION (feet)

20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130

0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 26E

CPA CMS

Cross Section B-B'

ARM Group LLC
Engineers and Scientists

LEGEND

Slag
Sand
Clay

Shallow Groundwater Elevation
Intermediate Groundwater Elevation

C (north)

C' (south)

GD02-MWI

Quay Wall

CO47-PZM046

B10-026-SB

B10-027-SB

CO188-MWI

CO189-MWS

CO191-MWS

CO33-PZM141

CO32-PZM004

CO32-PZM041

ELEVATION (feet)

20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 26F

CPA CMS

Cross Section C-C'

ARM Group LLC
Engineers and Scientists

LEGEND

- Slag
- Sand
- Clay
- Shallow Groundwater Elevation
- Intermediate Groundwater Elevation

D (north)

D' (south)

Quay Wall

B10-028-SB

B10-008-SB

B10-029-SB

CO03-PZM005

COA-MWI-006

B10-020-SB

B10-023-SB

CO02-PZM006

CO02-PZM041

CO07-PZM008

CO07-PZM050

COA-MW-003

CO211-MWS

CO211-MWI

ELEVATION (feet)

20

10

0

-10

-20

-30

-40

-50

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 26G

CPA CMS

Cross Section D-D'

ARM Group LLC
Engineers and Scientists

LEGEND

- Slag
- Sand
- Clay
- Clay with Sand
- Shallow Groundwater Elevation
- Intermediate Groundwater Elevation

12-23-2024 Z:\ARM Group LLC Projects\EnviroAnalytics Group\20010302 Coke Point Area CMS\Documents\Cross Sections\D-D'.cro

E (west)

E' (east)

CO198-MWS
CO199-MWS
CO200-MWS
CO201-MWS
COA-MWI-011
CO30-PZM015
CO30-PZM060
CO202-MWS
CO32-PZM004
CO32-PZM041
CO211-MWS
CO211-MWI
CO13-PZM030
CO173-SB036
CO171-SB031
CO206R-MWS
CO56-PZP001
CO72-PZM005
CO26-PZM007
CO26-PZM032

ELEVATION (feet)

20
10
0
-10
-20
-30
-40
-50
-60
-70
-80

0
500
1000
1500
2000
2500
3000
3500
4000

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 26H

CPA CMS

Cross Section E-E'

ARM Group LLC
Engineers and Scientists

LEGEND

Slag
Sand
Clay

▼ Shallow Groundwater Elevation

▽ Intermediate Groundwater Elevation

12-27-2024 C:\Users\JBarna\Desktop\Cross Sections 12-23-24\Cross Sections\E-E'.cro

CO46-PZM047
6/30/2022
Benzene: 24,000
Ethylbenzene: 280
Naphthalene: 820
Xylenes: 1,900

CO178-MWS
10/11/2019
Benzene: 14,200
Ethylbenzene: 242
Xylenes: 1,950
2/11/2025
Naphthalene: 510

CO27-PZM045
12/17/2024
Benzene: 11,000
Ethylbenzene: 140
Naphthalene: 840
Xylenes: 1,200

CO179-MWI
10/2/2019
Benzene: 28,500
Ethylbenzene: 373
Naphthalene: 6,280
Toluene: 13,000
Xylenes: 2,990

CO178-MWI
10/14/2019
Benzene: 40,800
Ethylbenzene: 268
Xylenes: 1,870
2/11/2025

CO47-PZM046
6/30/2022
Benzene: 22,000
Ethylbenzene: 290
Naphthalene: 990
Xylenes: 2,200

CO179-MWS
6/13/2023
Benzene: 4,700
Ethylbenzene: 230
Naphthalene: 1,200
Xylenes: 2,300

CO36-PZM043
8/10/2023
Benzene: 16,000
Naphthalene: 550

CO177-MWI
9/27/2019
Benzene: 4,900
Naphthalene: 125

CO180-MWI
5/23/2023
Benzene: 18,000
Xylenes: 1,200
2/11/2025
Naphthalene: 610

CO177-MWS
9/27/2019
Benzene: 5,950
Naphthalene: 161

CO121-PZM
9/19/2024
Benzene: 1,600
Naphthalene: 1,800

CO37-PZM003
3/12/2024

COA-MWI-007
11/11/2024
Benzene: 1,300
Naphthalene: 1,900

CO36-PZM008
8/10/2023
Benzene: 15,000
Naphthalene: 530

CO45-PZM047
6/30/2022

CO37-PZM038
3/11/2024
Benzene: 17,000
Ethylbenzene: 230
Naphthalene: 1,300
Xylenes: 2,000

CO180-MWS
5/23/2023
Benzene: 17,000
Xylenes: 1,500
2/11/2025
Naphthalene: 700

CO43-PZM049
6/30/2022
Benzene: 4,200

CO42-PZM004
3/4/2024

CO44-PZM048
6/30/2022
Benzene: 300

CO27-PZM012
12/17/2024
Benzene: 7,900
Naphthalene: 450

CO48-PZM044
6/30/2022
Benzene: 20,000
Ethylbenzene: 340
Naphthalene: 1,200
Toluene: 10,000
Xylenes: 2,500

CO39-PZM007
8/8/2023
Benzene: 380
Naphthalene: 240

CO181-MWS
5/24/2023
Benzene: 21,000
Ethylbenzene: 130
Naphthalene: 1,700
Xylenes: 2,000

CO181-MWI
5/24/2023
Benzene: 23,000
Ethylbenzene: 120
Naphthalene: 1,800
Xylenes: 1,800

CO39-PZM042
8/8/2023
Benzene: 4,200
Naphthalene: 870

CO38-PZM043
8/8/2023

CO38-PZM006
8/8/2023
Benzene: 2800
Naphthalene: 590

CO182-MWI
12/10/2024
Benzene: 22,000
Ethylbenzene: 100
Xylenes: 1,300

CO183-MWI
9/27/2019
Benzene: 146,000
Ethylbenzene: 743
Naphthalene: 757
Toluene: 51,200
Xylenes: 16,700

CO40-PZM008
8/9/2023
Benzene: 740
Naphthalene: 150

CO03-PZM005
6/10/2015
3/9/2020

CO28-PZM049
5/24/2023
Arsenic: 537.6
Benzene: 93,000
Ethylbenzene: 260 J
Naphthalene: 1,600
Xylenes: 4,800

CO28-PZM010
5/24/2023

CO184-MWI
11/1/2024
Benzene: 210,000
Ethylbenzene: 670
Naphthalene: 9,200
Toluene: 52,000
Xylenes: 10,000

CO186-MWS
12/10/2024
Benzene: 140,000
Ethylbenzene: 240 J
Toulene: 37,000
Xylenes: 4,200

CO215-RIW
9/18/2024

COA-MWI-006
11/12/2024
Benzene: 18,000

CO213-RIW
9/18/2024
Benzene: 29,000

CO41-PZM001
12/16/2024
Benzene: 35,000
Ethylbenzene: 760
Naphthalene: 330
Toluene: 18,000
Xylenes: 8,600

CO214-RIW
9/18/2024
Benzene: 630,000
Ethylbenzene: 330 J
Toluene: 57,000
Xylenes: 7,500

CO187-MWS
9/18/2024
Benzene: 710,000
Naphthalene: 130 J

CO167-PZM
9/19/2024
Benzene: 120
Naphthalene: 120

CO152-PZM
10/31/2024
Benzene: 300

CO41-PZM036
12/17/2024
Benzene: 280,000
Ethylbenzene: 830 J
Toulene: 90,000
Xylenes: 17,000

CO185-MWS
10/8/2019
Benzene: 2,610
Naphthalene: 581

CO185-MWI
11/1/2024
Benzene: 78,000
Ethylbenzene: 220
Naphthalene: 8,900
Toluene: 18,000
Xylenes: 3,900

CO15-PZM005
6/17/2015
Benzene: 169,000
Benzo[a]pyrene: 0.24 J
Ethylbenzene: 121
Toulene: 10,300

CO18-PZM006
11/4/2024
Benzene: 260,000
Benzo[a]pyrene: 0.34

CO159-PZM
9/19/2024

CO209-MWI
12/18/2024
Benzene: 2000
Naphthalene: 18,000

CO188-MWI
10/31/2024
Benzene: 270,000
Ethylbenzene: 1,100
Naphthalene: 770
Toluene: 37,000
Xylenes: 14,000

CO189-MWS
9/17/2024
Benzene: 290,000
Naphthalene: 720 J

CO02-PZM006
12/17/2020
Benzene: 134,000
Ethylbenzene: 248
Naphthalene: 173

CO100-PZM
9/17/2024

CO209-MWS
12/18/2024
Naphthalene: 3,300

CO02-PZM041
10/31/2024

CO190-MWS
12/17/2024
Benzene: 290,000
Toulene: 14,000

CO79-PZM
6/9/2015
Benzene: 1,380
Benzo[a]pyrene: 0.6 J
Benzo[b]fluoranthene: 1.6

CO192-MWS
10/7/2019
Benzene: 72,900
Ethylbenzene: 221
Naphthalene: 301

CO19-PZM004
9/17/2024

CO08A-PZM
9/17/2024
Benzene: 510
Ethylbenzene: 240
Naphthalene: 3,100
Xylenes: 4,100

CO93-PZM
6/9/2015
Benz[a]anthracene: 1.9
Benzo[a]pyrene: 1.8
Benzo[b]fluoranthene: 3.2
bis(2-Ethylhexyl)phalate: 1.0 J
12/10/2024
Benzene: 130,000
Ethylbenzene: 1,200
Naphthalene: 1,700
Toluene: 40,000
Xylenes: 13,000

CO08C-PZM
5/19/2021

CO088-PZM
9/17/2024
Benzene: 86,000
Ethylbenzene: 310 J
Naphthalene: 1,400
Xylenes: 1,700 J

CO16-PZM006
10/8/2019
Benzene: 78,000
Ethylbenzene: 250
Naphthalene: 503
Xylenes: 1,940

CO08-PZM036
6/10-18/2015
Benzene: 35,300
Ethylbenzene: 1,070
Naphthalene: 2,170
Toulene: 17,700
Xylenes: 8,770

CO08-PZM005
6/10-18/2015
Benzene: 15,000
Ethylbenzene: 198
Naphthalene: 257
Xylenes: 2,760

CO212-MWI
2/6/2020

CO212-MWS
11/5/2024
1,1,-Biphenyl: 110
Benzene: 4,400
Ethylbenzene: 580
Naphthalene: 3,800
Xylenes: 8,100

CO09-PZM007
6/10-18/2015
Benzene: 358
Naphthalene: 809

CO191-MWS
6/7/2024
Benzene: 34,000
Ethylbenzene: 110
Naphthalene: 190 J

CO193-MWI
11/1/2024
Benzene: 12,000
2/10/2025
Arsenic: 63.0

CO07-PZM050
3/10/2020

CO07-PZM008
3/10/2020
Benzene: 30,000
Naphthalene: 319

CO29-PZM051
12/19/2019

CO29-PZM010
12/18/2024
Naphthalene: 700

CO193-MWS
10/1/2019
Benzene: 33,700
Naphthalene: 1,170

COA-MWS-004
6/5/2024
Benzene: 16,000
Ethylbenzene: 460
Naphthalene: 3,700
Xylenes: 5,500

COA-MWI-004
6/5/2024
Benzene: 16,000
Ethylbenzene: 400
Naphthalene: 2,900
Xylenes: 4,700

CO08B-PZM
5/19/2021
Benz[a]anthracene: 4.5 J
Benzene: 5,240
Benzo[a]pyrene: 2.4
Benzo[b]fluoranthene: 2.1
Dibenz[a,h]anthracene: 0.37
Ethylbenzene: 211
Indeno[1,2,3-c,d]pyrene: 1.4
Naphthalene: 1,490
Xylenes: 1,480

COA-MWI-009
11/11/2024
Benzene: 940
Naphthalene: 900

COA-MW-003
6/5/2024
Benzene: 1,200
Naphthalene: 270

CO08D-PZM
5/19/2021

CO195-MWS
11/20/2024
Benzene: 24,000
Naphthalene: 1,300

CO196-MWS
12/13/2024
Benzene: 3,200
Naphthalene: 330

CO102-PZM
12/17/2020
Benzene: 13,500
Naphthalene: 874

CO197-MWS
10/1/2019
Benzene: 5,680
Naphthalene: 3,250

CO210-MWS
12/18/2024
Benzene: 230
Naphthalene: 1,800

CO210-MWI
12/20/2024
Benzene: 100

CO194-MWS
12/12/2024
Benzene: 370
Naphthalene: 1,400

CO103-PZM
12/17/2020
Benzene: 1,100

CO101-PZM
12/17/2020
Benzene: 5,480
Naphthalene: 179

CO202-MWS
9/30/2019
Benzene: 1,780
Naphthalene: 886

CO211-MWS
3/11/2020
Benz[a]anthracene: 2
Benzene: 369
Benzo[a]pyrene: 2
Benzo[a]fluoranthene: 2.5
Dibenz[a,h]anthracene: 0.37
Indeno[1,2,3-c,d]pyrene: 1.1

CO211-MWI
3/11/2020

CO104-PZM
12/16/2020

CO32-PZM004
3/29/2020

CO32-PZM041
3/16/2020

CO201-MWS
12/13/2024
Benzene: 600

CO198-MWS
12/13/2024
Benzene: 230
Naphthalene: 1,600

COA-MWI-011
11/11/2024
Benzene: 680
Naphthalene: 830

CO200-MWS
9/30/2019
Benzene: 34,100
Naphthalene: 1,130

TS06-PPM008
6/11/2015

CO199-MWS
9/30/2019
Benzene: 34,200
Naphthalene: 12,200
Xylenes: 1,150

CO30-PZM060
6/6/2024
2/10/2025
Arsenic: 78.7

CO30-PZM015
11/20/2024
Benzene: 38,000
2/10/2025
Naphthalene: 3,300

CP22-MWS
12/19/2024
Naphthalene: 440

CP22-MWI
2/28/2020

CP23-MWS
12/19/2024
Naphthalene: 880

CP23-MWI
3/13/2020

Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

CPA CMS COCs	Final Remedial Goals - Sitewide (µg/L)
Arsenic	40
1,1-Biphenyl	100
2-Methylnaphthalene	400
Benz[a]anthracene	1.0
Benzo[a]pyrene	0.16
Benzo[b]fluoranthene	1.0
Bis(2-Ethylhexyl)phthalate	1.0
Dibenz[a,h]anthracene	0.16
Indeno[1,2,3-c,d]pyrene	1.0
Naphthalene	115
Benzene	100
Ethylbenzene	100
Toluene	10,000
Xylenes	1,000

Notes:
1. Only exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. J = Result detected above the method detection limit but below the reporting limit.
4. All results shown in µg/L.
5. February 2025 SVOC data gap sampling was conducted at six GAA B wells: CO178-MWS, CO178-MWI, CO180-MWS, CO180-MWI, CO30-PZM015, and CO30-PZM060. BTEX was not included in the February 2025 sampling round. For these wells only, BTEX exceedances from the previous sampling round have also been included in this figure as n eded.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal Exceedances
(Sitewide) - GAA B
June 12, 2025

Figure 26I

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

N

0 50 100 200 Feet

Source: E

CPA CMS COCs	Final Remedial Goals - Shoreline (µg/L)
Iron	22,500
Benzo[a]pyrene	0.16
Dibenz[a,h]anthracene	0.16
Pyrene	13
Toluene	735

Notes:
1. Only exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. J = Result detected above the method detection limit but below the reporting limit.
4. All results shown in µg/L.
5. February 2025 SVOC data gap sampling was conducted at six GAA B wells: CO178-MWS, CO178-MWI, CO180-MWS, CO180-MWI, CO30-PZM015, and CO30-PZM060. BTEX was not included in the February 2025 sampling round. For these wells only, BTEX exceedances from the previous sampling round have also been included in this figure as needed.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal Exceedances
(Shoreline) - GAA B
June 12, 2025

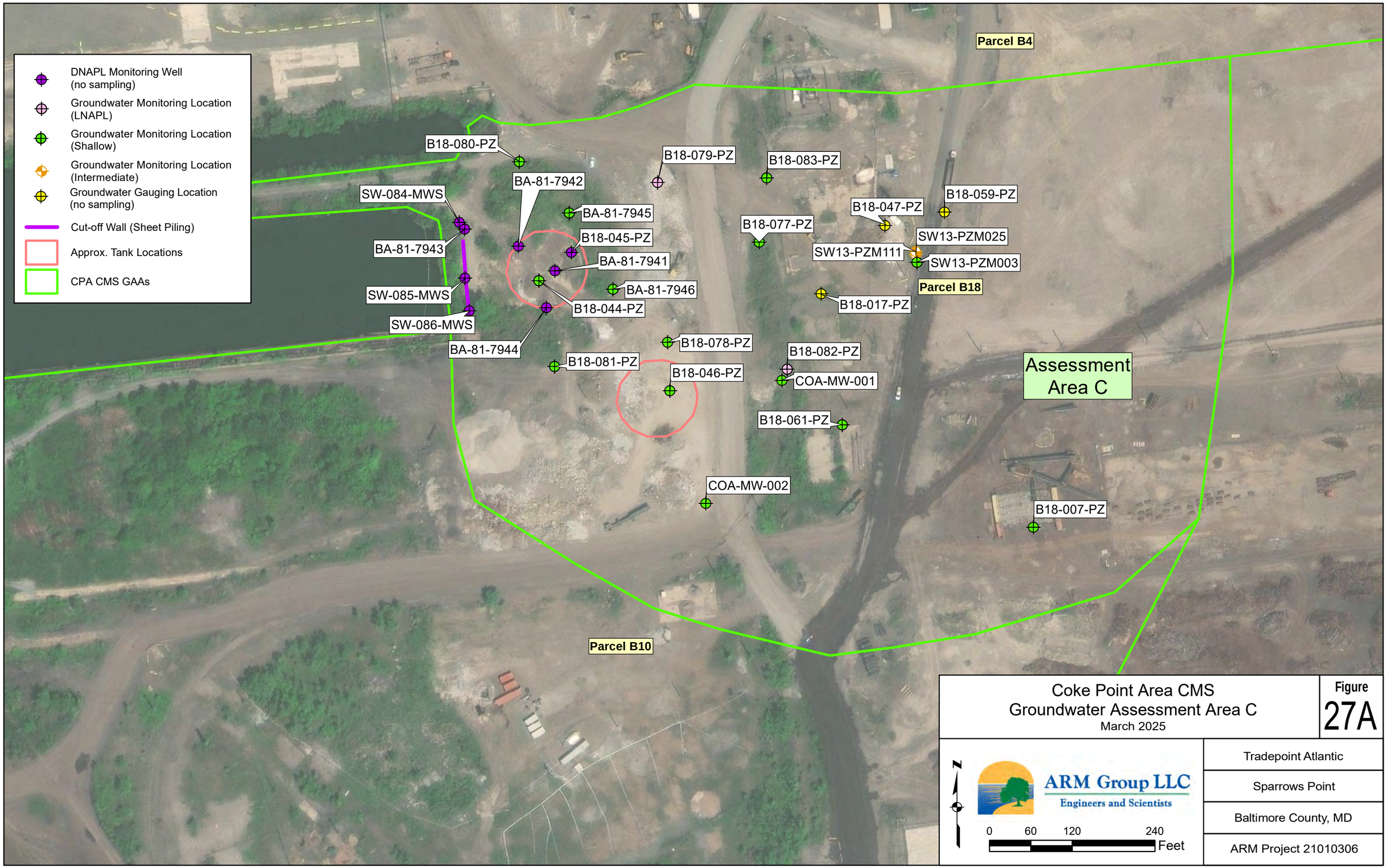
Figure 26J

ARM Group LLC Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Source: E

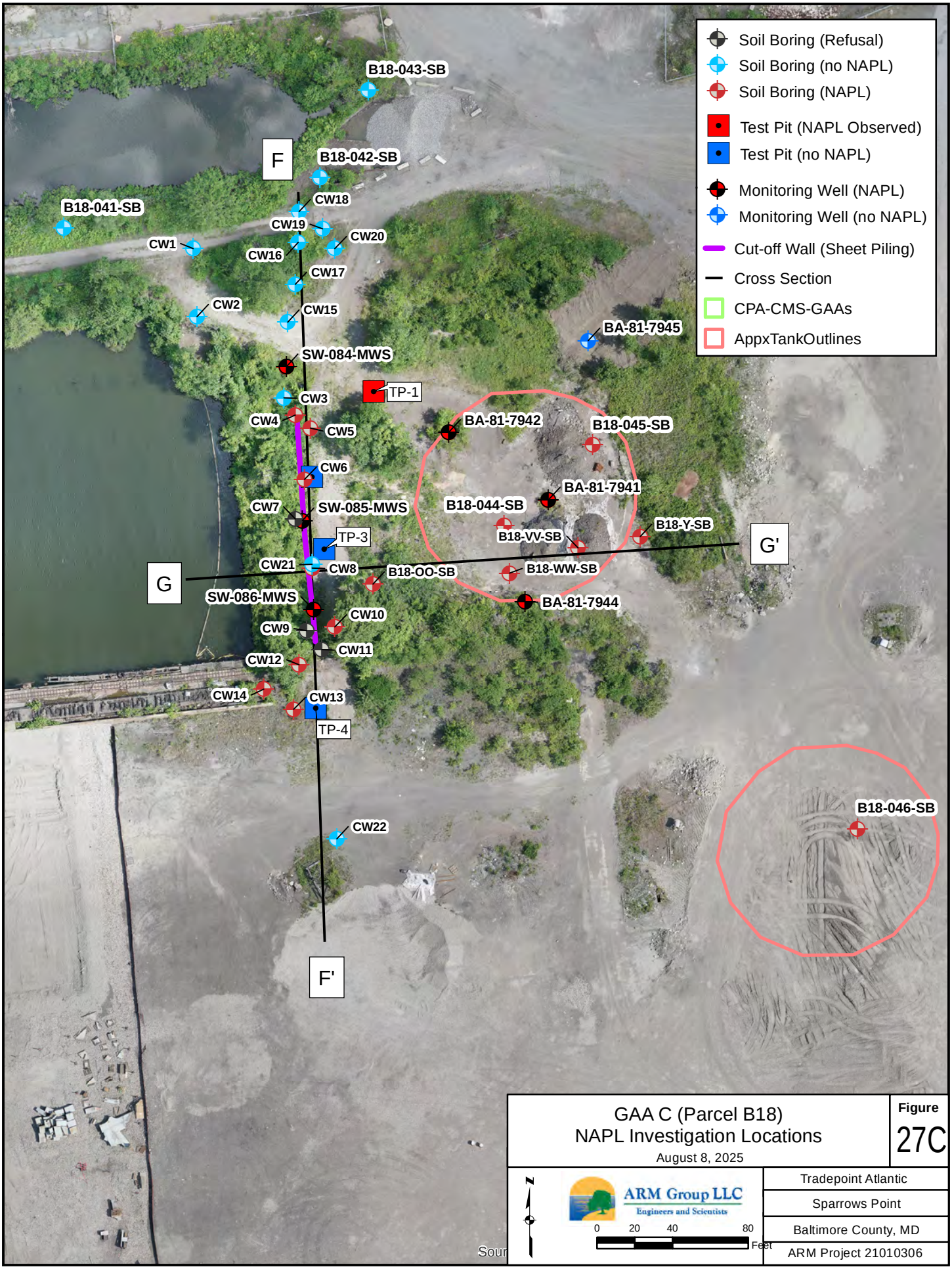

DNAPL Monitoring Well (no sampling)
Groundwater Monitoring Location (LNAPL)
Groundwater Monitoring Location (Shallow)
Groundwater Monitoring Location (Intermediate)
Groundwater Gauging Location (no sampling)
Cut-off Wall (Sheet Piling)
Approx. Tank Locations
CPA CMS GAAs
Parcel B4
Parcel B18
Parcel B10
Assessment Area C
B18-080-PZ
BA-81-7942
B18-079-PZ
B18-083-PZ
B18-059-PZ
SW-084-MWS
BA-81-7945
B18-047-PZ
B18-077-PZ
BA-81-7943
B18-045-PZ
SW13-PZM025
SW13-PZM111
SW13-PZM003
BA-81-7941
SW-085-MWS
BA-81-7946
B18-017-PZ
B18-044-PZ
SW-086-MWS
BA-81-7944
B18-078-PZ
B18-082-PZ
B18-081-PZ
B18-046-PZ
COA-MW-001
B18-061-PZ
COA-MW-002
B18-007-PZ
Coke Point Area CMS
Groundwater Assessment Area C
March 2025
Figure
27A
ARM Group LLC
Engineers and Scientists
0 60 120 240
Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306



GAA C (Parcel B18)
Shallow Groundwater Contours
June 16, 2025

Figure
27B

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306



GAA C (Parcel B18)
NAPL Investigation Locations
August 8, 2025

Figure
27C

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B18 Cutoff Wall Boring Locations.mxd

F (north)

F' (south)

CW20 SW-084-MWS CW4 CW5 CW6 SW-085-MWS CW21 SW-086-MWS CW10 CW22

Elevation (feet)

20 15 10 5 0 -5 -10 -15 -20 -25 -30 -35 -40

0 50 100 150 200 250 300 350 400

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 27D

GAA C (Parcel B18)

Cross Section F-F'

ARM Group LLC
Engineers and Scientists

LEGEND

- Slag Fill
- Sand Fill
- Silt/Clay Fill
- Native Sand
- Native Silt/Clay
- DNAPL in Soil Core
- DNAPL in Well
- Shallow Groundwater Elevation

Note: Screened intervals for wells SW-085-MWS and SW-086-MWS were chosen to target DNAPL observed during drilling and to ensure an adequate seal.

G (west)

G' (east)

Cutoff Wall

CW21

B18-OO-SB

B18-WW-SB

B18-VV-SB

B18-Y-SB

Elevation (feet)

20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40

0
50
100
150
200
250
300

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 27E

GAA C (Parcel B18)

Cross Section G-G'

ARM Group LLC
Engineers and Scientists

LEGEND

- Slag Fill
- Sand Fill
- Silt/Clay Fill
- Native Sand
- Native Silt/Clay
- DNAPL in Soil Core

B18-043-SB
B18-042-SB
B18-080-PZ
B18-TTT-SB
B18-SSS-SB
B18-RRR-SB
B18-QQQ-SB
B18-ZZZ-SB
B18-UUU-SB
B18-FF-SB
B18-CC-SB
B18-079-PZ
B18-083-PZ
B18-YYY-SB
B18-EE-SB
B18-PPP-SB
B18-II-SB
B18-HH-SB
B18-OOO-SB
B18-057-SB
B18-UU-SB
BA-81-7945
B18-JJ-SB
B18-BB-SB
SW-084-MWS
B18-AA-SB
B18-NNN-SB
B18-XXX-SB
BA-81-7943
B18-DD-SB
B18-RR-SB
B18-077-PZ
B18-KK-SB
BA-81-7942
B18-SS-SB
B18-045-SB
B18-LL-SB
B18-Z-SB
B18-GG-SB
B18-QQ-SB
B18-045-PZ
B18-VVV-SB
B18-WWW-SB
BA-81-7941
B18-W-SB
B18-TT-SB
SW-085-MWS
B18-MM-SB
B18-Y-SB
B18-044-PZ
B18-044-SB
BA-81-7946
B18-NN-SB
B18-058-SB
B18-VV-SB
B18-OO-SB
B18-X-SB
B18-WW-SB
BA-81-7944
B18-V-SB
SW-086-MWS
B18-C-SB
B18-F-SB
B18-PP-SB
B18-B-SB
B18-E-SB
B18-D-SB
B18-A-SB
B18-037-SB
B18-078-PZ
B18-MMM-SB
B18-LLL-SB
B18-GGG-SB
B18-FFF-SB
B18-038-SB
B18-M-SB
B18-081-PZ
B18-L-SB
B18-KKK-SB
B18-N-SB
B18-HHH-SB
B18-EEE-SB
B18-K-SB
B18-XX-SB
B18-JJJ-SB
B18-046-PZ
B18-DDD-SB
B18-J-SB
B18-049-SB
B18-CCC-SB
B18-046-SB
B18-YY-SB
B18-III-SB
B18-G-SB
B18-ZZ-SB
B18-050-SB
B18-BBB-SB
B18-AAA-SB
B18-I-SB
B18-O-SB
B18-U-SB
B18-H-SB
B18-Q-SB
B18-T-SB
B18-P-SB
B18-S-SB
B18-R-SB
COA-MW-002

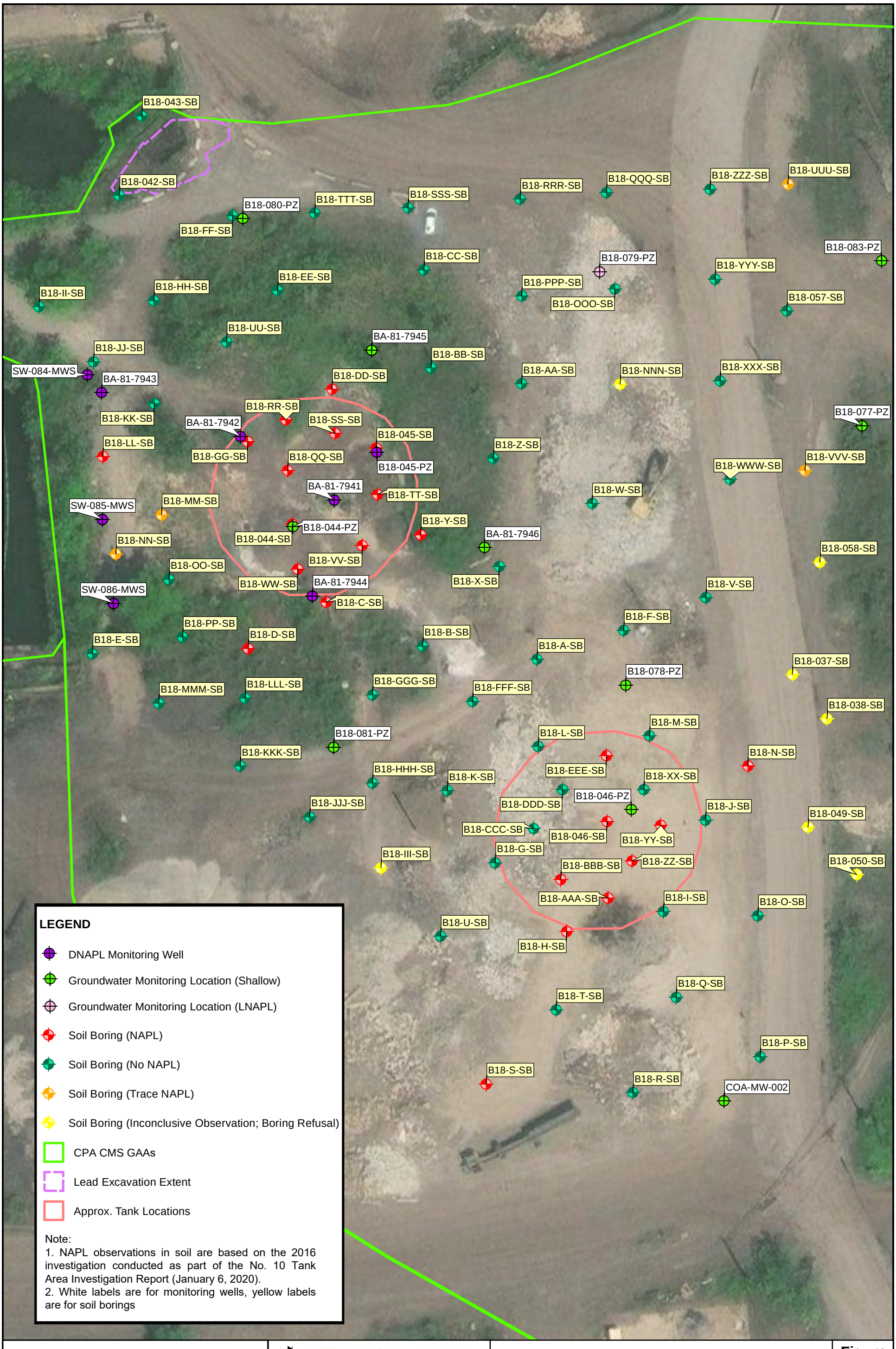
LEGEND

- DNAPL Monitoring Well
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (LNAPL)
- Soil Boring (NAPL)
- Soil Boring (No NAPL)
- Soil Boring (Trace NAPL)
- Soil Boring (Inconclusive Observation; Boring Refusal)
- CPA CMS GAAs
- Lead Excavation Extent
- Approx. Tank Locations

Note:
1. NAPL observations in soil are based on the 2016 investigation conducted as part of the No. 10 Tank Area Investigation Report (January 6, 2020).
2. White labels are for monitoring wells, yellow labels are for soil borings

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B18 - NAPL Investigation 11x17.mxd

Tradepoint Atlantic Sparrows Point Baltimore County, MD ARM Project 21010306	N ARM Group LLC Engineers and Scientists 0 15 30 60 Feet	GAA C (Parcel B18) - Presence of NAPL at Discrete Soil Depths (0-4' bgs)	Figure 27F



P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B18 - NAPL Investigation 11x17.mxd

Tradepoint Atlantic	ARM Group LLC Engineers and Scientists	GAA C (Parcel B18) - Presence of NAPL at Discrete Soil Depths (4-8' bgs)	Figure 27G
Sparrows Point			
Baltimore County, MD	0 15 30 60 Feet		
ARM Project 21010306			

B18-043-SB
B18-042-SB
B18-080-PZ
B18-TTT-SB
B18-SSS-SB
B18-FF-SB
B18-RRR-SB
B18-QQQ-SB
B18-ZZZ-SB
B18-UUU-SB
B18-CC-SB
B18-079-PZ
B18-083-PZ
B18-YYY-SB
B18-EE-SB
B18-PPP-SB
B18-HH-SB
B18-II-SB
B18-OOO-SB
B18-057-SB
B18-UU-SB
BA-81-7945
B18-JJ-SB
B18-BB-SB
SW-084-MWS
B18-AA-SB
B18-NNN-SB
B18-XXX-SB
BA-81-7943
B18-DD-SB
B18-RR-SB
B18-077-PZ
B18-KK-SB
BA-81-7942
B18-SS-SB
B18-045-SB
B18-LL-SB
B18-Z-SB
B18-GG-SB
B18-QQ-SB
B18-045-PZ
B18-VVV-SB
B18-WWW-SB
BA-81-7941
B18-W-SB
B18-TT-SB
SW-085-MWS
B18-MM-SB
B18-Y-SB
B18-044-PZ
B18-044-SB
BA-81-7946
B18-NN-SB
B18-058-SB
B18-VV-SB
B18-OO-SB
B18-X-SB
B18-WW-SB
BA-81-7944
B18-V-SB
SW-086-MWS
B18-C-SB
B18-F-SB
B18-PP-SB
B18-B-SB
B18-D-SB
B18-E-SB
B18-A-SB
B18-037-SB
B18-078-PZ
B18-MMM-SB
B18-LLL-SB
B18-GGG-SB
B18-FFF-SB
B18-038-SB
B18-M-SB
B18-L-SB
B18-081-PZ
B18-N-SB
B18-KKK-SB
B18-EEE-SB
B18-HHH-SB
B18-K-SB
B18-XX-SB
B18-046-PZ
B18-JJJ-SB
B18-DDD-SB
B18-J-SB
B18-049-SB
B18-CCC-SB
B18-046-SB
B18-YY-SB
B18-III-SB
B18-G-SB
B18-ZZ-SB
B18-050-SB
B18-BBB-SB
B18-AAA-SB
B18-I-SB
B18-O-SB
B18-U-SB
B18-H-SB
B18-Q-SB
B18-T-SB
B18-P-SB
B18-S-SB
B18-R-SB
COA-MW-002

LEGEND

- DNAPL Monitoring Well
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (LNAPL)
- Soil Boring (NAPL)
- Soil Boring (No NAPL)
- Soil Boring (Trace NAPL)
- Soil Boring (Inconclusive Observation; Boring Refusal)
- CPA CMS GAAs
- Lead Excavation Extent
- Approx. Tank Locations

Note:
1. NAPL observations in soil are based on the 2016 investigation conducted as part of the No. 10 Tank Area Investigation Report (January 6, 2020).
2. White labels are for monitoring wells, yellow labels are for soil borings

P:\EnviroAnalytics Group\150300M EAG_Sparrows Point Area B\GIS\Parcel B18 - NAPL Investigation 11x17.mxd

Tradepoint Atlantic Sparrows Point Baltimore County, MD ARM Project 21010306	N ARM Group LLC Engineers and Scientists 0 15 30 60 Feet	GAA C (Parcel B18) - Presence of NAPL at Discrete Soil Depths (8-12' bgs)	Figure 27H

B18-080-PZ
11/28/2018
Benz[a]anthracene: 1.6
Benzo[a]pyrene: 1.2
Benzo[b]fluoranthene: 1.8
Dibenz[a,h]anthracene: 0.25
Naphthalene: 587

B18-079-PZ
11/29/2018
Naphthalene: 1,310

B18-083-PZ
11/28/2018

BA-81-7945
11/30/2018

B18-044-PZ
11/30/2018
2-Methylnaphthalene: 582
Benz[a]anthracene: 41.8
Benzo[a]pyrene: 24.2
Benzo[b]fluoranthene: 15.1
Dibenz[a,h]anthracene: 2.9 J
Indeno[1,2,3-c,d]pyrene: 3.7 J
Naphthalene: 159

B18-077-PZ
11/29/2018

SW13-PZM111
12/19/2015
Bis(2-Ethylhexyl)phthalate: 1.1

SW13-PZM003
3/28/2016
Naphthalene: 169

SW13-PZM025
2/19/2016

SW-085-MWS
11/28/2018
Benz[a]anthracene: 6
Benzo[a]pyrene: 5.2
Benzo[b]fluoranthene: 7.5
Dibenz[a,h]anthracene: 0.52
Indeno[1,2,3-c,d]pyrene: 1.2

B18-082-PZ
11/29/2018
2-Methylnaphthalene: 508
Benzene: 2,440
Benzo[a]pyrene: 0.16
Ethylbenzene: 149
Naphthalene: 15,300
Xylenes: 2,010

B18-078-PZ
11/30/2018
Naphthalene: 127

BA-81-7946
11/29/2018
Naphthalene: 3,860

Groundwater Assessment Area C

SW-086-MWS
11/28/2018
Benzo[a]pyrene: 0.32
Naphthalene: 625

B18-046-PZ
11/29/2018
Naphthalene: 314

COA-MW-001
6/5/2024
Benzene: 3,500
Ethylbenzene: 210
Naphthalene: 13,000
Xylenes: 2,100

B18-061-PZ
12/13/2016

B18-081-PZ
11/28/2018
Benz[a]anthracene: 1.6
Benzo[a]pyrene: 1.2
Benzo[b]fluoranthene: 1.7
Dibenz[a,h]anthracene: 0.2
Naphthalene: 2520

COA-MW-002
6/5/2024
Naphthalene: 230

B18-007-PZ
12/13/2016
Naphthalene: 411

CPA CMS COCs	Final Remedial Goals - Sitewide (µg/L)
Arsenic	40
1,1-Biphenyl	100
2-Methylnaphthalene	400
Benz[a]anthracene	1.0
Benzo[a]pyrene	0.16
Benzo[b]fluoranthene	1.0
Bis(2-Ethylhexyl)phthalate	1.0
Dibenz[a,h]anthracene	0.16
Indeno[1,2,3-c,d]pyrene	1.0
Naphthalene	115
Benzene	100
Ethylbenzene	100
Toluene	10,000
Xylenes	1,000

Notes:
1. Only exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. J = Result detected above the method detection limit but below the reporting limit.
4. All results shown in µg/L.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal Exceedances
(Sitewide) - GAA C
June 12, 2025

Figure
27I

ARM Group LLC
Engineers and Scientists

0 30 60 120 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

SW-085-MWS
11/28/2018
Benzo[a]pyrene: 5.2
Dibenz[a,h]anthracene: 0.52
Pyrene: 18.2

SW-086-MWS
11/28/2018
Benzo[a]pyrene: 0.32

Groundwater Assessment Area C

CPA CMS COCs	Final Remedial Goals - Shoreline (µg/L)
Iron	22,500
Benzo[a]pyrene	0.16
Dibenz[a,h]anthracene	0.16
Pyrene	13
Toluene	735

Notes:
1. Only Exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. All results are shown in µg/L.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal Exceedances
(Shoreline) - GAA C
June 12, 2025

Figure
27J

ARM Group LLC
Engineers and Scientists

0 30 60 120 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306



Notes:
Only monitoring wells with groundwater analytical results are shown.
GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study

Coke Point Area CMS
Groundwater Assessment Area D

March 2025

Figure
28A

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306



P:\EnviroAnalytics Group\160443M EAG_TPA Redevelopment\GIS\Coke Oven (Container Terminal Northern).mxd



CPA CMS COCs	Final Remedial Goals - Sitewide (µg/L)
Arsenic	40
1,1-Biphenyl	100
2-Methylnaphthalene	400
Benz[a]anthracene	1.0
Benzo[a]pyrene	0.16
Benzo[b]fluoranthene	1.0
Bis(2-Ethylhexyl)phthalate	1.0
Dibenz[a,h]anthracene	0.16
Indeno[1,2,3-c,d]pyrene	1.0
Naphthalene	115
Benzene	100
Ethylbenzene	100
Toluene	10,000
Xylenes	1,000

Notes:
1. Only exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. J = Result detected above the method detection limit but below the reporting limit.
4. All results shown in µg/L.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs

Coke Point Area CMS
Final Remedial Goal Exceedances
(Sitewide) - GAA D
June 16, 2025

Figure
28C

ARM Group LLC
Engineers and Scientists

0 40 80 160
Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Assessment Area C

Assessment Area D

CO20-PZM004
6/18/2015

CPA CMS COCs	Final Remedial Goals - Shoreline (µg/L)
Iron	22,500
Benzo[a]pyrene	0.16
Dibenz[a,h]anthracene	0.16
Pyrene	13
Toluene	735

Note: Based on the most recent sampling event, there were no exceedances of the applicable Shoreline Final Remedial Goals in GAA D.

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs

Coke Point Area CMS
Final Remedial Goal
Exceedances (Shoreline) - GAA D
June 9, 2025

Figure
28D

ARM Group LLC
Engineers and Scientists

0 40 80 160 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Parcel B10

Parcel B11

Parcel B12

Groundwater Assessment Area E

CT-037-GW-41
CT-037-GW-12.5
CO24-PZM007
CO203-MWS
CO34-PZM048
CO60-PZP001
CO25-PZM008
CO23-PZM008
CO205-MWS
CO204-MWS
CO72-PZM005
CO26-PZM032
CO56-PZM001
CO71-PZM006
CO26-PZM007
CO206R-MWS
CO70-PZM005
CO69-PZM005
CO67-PZM006
CO68-PZM005
CO207-MWS
CO59-PZM002
CO55-PZM000
CO64-PZM006
CO66-PZM005
CO65-PZM005
CO62-PZM007
CO63-PZM007
CO58-PZM001
CO61-PZM007
CO208-MWS
CO57-PZP002
CO35-PZM013
CO35-PZM056
SW18-PZM008
SW18-PZM053
CP17-MWI
CP17-PZM013
CP26-MWS
CP26-MWI

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Notes:
Only monitroing wells with groundwater analytical results are shown.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study

Coke Point Area CMS
Groundwater Assessment Area E

March 2025

Figure
29A

ARM Group LLC
Engineers and Scientists

0 40 80 160 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Assessment Area C

Assessment Area D

Assessment Area B

Assessment Area E

Assessment Area F

CO216-MWS
Deeper than -8 ft

CT-030-SB

MB-01
-22 ft

A-2
-13 ft

CT-032-SB

MB-02
-8 ft

CT-034-SB

MB-03
-8 ft

CT-035-SB

CO-073-PW-1
Naphthalene: 1,530

CT-037-SB

CO-074-PW-1
Naphthalene: 9,230
CO-074-PW-2
Naphthalene: 8,880

CO203-MWS
Deeper than -14 ft

CT-038-SB

A-3
-36 ft

CT-039-SB

CO-079-PW-1
Naphthalene: 3,680

CT-040-SB

CO-080-PW-1
Naphthalene: 0.41

MB-05
-15 ft

CT-041-SB

CO26-PZM007/032
-26.6 ft

CO-086-PW-1
Naphthalene: 0.33

CT-043-SB

CO207-MWS
Deeper than -13.28 ft

CO-095-PW-1
Naphthalene: 0.14
CO-073-PW-2
Naphthalene: 30.4

CT-045-SB

CO58-PZM001

A-4
-17 ft

MB-06
-19 ft

CT-046-SB

CO-098-PW-1
Naphthalene: 352

CT-047-SB

CO208-MWS
Deeper than -14 ft

CT-048-SB

MB-07
-95 ft

CO35-PZM013/056
-21 ft

MB-08
-71 ft

MB-09
-69 ft

CP17-PZM013/058
-36 ft

A-5
-37 ft

MB-10
-106 ft

CP26-MWS
-50.4 ft

LEGEND

- Completed Soil Boring
- Geotech Boring
- Pore Water Sample
- CPA-CMS-GAAs
- Container Terminal LOD

GAA E (Container Terminal) - Soil Boring Locations and Clay Elevation (ft AMSL)

June 13, 2025

Figure
29B

ARM Group LLC
Engineers and Scientists

0 125 250 500 Feet

Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306

P:\EnviroAnalytics Group\160443M EAG_TPA Redevelopment\GIS\Container Terminal Depth to Clay.mxd

H (north)

H' (south)

CT-030-SB CT-032-SB CT-034-SB CT-035-SB CT-037-SB CT-038-SB CT-039-SB CT-040-SB CT-041-SB CT-043-SB CT-045-SB CT-046-SB CT-047-SB CT-048-SB

Sand

N/R

N/R

N/R

N/R

ELEVATION (feet)

20 10 0 -10 -20 -30 -40 -50 -60 -70 -80

0 100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100

DISTANCE (feet)

Tradepoint Atlantic
Sparrows Point, MD
ARM Project 21010306

Figure 29C

GAA E (Container Terminal)

Geologic Cross section H-H'

ARM Group LLC
Engineers and Scientists

LEGEND

- Slag
- Sand
- Silt
- Clay
- Peat
- No Recovery

01-30-2024 P:\EnviroAnalytics Group\160443M EAG_TPA Redevelopment\Documents\Parcel B10 Container Terminal\Container Terminal Cut Off Wall Investigation (Jan2024)\Container Terminal Cross Section\Container Terminal Cross Section 1-30.cro

CT-037-GW-41
2/6/2024
Benzene: 320
Naphthalene: 2600

CT-037-GW-12.5
2/6/2024
Benzene: 280
Naphthalene: 1,600

CO24-PZM007
6/10/2015
Benz[a]anthracene: 2.5
Benzo[a]pyrene: 2.0
Benzo[b]fluoranthene: 3.8
11/19/2024
Naphthalene: 1800

CO203-MWS
7/25/2023
Benzene: 380
2/10/2025
Naphthalene: 2,900

CO34-PZM048
6/10/2015

CO60-PZP001
5/12/2022
Naphthalene: 360

CO25-PZM008
11/19/2024
Benzene: 980
Naphthalene: 15,000

CO23-PZM008
6/10/2015
bis(2-Ethylhexyl)phthalate: 1.5
11/19/2024
Benzene: 380
Naphthalene: 3200

CO204-MWS
5/18/2023
Benzene: 760
Naphthalene: 6900

CO205-MWS
7/25/2023
Benzene: 380
Naphthalene: 2400

CO72-PZM005
6/22/2023
Benzene: 300
Naphthalene: 2900

CO56-PZM001
11/20/2024
Benzene: 120
Naphthalene: 1600

CO26-PZM032
8/3/2022

CO71-PZM006
6/22/22023

CO206R-MWS
11/4/2024
Benzene: 440
Naphthalene: 1,800

CO26-PZM007
11/20/2024
Benzene: 210
Naphthalene: 1200

CO70-PZM005
6/22/2023

CO67-PZM006
10/17/2024
Benzene: 220
Naphthalene: 4700

CO69-PZM005
6/22/2023
Benzene: 220
Naphthalene: 1500

CO207-MWS
7/26/2023
Benzene: 200
Naphthalene: 1600

CO59-PZP002
11/19/2024

CO64-PZM006
10/17/2024
Benzene: 350
Naphthalene: 6600

CO68-PZM005
10/17/2024
Benzene: 170
Naphthalene: 2300

CO55-PZM000
11/20/2024
Naphthalene: 130

CO66-PZM005
10/17/2024
Benzene: 370
Naphthalene: 8500

CO58-PZM001
11/20/2024
Benzene: 150
2/11/2025
Bis(2-ethylhexyl)phthalate: 2.4 JB
Naphthalene: 1,100

CO62-PZM007
6/22/2023
Benzene: 200
Naphthalene: 2100

CO65-PZM005
10/17/2024
Benzene: 360
Naphthalene: 7800

CO61-PZM007
6/22/2023
Benzene: 380
Naphthalene: 12000

CO63-PZM007
10/17/2024
Benzene: 350
Naphthalene: 4600

Groundwater Assessment Area E

CO208-MWS
10/10/2019
Benzene: 202
Naphthalene: 1390

CO57-PZP002
11/19/2024

CO35-PZM013
7/26/2023
Benzene: 110
Naphthalene: 420

CO35-PZM056
3/12/2020

SW18-PZM008
3/19/2020
Naphthalene: 253

SW18-PZM053
3/12/2020

CP17-MWI
3/13/2020

CP17-PZM013
3/16/2020
Naphthalene: 193

CP26-MWS
3/11/2020

CP26-MWI
3/11/2020

Groundwater Assessment Area F

CPA CMS COCs	Final Remedial Goals - Sitewide (µg/L)
Arsenic	40
1,1-Biphenyl	100
2-Methylnaphthalene	400
Benz[a]anthracene	1.0
Benzo[a]pyrene	0.16
Benzo[b]fluoranthene	1.0
Bis(2-Ethylhexyl)phthalate	1.0
Dibenz[a,h]anthracene	0.16
Indeno[1,2,3-c,d]pyrene	1.0
Naphthalene	115
Benzene	100
Ethylbenzene	100
Toluene	10,000
Xylenes	1,000

Notes:
1. Only exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. J = Result detected above the method detection limit but below the reporting limit.
4. B = This analyte was not detected substantially above the level of the associated blank or field blank.
5. All results shown in µg/L.
6. Wells CO61 through CO72 are extraction wells associated with the Cell 5 IM.
7. February 2025 SVOC data gap sampling was conducted at two GAA E wells: CO203-MWS and CO58-PZM001. BTEX was not included in the February 2025 sampling round. For these wells only, BTEX exceedances from the previous sampling round have also been included in this figure as needed.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal Exceedances
(Sitewide) - GAA E
June 12, 2025

Figure
29D

ARM Group LLC
Engineers and Scientists

0 40 80 160 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

CT-037-GW-41
2/6/2024

CT-037-GW-12.5
2/6/2024

CO203-MWS
7/25/2023
2/10/2025

CO60-PZP001
5/12/2022

CO205-MWS
7/25/2023

CO26-PZM032
8/3/2022

CO26-PZM007
11/20/2024

CO207-MWS
7/26/2023

CO58-PZM001
2/11/2025

CO208-MWS
10/10/2019

Groundwater Assessment Area E

CO35-PZM056
3/12/2020

CO35-PZM013
7/26/2023

CP17-MWI
3/13/2020

CP17-PZM013
3/16/2020

Groundwater Assessment Area F

CP26-MWI
3/11/2020

CP26-MWS
3/11/2020

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

CPA CMS COCs	Final Remedial Goals - Shoreline (µg/L)
Iron	22,500
Benzo[a]pyrene	0.16
Dibenz[a,h]anthracene	0.16
Pyrene	13
Toluene	735

Note: Based on the most recent sampling event, there were no exceedances of the applicable Shoreline Final Remedial Goals in GAA E.

Coke Point Area CMS
Final Remedial Goal
Exceedances (Shoreline) - GAA E
June 13, 2025

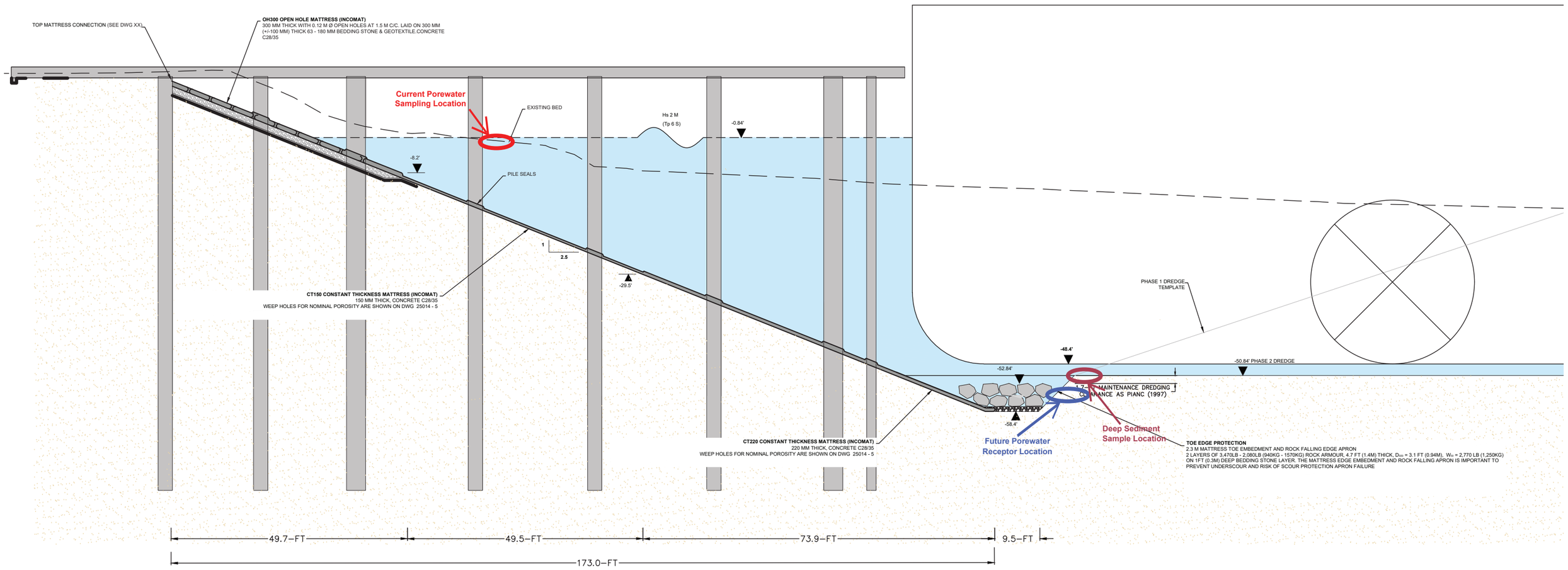
Figure
29E

ARM Group LLC
Engineers and Scientists

0 40 80 160
Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306



B-B'

SECTION B–B' – NORTH WHARF

SCALE: 1" = 15'

Container Terminal Wharf Cross Section June 27, 2025	**Figure** 29F
ARM Group LLC Engineers and Scientists	Tradepoint Atlantic Sparrows Point Baltimore County, MD ARM Project 21010306


LEGEND
Completed Excavation Boundary
Proposed Excavation Boundary
Cell 4 - Completed Excavation Extents
March 2025
Figure
29G
ARM Group LLC
Engineers and Scientists
N
0 10 20 40
Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306
P:\EnviroAnalytics Group\Coke Oven\GIS\Cell 4 Supp Borings.mxd

Parcel B10

CP02-PZM026

CP02-PZM007

B11-026-MWS

CP21-PZM004

Parcel B11

CP07-PZM006

CP08R-PZM034

CP08R-PZM008

CP20-PZM011

Groundwater Assessment Area F

CP19R-PZM008

CP18R-PZM009

Parcel B12

CP12-PZM012

CP12-PZM052

CP16-PZM008

CP16-PZM035

CP14-PZM062

CP14-PZM009

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- Abandoned NAPL Well
- CPA CMS GAAs
- COA IM Cell Parcel

Coke Point Area CMS
Groundwater Assessment Area F

March 2025

Figure
30A

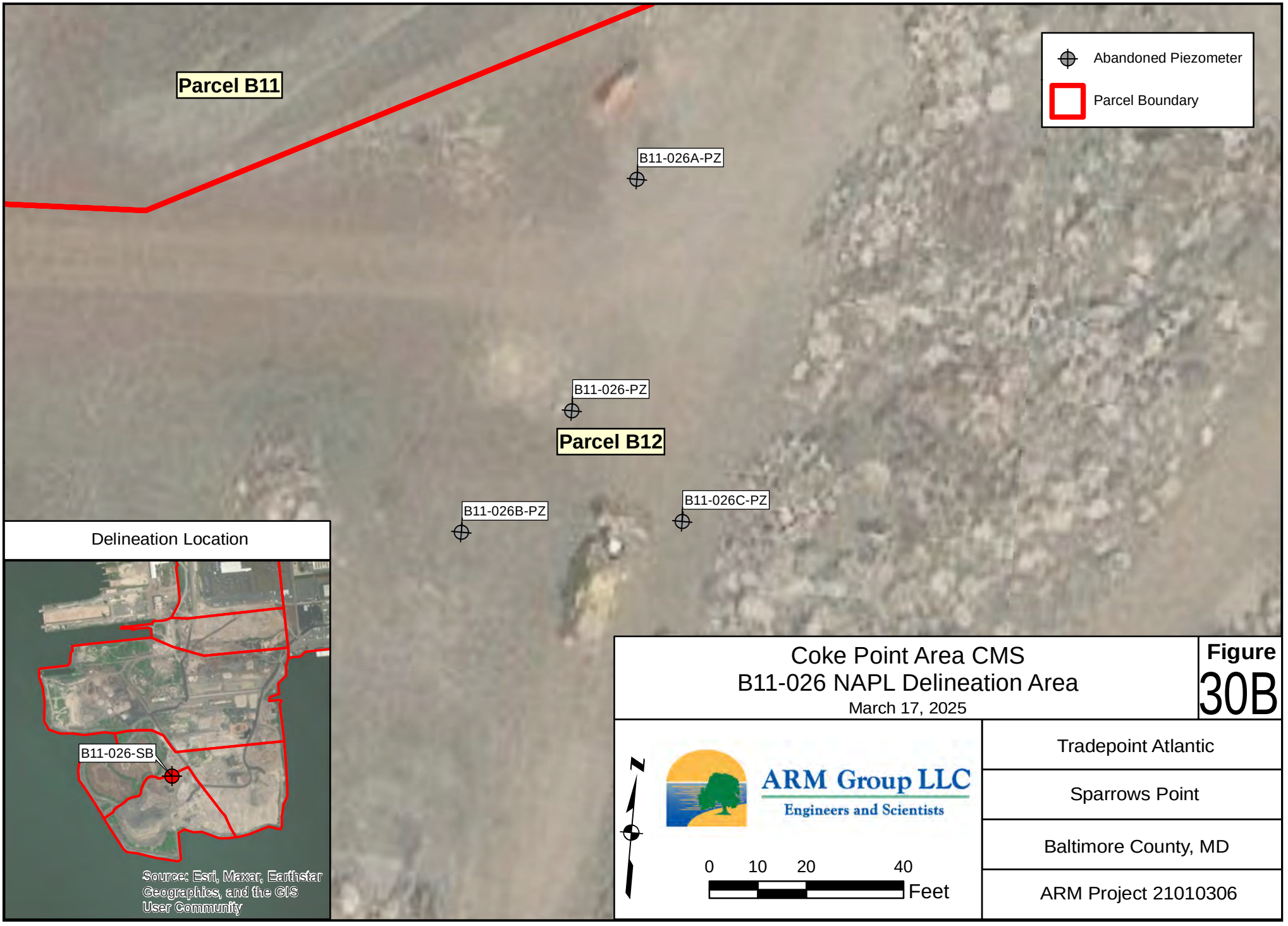
ARM Group LLC
Engineers and Scientists

0 25 50 100 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

G:\Projects\Tradepoint\CPA CMS GAA F.dgn (mxd)



Coke Point Area CMS
B11-026 NAPL Delineation Area

March 17, 2025

Figure 30B

ARM Group LLC
Engineers and Scientists

0 10 20 40 Feet

Tradepoint Atlantic

Sparrows Point

Baltimore County, MD

ARM Project 21010306

CPA CMS COCs	Final Remedial Goals - Sitewide (µg/L)
Arsenic	40
1,1-Biphenyl	100
2-Methylnaphthalene	400
Benz[a]anthracene	1.0
Benzo[a]pyrene	0.16
Benzo[b]fluoranthene	1.0
Bis(2-Ethylhexyl)phthalate	1.0
Dibenz[a,h]anthracene	0.16
Indeno[1,2,3-c,d]pyrene	1.0
Naphthalene	115
Benzene	100
Ethylbenzene	100
Toluene	10,000
Xylenes	1,000

Groundwater Assessment Area E

CP02-PZM026
10/9/2024

CP02-PZM007
10/9/2024

CP21-PZM004
10/11/2024

B11-026-MWS

CP07-PZM006
10/11/2024
Benzene: 360

CP08R-PZM034
10/9/2024

CP08R-PZM008
10/9/2024
Benzene: 1,000

CP20-PZM011
11/4/2024

Groundwater Assessment Area F

CP19R-PZM008
10/11/2024
Benzene: 2,500
Naphthalene: 340

CP18R-PZM009
10/7/2024
Benzene: 260

CP12-PZM012
10/3/2024

CP12-PZM052
10/4/2024

CP16-PZM008
10/4/2024

CP16-PZM035
10/7/2024
Benzene: 110

CP14-PZM009
10/7/2024

CP14-PZM062
10/7/2024

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- Abandoned NAPL Well
- CPA CMS GAAs
- COA IM Cell

Notes:
1. Only Exceedances of the applicable Final Remedial Goals are included in this figure.
2. Results are shown for the most recent sampling event only.
3. All results shown in µg/L.

GAA - Groundwater Assessment Area
IM - Interim Measure
CPA CMS - Coke Point Area Corrective Measures Study
COC - Contaminants of Concern

Coke Point Area CMS
Final Remedial Goal Exceedances (Sitewide) - GAA F
June 12, 2025

FIGURE
30C

ARM Group LLC
Engineers and Scientists

0 25 50 100 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Environmental Group, LLC. Data Source: Baltimore County, MD

Groundwater Assessment Area E

Groundwater Assessment Area F

CP12-PZM012
10/3/2024

CP12-PZM052
10/4/2024

CP16-PZM008
10/4/2024

CP16-PZM035
10/7/2024

CP14-PZM009
10/7/2024

CP14-PZM062
10/7/2024

CPA CMS COCs	Final Remedial Goals - Shoreline (µg/L)
Iron	22,500
Benzo[a]pyrene	0.16
Dibenz[a,h]anthracene	0.16
Pyrene	13
Toluene	735

Note: Based on the most recent sampling event, there were no exceedances of the applicable Shoreline Final Remedial Goals in GAA E.

LEGEND
- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- Abandoned NAPL Well
- CPA CMS GAAs
- COA IM Cell

Coke Point Area CMS
Final Remedial Goal Exceedances (Shoreline) - GAA F
June 17, 2025

Figure
30D

ARM Group LLC
Engineers and Scientists

0 25 50 100 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

B18-070R-MWS
B18-070-PZ
B18-071-PZ
B18-072-PZ
SW-030-MWS
B18-080-PZ
B18-079-PZ
B18-083-PZ
BA-81-7945
B18-077-PZ
SW-085-MWS
BA-81-7946
SW13-PZM003
SW-086-MWS
B18-044-PZ
B18-078-PZ
SW14-PZM004
Assessment Area C
B18-081-PZ
B18-082-PZ
B18-046-PZ
COA-MW-001
B18-061-PZ
CO177-MWS
CO178-MWS
CO179-MWS
CO121-PZM
CO36-PZM008
CO37-PZM003
B18-074-PZ
CO180-MWS
CO27-PZM012
CO42-PZM004
COA-MW-002
B18-007-PZ
B18-076-PZ
B18-075-PZ
CO39-PZM007
CO38-PZM006
CO05B-PZM
CO181-MWS
CO40-PZM008
CO03-PZM005
Assessment Area D
CO186-MWS
CO215-RIW
CO41-PZM001
CO213-RIW
CO216-MWS
CO28-PZM010
CO167-PZM
CO05-PZM006
CO15-PZM005
CO187-MWS
CO214-RIW
CO152-PZM
CO05A-PZM
CO05C-PZM
CO185-MWS
CO189-MWS
CO79-PZM
CO18-PZM006
CO159-PZM
CO190-MWS
CO209-MWS
CO02-PZM006
CO100-PZM
CO93-PZM
CO19-PZM004
CO20-PZM004
CO88-PZM
CO192-MWS
CO191-MWS
CO16-PZM006
CO212A-PZM
CO08A-PZM
CO10-PZM006
CO09-PZM007
CO212-MWS
CO08-PZM005
CT-037-GW-12.5
Assessment Area B
CO29-PZM010
CO07-PZM008
CO193-MWS
CO24-PZM007
CO08B-PZM
COA-MWS-004
CO203-MWS
COA-MW-003
CO60-PZP001
CO200-MWS
CO102-PZM
CO25-PZM008
CO205-MWS
CO23-PZM008
CO204-MWS
CO210-MWS
CO194-MWS
CO195-MWS
CO197-MWS
CO72-PZM005
CO196-MWS
CO101-PZM
CO56-PZP001
CO26-PZM007
CO104-PZM
CO103-PZM
CO202-MWS
CO71-PZM006
CO32-PZM004
CO206R-MWS
CO30-PZM015
TS06-PPM008
CO69-PZM005
CO70-PZM005
CO211-MWS
CO198-MWS
CO199-MWS
CO201-MWS
CO67-PZM006
CO68-PZM005
CO59-PZP002
CO207-MWS
CO55-PZM000
CO66-PZM005
CO63-PZM007
CO65-PZM005
CO62-PZM007
CO64-PZM006
CO58-PZM001
CP22-MWS
Assessment Area E
CO61-PZM007
CO208-MWS
CO57-PZP002
CP23-MWS
CP02-PZM007
CP21-PZM004
CO35-PZM013
SW18-PZM008
CP07-PZM006
CP08R-PZM008
CP20-PZM011
CP25-MWS
CP24-MWS
CP17-PZM013
Assessment Area A
CP19R-PZM008
Assessment Area F
CP18R-PZM009
CP05-PZM008
CP26-MWS
CP12-PZM012
CP16-PZM008
CP14-PZM009
CP10-PZM008
CP09-PZM010
CP15-PZM020
CP11-PZM010

LEGEND

- Shallow Monitoring Well - No Exceedance
- Shallow Monitoring Well - Benzene Exceedance
- Monitoring Well - Not Sampled
- CPA CMS GAAs

Coke Point Area CMS
Sitewide Final RG Groundwater Exceedances
(Benzene, Shallow Zone)
June 30, 2025

Figure 31A

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

0 62.5 125 250 Feet

Source: E

N:\Drawings\Sitewide Group\21010306 Excs_TPA Environmental\GIS\ArcGIS Pro\Gis @ Work_Arc\Supplemental.mxd

SW13-PZM111
SW13-PZM025
Assessment Area C
Assessment Area D
CO178-MWI
CO27-PZM046
CO48-PZM044
CO43-PZM048
CO46-PZM047
CO179-MWI
CO36-PZM043
CO177-MWI
CO37-PZM038
CO180-MWI
CO47-PZM046
CO45-PZM047
CO44-PZM048
CO39-PZM042
CO38-PZM043
CO182-MWI
CO181-MWI
CO183-MWI
CO28-PZM048
CO41-PZM036
CO184-MWI
CO188-MWI
CO04-PZM048
CO185-MWI
CO209-MWI
CO02-PZM041
CO08C-PZM
CO212-MWI
CO08-PZM036
CO07-PZM050
Assessment Area B
CO29-PZM051
CO193-MWI
COA-MWI-004
CO08D-PZM
CO34-PZM048
CO210-MWI
CO26-PZM032
CO30-PZM060
CO32-PZM041
CO211-MWI
CP22-MWI
Assessment Area E
CO23-MWI
CP02-PZM026
CO35-PZM056
SW18-PZM053
CP25-MWI
CP08R-PZM034
CP24-MWI
CP17-MWI
Assessment Area A
Assessment Area F
CP05-PZM028
CP05-PZM019
CP26-MWI
CP12-PZM052
CP16-PZM035
CP14-PZM062
CP09-PZM047
CP15-PZM042

Note:
SW13-PZM111 is a deep well.

LEGEND
- Intermediate Monitoring Well - No Exceedance
- Intermediate Monitoring Well - Benzene Exceedance
- CPA CMS GAAs

Coke Point Area CMS
Sitewide Final RG Groundwater Exceedances
(Benzene, Intermediate Zone)
June 30, 2025

Figure 31B

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

N

0 62.5 125 250 Feet

Sources: Esri

I:\Environmental Group\21010306\1 CAD_GIS\Reporting\GIS\CPA CMS GAAs\CPA_CMS_GAAs_Sitewide_Final_RG_GW_Benzene_Int.mxd

B18-070R-MWS
B18-070-PZ
B18-071-PZ
B18-072-PZ
SW-030-MWS
B18-080-PZ
B18-079-PZ
B18-083-PZ
BA-81-7945
B18-077-PZ
SW-085-MWS
BA-81-7946
SW13-PZM003
SW-086-MWS
B18-044-PZ
B18-078-PZ
SW14-PZM004
Assessment Area C
B18-081-PZ
B18-082-PZ
B18-046-PZ
COA-MW-001
B18-061-PZ
CO177-MWS
CO178-MWS
CO179-MWS
CO121-PZM
CO36-PZM008
CO37-PZM003
CO180-MWS
CO177-MWS
CO27-PZM012
CO42-PZM004
COA-MW-002
B18-007-PZ
B18-076-PZ
B18-075-PZ
B18-074-PZ
CO39-PZM007
CO38-PZM006
CO05B-PZM
CO181-MWS
CO40-PZM008
CO03-PZM005
Assessment Area D
CO186-MWS
CO215-RIW
CO28-PZM010
CO41-PZM001
CO213-RIW
CO216-MWS
CO05-PZM006
CO167-PZM
CO15-PZM005
CO187-MWS
CO214-RIW
CO152-PZM
CO05A-PZM
CO05C-PZM
CO185-MWS
CO189-MWS
CO79-PZM
CO18-PZM006
CO159-PZM
CO190-MWS
CO209-MWS
CO02-PZM006
CO100-PZM
CO93-PZM
CO19-PZM004
CO20-PZM004
CO88-PZM
CO192-MWS
CO212A-PZM
CO191-MWS
CO16-PZM006
CO08A-PZM
CO10-PZM006
CO09-PZM007
CO212-MWS
CO08-PZM005
CT-037-GW-12.5
Assessment Area B
CO29-PZM010
CO07-PZM008
CO193-MWS
CO24-PZM007
CO08B-PZM
COA-MWS-004
CO203-MWS
COA-MW-003
CO60-PZP001
CO200-MWS
CO102-PZM
CO25-PZM008
CO205-MWS
CO23-PZM008
CO204-MWS
CO210-MWS
CO194-MWS
CO195-MWS
CO197-MWS
CO72-PZM005
CO196-MWS
CO101-PZM
CO56-PZP001
CO26-PZM007
CO104-PZM
CO103-PZM
CO202-MWS
CO32-PZM004
CO71-PZM006
CO206R-MWS
CO30-PZM015
TS06-PPM008
CO211-MWS
CO69-PZM005
CO70-PZM005
CO198-MWS
CO199-MWS
CO201-MWS
CO67-PZM006
CO68-PZM005
CO59-PZP002
CO207-MWS
CO55-PZM000
CO66-PZM005
CO63-PZM007
CO65-PZM005
CO62-PZM007
CO64-PZM006
CO58-PZM001
CP22-MWS
Assessment Area E
CO61-PZM007
CO208-MWS
CO57-PZP002
CP23-MWS
CP02-PZM007
CP21-PZM004
CO35-PZM013
SW18-PZM008
CP07-PZM006
CP08R-PZM008
CP20-PZM011
CP25-MWS
CP24-MWS
CP17-PZM013
CP19R-PZM008
Assessment Area A
Assessment Area F
CP18R-PZM009
CP05-PZM008
CP26-MWS
CP12-PZM012
CP16-PZM008
CP14-PZM009
CP10-PZM008
CP09-PZM010
CP15-PZM020
CP11-PZM010

LEGEND

- Shallow Monitoring Well - No Exceedance
- Shallow Monitoring Well - Naphthalene Exceedance
- Monitoring Well - Not Sampled
- CPA CMS GAAs

Coke Point Area CMS
Sitewide Final RG Groundwater Exceedances
(Naphthalene, Shallow Zone)
June 30, 2025

Figure 31C

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Source: Esri

N:\Drawings\Projects Group\21010306 Exhs_TPA Redevelopment\GIS\ArcGIS Pro\CMS GIS\Figures.aprx\Naphthalene.mxd

SW13-PZM111
SW13-PZM025
CO178-MWI
CO27-PZM046
CO43-PZM048
CO46-PZM047
CO179-MWI
CO48-PZM044
COA-MWI-007
CO36-PZM043
CO177-MWI
CO180-MWI
CO37-PZM038
CO47-PZM046
CO45-PZM047
CO44-PZM048
CO39-PZM042
CO38-PZM043
CO182-MWI
CO181-MWI
CO183-MWI
CO28-PZM048
CO41-PZM036
COA-MWI-006
CO184-MWI
CO188-MWI
CO04-PZM048
CO185-MWI
CO209-MWI
CO02-PZM041
CO08C-PZM
CO212-MWI
CO08-PZM036
CT-037-GW-41
CO07-PZM050
CO29-PZM051
CO193-MWI
COA-MWI-004
CO08D-PZM
COA-MWI-009
CO34-PZM048
CO210-MWI
COA-MWI-011
CO30-PZM060
CO26-PZM032
CO32-PZM041
CO211-MWI
CP22-MWI
CO35-PZM056
CP23-MWI
CP02-PZM026
SW18-PZM053
CP25-MWI
CP08R-PZM034
CP24-MWI
CP17-MWI
CP05-PZM028
CP05-PZM019
CP26-MWI
CP12-PZM052
CP16-PZM035
CP14-PZM062
CP09-PZM047
CP15-PZM042

Assessment Area C
Assessment Area D
Assessment Area B
Assessment Area E
Assessment Area A
Assessment Area F

Note:
SW13-PZM111 is a deep well.

LEGEND
- Intermediate Monitoring Well - No Exceedance
- Intermediate Monitoring Well - Naphthalene Exceedance
- CPA CMS GAAs

Coke Point Area CMS
Sitewide Final RG Groundwater Exceedances
(Naphthalene, Intermediate Zone)
June 30, 2025

Figure 31D

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

N

0 62.5 125 250 Feet

Sources: [illegible]

I:\Environmental Group\21010306\1 CAD_GIS\1 Projects\mxd\SCS\PA CMS 31 Wide_ARC_Sightlines.mxd

Assessment Area A

Assessment Area B

Assessment Area C

Assessment Area D

Assessment Area E

Assessment Area F

Note:
1. PAH exceedances include benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and/or indeno[1,2,3-c,d]pyrene.
2. SW13-PZM111 is a deep monitoring well.

LEGEND

- Intermediate Monitoring Well - PAH Exceedance
- Shallow Monitoring Well - PAH Exceedance
- Monitoring Well - No Exceedance
- Monitoring Well - Not Sampled
- CPA CMS GAAs

Coke Point Area CMS
Sitewide Final RG Groundwater Exceedances (PAHs)
June 17, 2025

Figure 31E

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

0 62.5 125 250 Feet

Source: E

P:\Drawings Group\2010\306 ERC, TPA Redevelopment\GIS\PDFs\CMS\Figure 31E_Sitewide Final RG Groundwater Exceedances (PAHs).mxd

SW-085-MWS
SW-086-MWS
CO179-MWS
CO121-PZM
CO36-PZM008
CO177-MWS
CO178-MWS
CO180-MWS
CO27-PZM012
CO37-PZM003
CO181-MWS
CO28-PZM010
CO209-MWS
CO29-PZM010
CO210-MWS
CO200-MWS
CO201-MWS
CO101-PZM
CO104-PZM
CO198-MWS
CO199-MWS
CO202-MWS
CO30-PZM015
TS06-PPM008
CP22-MWS
CP23-MWS
CP24-MWS
CP05-PZM008
CP09-PZM010
CP15-PZM020
CP11-PZM010
CP12-PZM012
CP16-PZM008
CP14-PZM009
CP26-MWS
CO10-PZM006
CT-037-GW-41
CO203-MWS
CO60-PZP001
CO205-MWS
CO26-PZM007
CO207-MWS
CO58-PZM001
CO208-MWS
CO35-PZM013
CP17-PZM013

Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

LEGEND

- Shallow Monitoring Well - Toluene Exceedance
- Shallow Monitoring Well - No Exceedance
- Monitoring Well - Not Sampled
- CPA CMS GAA

Coke Point Area CMS
Shoreline Final RG Groundwater Exceedances
(Toluene Shallow Zone)
June 18, 2025

Figure
31F

ARM Group LLC
Engineers and Scientists

N

0 62.5 125 250 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Source: E

SW-085-MWS
SW-086-MWS
CO177-MWS
CO178-MWS
CO179-MWS
CO121-PZM
CO36-PZM008
CO180-MWS
CO27-PZM012
CO37-PZM003
CO181-MWS
CO28-PZM010
CO209-MWS
CO29-PZM010
CO210-MWS
CO199-MWS
CO30-PZM015
CO200-MWS
CO101-PZM
CO202-MWS
CO104-PZM
CO198-MWS
CO201-MWS
TS06-PPM008
CP22-MWS
CP23-MWS
CP24-MWS
CP05-PZM008
CP09-PZM010
CP15-PZM020
CP11-PZM010
CP12-PZM012
CP16-PZM008
CP14-PZM009
CO10-PZM006
CT-037-GW-12.5
CO203-MWS
CO60-PZP001
CO205-MWS
CO26-PZM007
CO207-MWS
CO58-PZM001
CO208-MWS
CO35-PZM013
CP17-PZM013
CP26-MWS
Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

Note:
1. PAH exceedances include benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, dibenz[a,h]anthracene, and/or indeno[1,2,3-c,d]pyrene. Naphthalene exceedances are identified in Figures 31C and 31D.

LEGEND
- Shallow Monitoring Well - PAH Exceedance
- Shallow Monitoring Well - No Exceedance
- Monitoring Well - Not Sampled
- CPA CMS GAA

Coke Point Area CMS
Shoreline Final RG Groundwater Exceedances
(PAHs Shallow Zone)
June 18, 2025

Figure 31G

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

N

0 62.5 125 250 Feet

Source: E

CO178-MWI
CO27-PZM046
CO179-MWI
CO177-MWI
CO48-PZM044
COA-MWI-007
CO36-PZM043
CO37-PZM038
CO180-MWI
CO44-PZM048
CO47-PZM046
CO45-PZM047
CO46-PZM047
CO43-PZM048
CO181-MWI
CO28-PZM048
CO209-MWI
CO29-PZM051
CO210-MWI
COA-MWI-011
CO30-PZM060
CP22-MWI
CP23-MWI
CP24-MWI
CP05-PZM028
CP05-PZM019
CP09-PZM047
CP15-PZM042
CP12-PZM052
CP16-PZM035
CP14-PZM062
CP26-MWI
CP17-MWI
CO35-PZM056
CO26-PZM032
CT-037-GW-41

Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

LEGEND

- Intermediate Monitoring Well - Toluene Exceedance
- Intermediate Monitoring Well - No Exceedance
- Monitoring Well - Not Sampled
- CPA CMS GAAs

Coke Point Area CMS
Shoreline Final RG Groundwater Exceedances - Toluene (Intermediate Zone)
June 19, 2025

Figure 31H

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

N

0 62.5 125 250 Feet

Source: E

© ESRI, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS User Community

CO27-PZM046
CO48-PZM044
CO179-MWI
COA-MWI-007
CO36-PZM043
CO177-MWI
CO178-MWI
CO37-PZM038
CO180-MWI
CO43-PZM048
CO47-PZM046
CO44-PZM048
CO46-PZM047
CO45-PZM047
CO181-MWI
CO28-PZM048
CO209-MWI
CO29-PZM051
CO210-MWI
COA-MWI-011
CO30-PZM060
CP22-MWI
CP23-MWI
CP24-MWI
CP05-PZM028
CP05-PZM019
CP09-PZM047
CP15-PZM042
CP12-PZM052
CP16-PZM035
CP14-PZM062
CT-037-GW-41
CO26-PZM032
CO35-PZM056
CP17-MWI
CP26-MWI

Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

Note: Iron exceedances may be based on total or dissolved iron.

LEGEND

- Intermediate Monitoring Well - Iron Exceedance
- Intermediate Monitoring Well - No Exceedance
- Monitoring Well - Not Sampled
- CPA CMS GAAs

Coke Point Area CMS
Shoreline Final RG Groundwater Exceedances
- Iron (Intermediate Zone)
June 19, 2025

Figure 31I

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

N

0 62.5 125 250 Feet

Source: E

© ESRI, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS User Community

B18-043-SB
B18-041-SB
B18-042-SB
B18-028-SB
B18-060-SB
B18-027-SB
B18-068-SB
B18-040-SB
B18-039-SB
B18-057-SB
B18-030-SB
B18-059-SB
B18-069-SB
B18-047-SB
B18-077-SB
B18-048-SB
B18-033-SB
B18-029-SB
B18-017-SB
B18-031-SB
B18-058-SB
B18-009-SB
B18-037-SB
B18-032-SB
B18-010-SB
B18-038-SB
B18-018-SB
B18-026-SB
B18-046-SB
B18-049-SB
B18-050-SB
B18-061-SB
B18-025-SB
B18-008-SB
B18-007-SB
B18-034-SB
B18-073-SB
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B18-053-SB
B18-070-SB
B18-019-SB
B18-015-SB
B18-020-SB
B18-067-SB
B18-022-SB
B18-054-SB
B18-016-SB
B18-052-SB
B18-055-SB
B18-071-SB
B18-023-SB
B18-013-SB
B18-066-SB
B18-051-SB
B18-056-SB
B18-014-SB
B18-072-SB
B18-024-SB
B18-035-SB
B18-036-SB
B18-012-SB
B18-011-SB
B18-001-SB
B18-003-SB
B18-074-SB
B18-002-SB
B18-006-SB
B18-005-SB
B18-004-SB
B18-076-SB
B18-075-SB
CT-001-SB
CT-007-SB
CT-006-SB
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B11-006-SB
B11-008-SB
B11-015-SB
B11-014-SB
B11-019-SB
B11-026-SB
B11-004-SB
B11-003-SB
B11-018-SB
B11-027-SB
CT-022-SB
B11-017-SB
B11-016-SB
B11-001-SB
B11-002-SB
B11-020-SB
CT-023-SB
B11-022-SB
B11-021-SB
CT-024-SB
B11-024-SB
B11-023-SB
B10-013-SB
B10-008-SB
B10-007-SB
B10-014-SB
B10-020-SB
B10-022-SB
B10-021-SB
B10-010-SB
B10-015-SB
B10-019-SB
B10-018-SB
B10-005-SB
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B10-003-SB
B10-011-SB
B10-016-SB
B10-006-SB
B10-012-SB
B10-002-SB
B10-004-SB
B10-017-SB
CT-008-SB
B10-009-SB
B11-033-SB
B11-032-SB
B11-031-SB
B11-030-SB
B11-029-SB
B11-028-SB
Cell 1
Cell 2
Cell 3
Cell 5
Cell 6
Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

LEGEND

- Soil Sample Location - No Exceedance
- Soil Sample Location - Benzene Exceedance
- Former COA IM Cell
- CPA-CMS-GAAs

Coke Point Area CMS
Sitewide SSL Exceedances
(Benzene)
June 27, 2025

Figure
32A

ARM Group LLC
Engineers and Scientists

0 62.5 125 250 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Sources: E

P:\Groups\Projects Engr\21010306\GIS\MXD\Figure 32A_Benzene_Sitewide_SSL_Exceedances_June_2025.mxd

B18-043-SB
B18-041-SB
B18-042-SB
B18-028-SB
B18-060-SB
B18-027-SB
B18-068-SB
B18-040-SB
B18-039-SB
B18-057-SB
B18-030-SB
B18-059-SB
B18-069-SB
B18-047-SB
B18-077-SB
B18-048-SB
B18-033-SB
B18-029-SB
B18-017-SB
B18-031-SB
B18-058-SB
B18-009-SB
B18-037-SB
B18-032-SB
B18-010-SB
B18-038-SB
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B18-052-SB
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B18-056-SB
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B10-003-SB
B10-011-SB
B10-016-SB
B10-006-SB
B10-012-SB
B10-002-SB
B10-004-SB
B10-017-SB
CT-008-SB
B10-009-SB
Cell 2
Cell 6
Cell 1
Cell 3
Cell 5
Assessment Area A
Assessment Area B
Assessment Area C
Assessment Area D
Assessment Area E
Assessment Area F

LEGEND

- Soil Sample Location - No Exceedance
- Soil Sample Location - Naphthalene Exceedance
- Former COA IM Cell
- CPA-CMS-GAAs

Coke Point Area CMS
Sitewide SSL Exceedances
(Naphthalene)
June 27, 2025

Figure 32B

ARM Group LLC
Engineers and Scientists

0 62.5 125 250 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Sources: E

P:\Groups\Projects Group\21010306\GIS_GIS_DATA\Tradepoint\MXDs\CA\GIS_SSL_Naph.mxd

Assessment Area A

Assessment Area B

Assessment Area C

Assessment Area D

Assessment Area E

Assessment Area F

Cell 1

Cell 2

Cell 3

Cell 5

Cell 6

B18-043-SB
B18-041-SB
B18-042-SB
B18-028-SB
B18-060-SB
B18-027-SB
B18-068-SB
B18-040-SB
B18-039-SB
B18-057-SB
B18-030-SB
B18-069-SB
B18-059-SB
B18-047-SB
B18-077-SB
B18-048-SB
B18-033-SB
B18-029-SB
B18-017-SB
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B18-037-SB
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B18-013-SB
B18-066-SB
B18-051-SB
B18-056-SB
B18-014-SB
B18-072-SB
B18-024-SB
B18-035-SB
B18-036-SB
B18-011-SB
B18-012-SB
B18-001-SB
B18-003-SB
B18-074-SB
B18-002-SB
B18-005-SB
B18-006-SB
B18-004-SB
B18-076-SB
B18-075-SB
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CT-014-SB
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CT-016-SB
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B10-007-SB
B10-014-SB
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B10-022-SB
B10-021-SB
B10-010-SB
B10-015-SB
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B10-018-SB
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B10-001-SB
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B10-016-SB
B10-006-SB
B10-012-SB
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B11-028-SB
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B11-005-SB
B11-006-SB
B11-007-SB
B11-025-SB
B11-015-SB
B11-019-SB
B11-018-SB
B11-017-SB
B11-001-SB
B11-002-SB
B11-020-SB
B11-022-SB
B11-021-SB
B11-024-SB

LEGEND

- Soil Sample Location - No Exceedance
- Soil Sample Location - PAHs Exceedance
- Former COA IM Cell
- CPA-CMS-GAAs

Coke Point Area CMS
Sitewide SSL Exceedances
(Other PAHs)
June 27, 2025

Figure
32C

ARM Group LLC
Engineers and Scientists

0 62.5 125 250 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Sources: E

P:\Groups\Projects Eng\21010306 Eng_GIS_Data Engineering\MXDs\CA 045_Sed_Area.mxd

B18-043-SB
B18-041-SB
B18-042-SB
Cell 2
B10-007-SB
B10-008-SB
Assessment Area C
Assessment Area D
Cell 6
B10-018-SB
B10-001-SB
Cell 1
Assessment Area B
B10-002-SB
CT-019-SB
B10-009-SB
Cell 3
Cell 5
CT-020-SB
B11-031-SB
Assessment Area E
B11-025-SB
B11-030-SB
B11-019-SB
B11-029-SB
Assessment Area A
B11-028-SB
Assessment Area F
B11-022-SB
B11-024-SB
B11-023-SB

LEGEND

- Soil Sample - No Exceedances
- Soil Sample - Iron Exceedances
- Soil Sample - PAHs Exceedances
- Former COA IM Cell
- CPA CMS GAAs

Coke Point Area CMS
Shoreline SSL Exceedances
(All)
June 16, 2025

Figure 32D

ARM Group LLC
Engineers and Scientists

0 62.5 125 250 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Sources: E

P:\Drawings\Coke Point\2024\24 ENGL DWG Shoreline\mxd\SSLCPA CMS_Shl_AOC.mxd

B18-070-PZ
B18-070R-MWS
B18-071-PZ
B18-072-PZ
SW-030-MWS
B18-080-PZ
B18-079-PZ
B18-083-PZ
BA-81-7945
B18-077-PZ
SW13-PZM111
SW13-PZM003
SW13-PZM025
SW-085-MWS
B18-044-PZ
BA-81-7946
SW-086-MWS
B18-081-PZ
B18-078-PZ
B18-082-PZ
B18-046-PZ
COA-MW-001
B18-061-PZ
SW14-PZM004
B18-074-PZ
B18-076-PZ
B18-075-PZ
CO05B-PZM
B18-007-PZ
COA-MW-002
CO216-MWS
CO005-PZM006
CO04-PZM048
CO05A-PZM
CO05C-PZM
CO20-PZM004
CO212A-PZM
CO10-PZM006
CO09-PZM007
CO212-MWI
CO212-MWS
CT-037-GW-12.5
CT-037-GW-41
CO24-PZM007
CO203-MWS
CO34-PZM048
CO60-PZP001
CO25-PZM008
CO205-MWS
CO204-MWS
CO23-PZM046
CO23-PZM008
CO71-PZM006
CO72-PZM005
CO56-PZP001
CO26-PZM032
CO26-PZM007
CO13-PZM008
CO206R-MWS
CO13-PZM030
CO70-PZM005
CO69-PZM005
CO107-PZM
CO118-PZM007
CO67-PZM006
CO68-PZM005
CO207-MWS
CO114-PZM002
CO112-PZM
CO55-PZM000
CO66-PZM005
CO120-PZM009
CO113-PZM004
CO65-PZM005
CO64-PZM006
CO59-PZP002
CO63-PZM007
CO58-PZM001
CO62-PZM007
CO61-PZM007
CO208-MWS
CO57-PZP002
CO35-PZM013
CO35-PZM056
SW18-PZM008
SW18-PZM053
CO216-MWS
CO167-PZM
CO152-PZM
CO159-PZM
CO100-PZM
CO19-PZM004
CO08C-PZM
CO08A-PZM
CO08-PZM005
CO08-PZM036
CO08B-PZM
CO08D-PZM
COA-MWI-004
COA-MWS-004
COA-MW-003
CO211-MWS
CO211-MWI
CO32-PZM004
CO32-PZM041
TS06-PPM008
CO07-PZM050
CO07-PZM008
CO16-PZM006
CO88-PZM
CO192-MWS
CO191-MWS
CO02-PZM041
CO02-PZM006
CO190-MWS
CO79-PZM
CO18-PZM006
CO189-MWS
CO185-MWS
CO185-MWI
CO209-MWS
CO209-MWI
CO188-MWI
CO187-MWS
CO214-RIW
CO213-RIW
CO15-PZM005
CO41-PZM036
CO41-PZM001
CO186-MWS
CO215-RIW
COA-013-MWS
COA-MWI-006
CO184-MWI
CO28-PZM048
CO28-PZM010
CO38-PZM043
CO44-PZM048
CO27-PZM046
CO27-PZM012
CO38-PZM006
CO183-MWI
CO182-MWI
CO40-PZM008
CO39-PZM042
CO39-PZM007
CO43-PZM048
CO46-PZM047
CO48-PZM044
CO36-PZM008
CO36-PZM043
CO180-MWS
CO180-MWI
CO181-MWS
CO181-MWI
CO03-PZM005
CO42-PZM004
CO121-PZM
COA-MWI-007
CO37-PZM003
CO37-PZM038
CO177-MWS
CO177-MWI
CO45-PZM047
CO178-MWI
CO178-MWS
CO179-MWI
CO179-MWS
CO47-PZM046
COA-012-MWS
CO29-PZM051
CO29-PZM010
CO193-MWI
CO193-MWS
COA-MWI-009
CO210-MWS
CO210-MWI
CO194-MWS
CO126-WS
CO103-PZM
CO195-MWS
CO196-MWS
CO102-PZM
CO197-MWS
CO104-PZM
CO198-MWS
CO101-PZM
CO202-MWS
COA-MWI-011
CO199-MWS
CO200-MWS
CO201-MWS
CO30-PZM015
CO30-PZM060
CP22-MWS
CP22-MWI
CP23-MWS
CP23-MWI
CP24-MWS
CP24-MWI
CP25-MWS
CP25-MWI
CP05-PZM028
CP05-PZM008
CP05-PZM019
CP09-PZM047
CP09-PZM010
CP15-PZM042
CP15-PZM020
CP11-PZM010
CP10-PZM008
CP12-PZM052
CP12-PZM012
CP16-PZM008
CP16-PZM035
CP14-PZM062
CP14-PZM009
CP26-MWS
CP26-MWI
CP17-PZM013
CP17-MWI
CP18R-PZM009
CP19R-PZM008
CP08R-PZM034
CP08R-PZM008
CP20-PZM011
CP07-PZM006
CP21-PZM004
CP02-PZM026
CP02-PZM007

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- Former COA IM Cell
- CPA CMS GAAs
- Container Terminal LOD

Note: Only monitoring wells with groundwater analytical results are shown.

Coke Point Area CMS - Sitewide Wells and Container Terminal LOD

August 8, 2025

Figure 33

ARM Group LLC
Engineers and Scientists

0 100 200 400 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

P:\Enviro\Analytics Group\L\00443M EAS_TPA Redevelopment\GIS\CPA CMS All Wells Simplified 3.mxd

TABLES

Table 1 - Exposure Parameter Values
CPA Groundwater CMS

Description	Variable	Value	Source
Target cancer risk (unitless)	TR	1.00E-06	For initial screening of COPCs
Target cancer risk (unitless)	TR	1.00E-05	For use if a receptor has less than 10 carcinogenic COPC exceedances when conducting the intital screening at 1E-6.
Target hazard quotient (unitless)	THQ	1	
Averaging time - cancer (days) [ATc=365 days/yr x LT (70 years)]	ATc	25,550	ATc=365 days/yr x LT (70 yrs)
Lifetime - cancer (yrs)	LTc	70	70 years
Averaging time - non-cancer (days) [ATnc=365 days/yr x ED (years)]			
Utility Worker	ATnc_uw	365	ATnc=365 days/yr x ED (1 yr)
Industrial Non-Potable Water User	ATnc_rr	9125	ATnc=365 days/yr x ED (25 yr)
Recreational User / Fish Ingestion	ATnc,rec_fish	9490	ATnc=365 days/yr x ED (26 yr)
Exposure Duration (yrs)			
Utility Worker	EDuw	1	EPA
Industrial Non-Potable Water User	EDrr	25	USEPA, 2014
Recreational User / Fish Ingestion	EDrec_fish	26	EPA RSL Equations
Exposure Frequency (days / yr)			
Utility Worker	EFuw	20	Sparrows Point assumption, based on maintenance work
Industrial Non-Potable Water User	EFrr	150	Sparrows Point assumption, accounting for number of rain days
Recreational User / Fish Ingestion	EFrec_fish	32	2016 Offshore Investigation (EA)
Exposure Time (hours / day)			
Utility Worker	ETuw	4	Sparrows Point assumption, based on maintenance work
Industrial Non-Potable Water User	ETrr	4	Sparrows Point assumption
Body Weight (kg)			
Utility Worker	BWuw	80	USEPA, 2014
Industrial Non-Potable Water User	BWrr	80	USEPA, 2014
Recreational User / Fish Ingestion	BWrec_fish	80	USEPA, 2014
Fish Ingestion rate (mg/day)	IRF	230,000	2016 Offshore Investigation (EA)
Skin surface area (cm2)			
Utility Worker	SAuw	2,550	USEPA, 2011, adult male (a)
Industrial Non-Potable Water User	SArr	2,550	USEPA, 2011, adult male (a)
Hourly Air Exchange Rate - Utility Worker	ACHuw	46	Battelle, 2017
Area of Trench (m2) - Utility Worker	A_{uw}	2.44	VDEQ, 2018 (trench length of 2.44m)
Volume of Trench (m3) - Utility Worker	V_{uw}	5.95	VDEQ, 2018 (trench depth of 2.44m for GW<15 ft bgs)
Fraction of floor contaminant can enter (unitless)	F	1	
Average wind speed in the mixing zone (m/s)	Uw	4.69	VDEQ, 2018
Ambient Air Mixing Zone Height (m)	Hm	2	RAGS Part B Soil to Air Volatilization Factor Equation, default parameters
Work area width (m)	W	6.096	Site specific, assume 20 ft
Groundwater extraction rate (L/s)	Qw	0.31542	Assume 5 gpm from a hose
Molecular weight of O2 (g/mol)	MWo2	32	
Molecular weight of H2O (g/mol)	MWh2o	18	
Groundwater temp (degree K)	Tgw	284	
Liquid phase transfer coeff of O2 (cm/sec)	kLO2	0.002	
Gas phase transfer coeff of H2O (cm/sec)	kGH2O	0.833	
Ideal Gas Constant	R	8.20E-05	

Table 1 - Exposure Parameter Values
CPA Groundwater CMS

References:

EA, 2016: Phase I Offshore Investigation Report for the Sparrows Point Site (EA, 2016).

USEPA, 2011: Exposure Factors Handbook (USEPA, September 2011)

USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors (USEPA, 2014).

VDEQ, 2010: Guidance for estimating exposure of workers to vapors in construction and utility trenches (VDEQ, 2010)

VDEQ, 2018: Virginia Unified Risk Assessment Model - VARUM User Guide (VDEQ, October 2018)

Notes:

(a) Skin surface area for utility worker and industrial non-potable water user assumes contact with hands (0.107 m^2) and forearms (0.148 m^2) only. Values from Table 7-12 of the Exposure Factors Handbook (USEPA, 2011) for adult males.

Table 2 - Chemical Specific Toxicological Criteria and Physiochemical Parameter Values
CPA Groundwater CMS

			Parameter Specific Data																
Chemical	**CAS**	**Parameter Group**	**Tevent** (hr/event)	**B** (unitless)	**t*** (hr)	**Kp** (cm/hr)	**MW** (g/mol)	**GIABS** (unitless)	**Sfo** $(mg/kg*day)^{-1}$	**RfD** (mg/kg*day)	**FA** (unitless)		**kL** (cm/sec)	**kG** (cm/sec)	**HLC** ($atm*m^3/mole$)	**K** (cm/sec)	**IUR** $(ug/m^3)^{-1}$	**BCF** (L/kg)	**RfC** (mg/m^3)
Cyanide	57-12-5	CN	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1		6.0E-04	0.01		2.1E-03	7.0E-01	1.0E-04	1.2E-03		NA	8.0E-04
Antimony	7440-36-0	Metal	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15		4.0E-04	1	*	9.8E-04	4.2E-01				1.0E+02	3.0E-04
Arsenic	7440-38-2	Metal	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1.5E+00	3.0E-04	1	*	1.2E-03	4.9E-01			4.3E-03	3.0E+02	1.5E-05
Chromium VI	18540-29-9	Metal	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	5.0E-01	3.0E-03	1	*	1.5E-03	5.6E-01			8.4E-02	2.0E+02	1.0E-04
Cobalt	7440-48-4	Metal	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1		3.0E-04	1	*	1.4E-03	5.3E-01			9.0E-03	3.0E+02	6.0E-06
Iron	7439-89-6	Metal	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1		7.0E-01	1	*	1.4E-03	5.4E-01				2.0E+02	
Manganese	7439-96-5	Metal	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04		2.4E-02	1	*	1.5E-03	5.5E-01				4.0E+02	5.0E-05
Nickel	7440-02-0	Metal	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04		2.0E-02	1	*	1.4E-03	5.3E-01			2.6E-04	1.0E+02	1.0E-05
Thallium	7440-28-0	Metal	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1		1.0E-05	1	*	7.6E-04	3.5E-01				1.0E+04	
Vanadium	7440-62-2	Metal	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026		5.0E-03	1	*	1.5E-03	5.6E-01				NA	1.0E-04
PCBs (total) (a)	1336-36-3	PCB	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E+00	2.0E-05	0.5		5.9E-04	3.0E-01	2.8E-04	5.1E-04	5.7E-04	9.1E+03	
1,1-Biphenyl	92-52-4	SVOC	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	8.0E-03	5.0E-01	1	*	8.8E-04	3.9E-01	3.1E-04	7.5E-04		4.4E+02	4.0E-04
2,4-Dimethylphenol	105-67-9	SVOC	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1		2.0E-02	1		9.8E-04	4.2E-01	9.5E-07	1.7E-05		1.5E+01	
2,6-Dinitrotoluene	606-20-2	SVOC	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1.5E+00	3.0E-04	1		8.0E-04	3.7E-01	7.5E-07	1.2E-05		2.2E+01	
2-Butanone (MEK)	78-93-3	SVOC	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1		6.0E-01	1		1.3E-03	5.0E-01	5.7E-05	6.2E-04		3.2E+00	5.0E+00
2-Methylnaphthalene	91-57-6	SVOC	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1		4.0E-03	1	*	9.1E-04	4.0E-01	5.2E-04	8.3E-04		7.5E+01	
2-Methylphenol	95-48-7	SVOC	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1		5.0E-02	1		1.0E-03	4.3E-01	1.2E-06	2.2E-05		1.1E+01	6.0E-01
Acenaphthene	83-32-9	SVOC	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1		6.0E-02	1	*	8.7E-04	3.9E-01	1.8E-04	6.8E-04		7.6E+02	
Benz[a]anthracene	56-55-3	SVOC	2.0E+00	3.2E+00	8.5E+00	5.5E-01	2.3E+02	1	1.0E-01		1		7.1E-04	3.4E-01	1.2E-05	1.4E-04	6.0E-05	2.6E+02	
Benzo[a]pyrene	50-32-8	SVOC	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1.0E+00	3.0E-04	1		6.8E-04	3.3E-01	4.6E-07	6.4E-06	6.0E-04	5.1E+03	2.0E-06
Benzo[b]fluoranthene	205-99-2	SVOC	2.7E+00	2.5E+00	1.1E+01	4.2E-01	2.5E+02	1	1.0E-01		1		6.8E-04	3.3E-01	6.6E-07	9.1E-06	6.0E-05	3.0E+03	
Benzo[k]fluoranthene	207-08-9	SVOC	2.7E+00	4.2E+00	1.2E+01	6.9E-01	2.5E+02	1	1.0E-02		1	*	6.8E-04	3.3E-01	5.8E-07	8.1E-06	6.0E-06	5.0E+03	
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	1.4E-02	2.0E-02	0.8		5.5E-04	2.8E-01	2.7E-07	3.3E-06	2.4E-06	5.9E+02	
Chrysene	218-01-9	SVOC	2.0E+00	3.5E+00	8.5E+00	6.0E-01	2.3E+02	1	1.0E-03		1		7.1E-04	3.4E-01	5.2E-06	6.9E-05	6.0E-07	3.2E+03	
Dibenz[a,h]anthracene	53-70-3	SVOC	3.8E+00	6.1E+00	1.7E+01	9.5E-01	2.8E+02	1	1.0E+00		0.6		6.5E-04	3.2E-01	1.4E-07	1.9E-06	6.0E-04	9.6E+03	
Fluoranthene	206-44-0	SVOC	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1		4.0E-02	1		7.6E-04	3.5E-01	8.9E-06	1.1E-04		3.6E+03	
Fluorene	86-73-7	SVOC	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1		4.0E-02	1	*	8.3E-04	3.7E-01	9.6E-05	5.4E-04		5.3E+02	
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7E+00	7.9E+00	1.7E+01	1.2E+00	2.8E+02	1	1.0E-01		0.6		6.4E-04	3.2E-01	3.5E-07	4.7E-06	6.0E-05	1.2E+04	
Naphthalene	91-20-3	SVOC	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1.2E-01	2.0E-02	1		9.5E-04	4.1E-01	4.4E-04	8.4E-04	3.4E-05	8.5E+01	3.0E-03
Pentachlorophenol	87-86-5	SVOC	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	4.0E-01	5.0E-03	0.9		6.6E-04	3.2E-01	2.5E-08	3.4E-07	5.1E-06	6.0E+02	
Pyrene	129-00-0	SVOC	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1		3.0E-02	1	*	7.6E-04	3.5E-01	1.2E-05	1.5E-04		1.5E+03	
Pyridine	110-86-1	SVOC	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1		1.0E-03	1	*	1.2E-03	4.8E-01	1.1E-05	1.9E-04		3.2E+00	
Styrene	100-42-5	SVOC	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1		2.0E-01	1		1.1E-03	4.4E-01	2.8E-03	1.0E-03		1.4E+01	1.0E+00
4-Chloroaniline	106-47-8	VOC	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	2.0E-01	5.0E-04	1	*	9.5E-04	4.1E-01	1.2E-06	2.0E-05		7.0E+00	
Benzaldehyde	100-52-7	VOC	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	4.0E-03	1.0E-01	1	*	1.0E-03	4.4E-01	2.7E-05	3.4E-04		4.4E+00	
Benzene	71-43-2	VOC	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	5.5E-02	4.0E-03	1		1.2E-03	4.9E-01	5.6E-03	1.2E-03	7.8E-06	4.3E+00	3.0E-02
Ethylbenzene	100-41-4	VOC	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1.1E-02	5.0E-02	1		1.0E-03	4.4E-01	7.9E-03	1.0E-03	2.5E-06	5.6E+01	1.0E+00
Methylene Chloride	75-09-2	VOC	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	2.0E-03	6.0E-03	1		1.2E-03	4.7E-01	3.3E-03	1.1E-03	1.0E-08	2.3E+01	6.0E-01
Toluene	108-88-3	VOC	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1		8.0E-02	1		1.1E-03	4.6E-01	6.6E-03	1.1E-03		8.3E+00	5.0E+00
Xylenes	1330-20-7	VOC	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1		2.0E-01	1		1.0E-03	4.4E-01	6.6E-03	1.0E-03		1.4E+01	1.0E-01
1,4-Dioxane	123-91-1	VOC / SVOC	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1.0E-01	3.0E-02	1		1.1E-03	4.7E-01	4.8E-06	8.9E-05	5.0E-06	5.0E-01	3.0E-02
Sources			EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RTAP RSL	RAGSE		CALC	CALC	EPA CS	CALC	RTAP RSL	RAIS	RTAP RSL

Table 2 - Chemical Specific Toxicological Criteria and Physiochemical Parameter Values
CPA Groundwater CMS

Notes:
(a) PCBs (total) using Aroclor 1254 values, with the exception of BCF (uses Aroclor 1016)
* FA <1 applies to a limited number of organic compounds. An FA of 1 was utilized for inorganics and for organic analytes not listed on RAGSE Exhibit B-3.

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Acronyms and Units:

τ_{event}	Lag time per event (hour/event)
B	Ratio of permeability coefficient through the stratum corneum to permeability coefficient across the viable epidermis (unitless)
t*	Time to reach steady state (hours)
Kp	Dermal permeability coefficient of COPC in water (cm/hour)
MW	Molecular weight (g/mol)
GIABS	Gastrointestinal absorption fraction (unitless)
SFo	Oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
RfD	Reference dose (mg/kg-day)
FA	Fraction absorbed from water (unitless)
kL	Liquid-phase mass transfer coefficient (cm/sec)
kG	Gas-phase mass transfer coefficient (cm/sec)
HLC	Henry's Law constant $(atm\text{-}m^3/mole)$
K	Overall mass transfer coefficient (cm/sec)
IUR	Inhalation unit risk $(\mu g/m^3)^{-1}$
BCF	Fish bioconcentration factor (L/kg)
RfC	Reference concentration (mg/m^3)

Table 3 - Preliminary Risk Based Screening Levels - Ecological Receptors
CPA Groundwater CMS

Constituents of Potential Concern		Toxicity Reference Values (Ecological)				Calculated Perimeter Well RBSL (µg/L)		Proposed Perimeter Well RBSL (µg/L)
Chemical	Parameter Group	Pore Water TRV (ug/L)	Source	Surface Water TRV (ug/L)	Source	GW to PW (a)	GW to SW (b)	Ecological
Cyanide	CN	1.0	NRWQC	1.00	NRWQC	75	121	75
Antimony	Metal	4,300	EPA Region IV - Saltwater	4,300	EPA Region IV - Saltwater	322,500	520,300	322,500
Arsenic	Metal	36	NRWQC	36	NRWQC	2,700	4,356	2,700
Chromium VI	Metal	50	NRWQC	50	NRWQC	3,750	6,050	3,750
Cobalt	Metal	1.0	NOAA SQuiRT - Marine	1.0	NOAA SQuiRT - Marine	75	121	75
Iron	Metal	300	EPA Region IV - Saltwater	300	EPA Region IV - Saltwater	22,500	36,300	22,500
Manganese	Metal	100	EPA Region IV - Saltwater	100	EPA Region IV - Saltwater	7,500	12,100	7,500
Nickel	Metal	8.20	NRWQC	8.20	NRWQC	615	992	615
Thallium	Metal	6.30	EPA Region IV - Saltwater	6.30	EPA Region IV - Saltwater	473	762	473
Vanadium	Metal	50	NOAA SQuiRT - Marine	50	NOAA SQuiRT - Marine	3,750	6,050	3,750
PCBs (total)	PCB	0.03	NRWQC	0.03	NRWQC	2	4	2.25
1,1-Biphenyl	SVOC	49	EPA Region IV - Saltwater	49	EPA Region IV - Saltwater	3,675	5,929	3,675
2,4-Dimethylphenol	SVOC	193	EPA Region IV - Saltwater	193	EPA Region IV - Saltwater	14,475	23,353	14,475
2,6-Dinitrotoluene	SVOC	36	EPA Region IV - Saltwater	36	EPA Region IV - Saltwater	2,700	4,356	2,700
2-Butanone (MEK)	SVOC	65,695	EPA Region IV - Saltwater	65,695	EPA Region IV - Saltwater	4,927,125	7,949,095	4,927,125
2-Methylnaphthalene	SVOC	52	EPA Region IV - Saltwater	52	EPA Region IV - Saltwater	3,900	6,292	3,900
2-Methylphenol	SVOC	995	EPA Region IV - Saltwater	995	EPA Region IV - Saltwater	74,625	120,395	74,625
Acenaphthene	SVOC	56	EPA 2017	15	EPA Region IV - Saltwater	4,189	1,815	1,815
Benz[a]anthracene	SVOC	2.227	EPA 2017	0.35	EPA Region IV - Saltwater	167	42	42
Benzo[a]pyrene	SVOC	0.96	EPA 2017	0.02	EPA Region IV - Saltwater	72	2	2.42
Benzo[b]fluoranthene	SVOC	0.68	EPA 2017	0.06	EPA Region IV - Saltwater	51	7	7.26
Benzo[k]fluoranthene	SVOC	0.64	EPA 2017	0.06	EPA Region IV - Saltwater	48	7	7.26
bis(2-Ethylhexyl)phthalate	SVOC	6.00	EPA Region IV - Saltwater	6.00	EPA Region IV - Saltwater	450	726	450
Chrysene	SVOC	2.042	EPA 2017	0.35	EPA Region IV - Saltwater	153	42	42
Dibenz[a,h]anthracene	SVOC	0.283	EPA 2017	0.01	EPA Region IV - Saltwater	21	1	1.21
Fluoranthene	SVOC	7.11	EPA 2017	0.82	EPA Region IV - Saltwater	533	99	99
Fluorene	SVOC	39.3	EPA 2017	24	EPA Region IV - Saltwater	2,948	2,904	2,904
Indeno[1,2,3-c,d]pyrene	SVOC	0.275	EPA 2017	0.012	EPA Region IV - Saltwater	21	1	1.45
Naphthalene	SVOC	193.5	EPA 2017	1.40	EPA Region III - Marine	14,513	169	169
Pentachlorophenol	SVOC	7.90	NRWQC	7.90	NRWQC	593	956	593
Pyrene	SVOC	10.11	EPA 2017	0.11	EPA Region IV - Saltwater	758	13	13
Pyridine	SVOC	2,380	EPA Region III - Freshwater	2,380	EPA Region III - Freshwater	178,500	287,980	178,500
Styrene	SVOC	412	EPA Region IV - Saltwater	412	EPA Region IV - Saltwater	30,900	49,852	30,900
4-Chloroaniline	VOC	0.80	EPA Region IV - Saltwater	0.80	EPA Region IV - Saltwater	60	97	60
Benzaldehyde	VOC	143	EPA Region IV - Saltwater	143	EPA Region IV - Saltwater	10,725	17,303	10,725
Benzene	VOC	130	EPA 2017	110	EPA Region IV - Saltwater	9,750	13,310	9,750
Ethylbenzene	VOC	7.3	EPA 2017	25	EPA Region IV - Saltwater	548	3,025	548

Table 3 - Preliminary Risk Based Screening Levels - Ecological Receptors
CPA Groundwater CMS

Constituents of Potential Concern		Toxicity Reference Values (Ecological)				Calculated Perimeter Well RBSL (µg/L)		Proposed Perimeter Well RBSL (µg/L)
Chemical	Parameter Group	Pore Water TRV (ug/L)	Source	Surface Water TRV (ug/L)	Source	GW to PW (a)	GW to SW (b)	Ecological
Methylene Chloride	VOC	1,580	EPA Region IV - Saltwater	1,580	EPA Region IV - Saltwater	118,500	191,180	118,500
Toluene	VOC	9.8	EPA 2017	215	EPA Region IV - Saltwater	735	26,015	735
Xylenes	VOC	67	EPA 2017	260	EPA Region IV - Saltwater	5,025	31,460	5,025
1,4-Dioxane	VOC/SVOC	200,733	EPA Region IV - Saltwater	200,733	EPA Region IV - Saltwater	15,054,975	24,288,693	15,054,975

Acronyms:
TRV = Toxicity Reference Value
RBSL = Risk Based Screening Level
MD WQS = Maryland Water Quality Standard
GW = groundwater
PW = pore water
SW = surface water

Notes:
(a) Perimeter Well RBSL (Pore Water) = Pore Water TRV x Attenuation Factor of **75**
(b) Perimeter Well RBSL (Surface Water) = Surface Water TRV x Attenuation/Mixing Factor of **121**
(c) Freshwater screening values have been utilized where marine values were unavailable.

References:
NRWQC = USEPA National Recommended Water Quality Criteria (2014)
EPA Region 4 = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018. Table 1a, Region 4 Surface Water Screening Values for Hazardous Waste Sites, Saltwater, Chronic
Maryland = Code of Maryland Regulations, 26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Salt Water – Chronic (2024)
NOAA SQuiRT - Marine = NOAA Screening Quick Reference Tables, Marine Surface Water – Chronic (2008)
EPA Region III - Marine = EPA Region III BTAG Marine Screening Benchmarks (2006)
Organic Contaminants (2017)
EPA Region III - Freshwater = EPA Region III BTAG Freshwater Screening Benchmarks (2006)
NOAA SQuiRT - Freshwater = NOAA Screening Quick Reference Tables, Fresh Surface Water – Chronic (2008)
EPA Region 5 = EPA Region 5 Ecological Screening Levels (2003)
RAIS = Risk Assessment Information System
NAWQC = USEPA National Ambient Water Quality Criteria (NAWQC) , acute surface water screening benchmark (1999)

Table 4 - Summary of Preliminary Risk Based Screening Levels (TR = 1E-06)
CPA Groundwater CMS

Constituents of Potential Concern			Preliminary Risk Based Screening Levels (ug/L)				
			Sitewide			Perimeter	
			Human Health		Resource Restoration	Human Health	Ecological Receptors
			On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	Off-Site Recreational User	
Chemical	CAS	Parameter Group	Dermal & Inhalation, calculated	VISL	Dermal & Inhalation, calculated	Fish & Crab Ingestion (includes GW to SW MF)	SW or PW Screening Level (includes GW or SW MF)
Cyanide	57-12-5	CN	109	84.4	893	16,940	75
Antimony	7440-36-0	Metal	1,074	-	143	77,440	322,500
Arsenic	7440-38-2	Metal	6,680	-	35.6	16.9	2,700
Chromium VI	18540-29-9	Metal	250	-	1.34	12.9	3,750
Cobalt	7440-48-4	Metal	13,419	-	1,789	60	75
Iron	7439-89-6	Metal	33,398,693	-	4,453,159	560,063	22,500
Manganese	7439-96-5	Metal	22,902	-	3,054	4,801	7,500
Nickel	7440-02-0	Metal	71,569	-	9,542	556,600	615
Thallium	7440-28-0	Metal	358	-	47.7	56.9	473
Vanadium	7440-62-2	Metal	2,345	-	313	--	3,750
PCBs (total)	1336-36-3	PCB	0.52	1.26	0.019	0.0077	2.25
1,1-Biphenyl	92-52-4	SVOC	18	13.9	57.7	370	3,675
2,4-Dimethylphenol	105-67-9	SVOC	35,474	-	4,122	363,000	14,475
2,6-Dinitrotoluene	606-20-2	SVOC	1,171	-	6.24	39.2	2,700
2-Butanone (MEK)	78-93-3	SVOC	883,933	941,000	1,927,801	30,383,187	4,927,125
2-Methylnaphthalene	91-57-6	SVOC	670	-	81	3,215	3,900
2-Methylphenol	95-48-7	SVOC	130,568	-	16,006	80,371	74,625
Acenaphthene	83-32-9	SVOC	8,071	-	899	10,890	1,815
Benz[a]anthracene	56-55-3	SVOC	90	417	0.50	0.157	42
Benzo[a]pyrene	50-32-8	SVOC	6.21	-	0.033	0.0157	2.42
Benzo[b]fluoranthene	205-99-2	SVOC	105	-	0.56	0.157	7.26
Benzo[k]fluoranthene	207-08-9	SVOC	639	-	3.41	1.573	7.26
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	57	-	0.76	44.8	450
Chrysene	218-01-9	SVOC	8,544	-	45.6	2.178	42
Dibenz[a,h]anthracene	53-70-3	SVOC	6.50	-	0.03	0.0157	1.21
Fluoranthene	206-44-0	SVOC	1,130	-	151	2,420	99
Fluorene	86-73-7	SVOC	9,922	-	1,087	8,470	2,904
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	52	-	0.28	0.157	1.45
Naphthalene	91-20-3	SVOC	148	20.1	7.86	127	169
Pentachlorophenol	87-86-5	SVOC	85	-	0.45	363	593
Pyrene	129-00-0	SVOC	2,188	-	292	3,630	13
Pyridine	110-86-1	SVOC	8,250	-	1,066	15,192	178,500
Styrene	100-42-5	SVOC	22,381	3,900	8,504	711,192	30,900

Table 4 - Summary of Preliminary Risk Based Screening Levels (TR = 1E-06)
CPA Groundwater CMS

Constituents of Potential Concern			Preliminary Risk Based Screening Levels (ug/L)				
			Sitewide			Perimeter	
			Human Health		Resource Restoration	Human Health	Ecological Receptors
			On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	Off-Site Recreational User	
Chemical	CAS	Parameter Group	Dermal & Inhalation, calculated	VISL	Dermal & Inhalation, calculated	Fish & Crab Ingestion (includes GW to SW MF)	SW or PW Screening Level (includes GW or SW MF)
4-Chloroaniline	106-47-8	VOC	2,869	-	42.8	926	60
Benzaldehyde	100-52-7	VOC	521,326	-	2,919	73,435	10,725
Benzene	71-43-2	VOC	1,701	6.93	55.3	6,171	9,750
Ethylbenzene	100-41-4	VOC	5,975	15.2	88.3	254,100	548
Methylene Chloride	75-09-2	VOC	9,669	1,980	2,668	121,000	118,500
Toluene	108-88-3	VOC	46,071	8,070	7,165	1,815,000	735
Xylenes	1330-20-7	VOC	5,160	162	8,919	1,134,880	5,025
1,4-Dioxane	123-91-1	VOC / SVOC	260,846	12,500	1,391	25,847	15,054,975

Minimum sitewide RBSL
Minimum perimeter RBSL

Acronyms:
RBSL = Risk Based Screening Level
VISL = Vapor Intrusion Screening Level
GW = Groundwater
SW = Surface Water
PW = Pore Water
MF = Mixing Factor

Note:
(a) All preliminary RBSLs are in ug/L.
(b) Cobalt, Iron, Manganese, and Vanadium are slag related COPCs.
(c) The preliminary RBSL for the On-Site Industrial Worker is based on the USEPA's commercial scenario Vapor Intrusion Screening Levels (VISLs). VISLs are only calculated for chemicals that are volatile and have inhalation toxicity data, specifically those with a Henry's Law Constant greater than 1 × 10-5 atm-m3/mol or a Vapor Pressure (mmHg) greater than 1.

Table 5 - Summary of CPA Groundwater Chemicals with Results that Exceed the Preliminary Risk Based Screening Levels
CPA Groundwater CMS

Constituents of Potential Concern				Sitewide			Perimeter	
				Human Health		Resource Restoration	Human Health	Ecological Receptors
				On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	Off-Site Recreational User	
Chemical	CAS	Parameter Group	Carcinogen?	Dermal & Inhalation, calculated	VISL	Dermal & Inhalation, calculated	Fish & Crab Ingestion (includes GW to SW MF)	SW or PW Screening Level (includes GW or SW MF)
Cyanide	57-12-5	CN	No	X	X			X
Arsenic	7440-38-2	Metal	Yes			X	X	
Chromium VI (a)	18540-29-9	Metal	Yes	X		X	X	
Iron (b)	7439-89-6	Metal	No					X
Manganese (b)	7439-96-5	Metal	No			X		
Vanadium (b)	7440-62-2	Metal	No			X		
1,1-Biphenyl	92-52-4	SVOC	Yes	X	X			
2-Methylnaphthalene	91-57-6	SVOC	No			X		
Benz[a]anthracene	56-55-3	SVOC	Yes			X	X	
Benzo[a]pyrene	50-32-8	SVOC	Yes	X		X	X	X
Benzo[b]fluoranthene	205-99-2	SVOC	Yes			X	X	X
Benzo[k]fluoranthene	207-08-9	SVOC	Yes			X	X	
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	Yes			X		
Chrysene	218-01-9	SVOC	Yes			X	X	
Dibenz[a,h]anthracene	53-70-3	SVOC	Yes			X	X	
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	Yes			X	X	
Naphthalene	91-20-3	SVOC	Yes	X	X	X	X	X
Pentachlorophenol	87-86-5	SVOC	Yes			X		
Pyrene	129-00-0	SVOC	No					X
4-Chloroaniline	106-47-8	VOC	Yes			X		
Benzene	71-43-2	VOC	Yes	X	X	X	X	X
Ethylbenzene	100-41-4	VOC	Yes		X	X		
Toluene	108-88-3	VOC	No	X	X	X		X
Xylenes	1330-20-7	VOC	No	X	X	X		

Acronyms:
VISL = Vapor Intrusion Screening Level
GW = Groundwater
SW = Surface Water
PW = Pore Water
MF = Mixing Factor

Notes:
(a) Hexavalent chromium was analyzed via USEPA Method 7196A, which uses a colorimetric process and is therefore biased high for cloudy or colored water samples. At other locations within the TPA Property, follow up analysis using USEPA Method 7199 has resulted in lower detections for hexavalent chromium. In addition, there are several non-detect results with elevated detection limits (above the preliminary groundwater cleanup level); these are not included as exceedances.

(b) Iron, Manganese, and Vanadium are slag related COPCs.

Table 6 - Non-Cancer Hazard Quotient and Hazard Index by Target Organ for All On-Site Receptors at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations
CPA Groundwater CMS

Chemical	CAS Number	Detected Maximum Concentration (ug/L)	Proposed Final Remedial Goals (ug/L)	Resource Restoration / Industrial Non-Potable Water User			On-Site Industrial Worker (VISL)			On-Site Utility Worker		
				RBSL - Noncancer (ug/L)	Hazard Quotient (Max Concentration)	Hazard Quotient (Final RGs)	RBSL - Noncancer (ug/L)	Hazard Quotient (Max Concentration)	Hazard Quotient (Final RGs)	RBSL - Noncancer (ug/L)	Hazard Quotient (Max Concentration)	Hazard Quotient (Final RGs)
Body Weight - Target Organ												
Naphthalene	91-20-3	64,100	115	3,478	1.84E+01	3.31E-02	730	8.78E+01	1.58E-01	1,187	5.40E+01	9.69E-02
Xylenes	1330-20-7	21,000	1,000	53,516	3.92E-01	1.87E-02	1,620	1.30E+01	6.17E-01	30,957	6.78E-01	3.23E-02
Total Hazard Index - Body Weight					**19**	**0.05**		**101**	**1**		**55**	**0.1**
Cardiovascular - Target Organ												
Arsenic	7440-38-2	538	40	5,725	9.390E-02	6.986E-03	-	-	-	42,941	1.25E-02	9.32E-04
Total Hazard Index - Cardiovascular					**0.094**	**0.007**		**--**	**--**		**0.0125**	**0.0009**
Dermal - Target Organ												
Arsenic	7440-38-2	538	40	5,725	9.39E-02	6.99E-03	-	-	-	42,941	1.25E-02	9.32E-04
Vanadium	7440-62-2	1,430	1,430	2,501	5.72E-01	5.72E-01	-	-	-	18,757	7.62E-02	7.62E-02
Total Hazard Index - Dermal					**0.666**	**0.579**		**--**	**--**		**0.09**	**0.08**
Developmental - Target Organ												
Benzo[a]pyrene	50-32-8	24.2	0.16	3.55	6.81E+00	4.51E-02	-	-	-	27	9.09E-01	6.01E-03
Ethylbenzene	100-41-4	1,500	100	16,868	8.89E-02	5.93E-03	-	-	-	95,213	1.58E-02	1.05E-03
Total Hazard Index - Developmental					**7**	**0.1**		**--**	**--**		**0.9**	**0.01**
Gastrointestinal - Target Organ												
Chromium VI	18540-29-9	38.8	1.0	716	5.42E-02	1.40E-03	-	-	-	5,368	7.23E-03	1.86E-04
Iron	7439-89-6	205,000	205,000	13,359,477	1.53E-02	1.53E-02	-	-	-	100,196,078	2.05E-03	2.05E-03
Total Hazard Index - Gastrointestinal					**0.07**	**0.02**		**--**	**--**		**0.009**	**0.002**
Hepatic - Target Organ												
1,1-Biphenyl	92-52-4	110	100	1,043	1.055E-01	9.588E-02	139	7.91E-01	7.19E-01	181	6.06E-01	5.51E-01
bis(2-Ethylhexyl)phthalate	117-81-7	18	1.0	76	2.4E-01	1.3E-02	-	-	-	570	3.16E-02	1.76E-03
Pentachlorophenol	87-86-5	2.8	2.8	325	8.6E-03	8.6E-03	-	-	-	2,437	1.15E-03	1.15E-03
Ethylbenzene	100-41-4	1,500	100	16,868	8.9E-02	5.9E-03	-	-	-	95,213	1.58E-02	1.05E-03
Total Hazard Index - Hepatic					**0.4**	**0.1**		**0.8**	**0.7**		**0.7**	**0.6**
Immune - Target Organ												
4-Chloroaniline	106-47-8	46.9	46.9	1,292	3.63E-02	3.63E-02	-	-	-	11,477	4.09E-03	4.09E-03
Benzene	71-43-2	710,000	100	4,241	1.674E+02	2.358E-02	579	1.23E+03	1.73E-01	6,805	1.04E+02	1.47E-02
Total Hazard Index - Immune					**167**	**0.1**		**1226**	**0.2**		**104**	**0.02**
Nervous - Target Organ												
Manganese	7439-96-5	6,392	6,392	18,322	3.49E-01	3.49E-01	-	-	-	137,412	4.65E-02	4.65E-02
Toluene	108-88-3	100,000	10,000	42,987	2.33E+00	2.33E-01	80,700	1.24E+00	1.24E-01	276,426	3.62E-01	3.62E-02
Xylenes	1330-20-7	21,000	1,000	53,516	3.92E-01	1.87E-02	1,620	1.30E+01	6.17E-01	30,957	6.78E-01	3.23E-02
Total Hazard Index - Nervous					**3**	**0.6**		**14**	**0.7**		**1**	**0.1**
Reproductive - Target Organ												
Cyanide	57-12-5	380	300	1,787	2.126E-01	1.679E-01	844	4.502E-01	3.555E-01	218	1.741E+00	1.375E+00
Total Hazard Index - Reproductive					**0.2**	**0.2**		**0.5**	**0.4**		**2**	**1**
Respiratory - Target Organ												
Chromium VI	18540-29-9	38.8	1.0	716	5.42E-02	1.40E-03	-	-	-	5,368	7.23E-03	1.86E-04
Vanadium	7440-62-2	1,430	1,430	2,501	5.72E-01	5.72E-01	-	-	-	18,757	7.62E-02	7.62E-02
2-Methylnaphthalene	91-57-6	582	400	644	9.03E-01	6.21E-01	-	-	-	5,362	1.09E-01	7.46E-02
Naphthalene	91-20-3	64,100	115	3,478	1.84E+01	3.31E-02	730	8.78E+01	1.58E-01	1,187	5.40E+01	9.69E-02
Total Hazard Index - Respiratory					**20**	**1**		**88**	**0.2**		**54**	**0.2**
Thyroid - Target Organ												
Cyanide	57-12-5	380	300	1,787	2.13E-01	1.68E-01	844	4.50E-01	3.55E-01	218	1.74E+00	1.37E+00
Total Hazard Index - Thyroid					**0.2**	**0.2**		**0.5**	**0.4**		**2**	**1**

Table 6 - Non-Cancer Hazard Quotient and Hazard Index by Target Organ for All On-Site Receptors at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations CPA Groundwater CMS

Chemical	CAS Number	Detected Maximum Concentration (ug/L)	Proposed Final Remedial Goals (ug/L)	Resource Restoration / Industrial Non-Potable Water User			On-Site Industrial Worker (VISL)			On-Site Utility Worker		
				RBSL - Noncancer (ug/L)	Hazard Quotient (Max Concentration)	Hazard Quotient (Final RGs)	RBSL - Noncancer (ug/L)	Hazard Quotient (Max Concentration)	Hazard Quotient (Final RGs)	RBSL - Noncancer (ug/L)	Hazard Quotient (Max Concentration)	Hazard Quotient (Final RGs)
Urinary - Target Organ												
1,1-Biphenyl	92-52-4	110	100	1,043	1.05E-01	9.59E-02	139	7.91E-01	7.19E-01	181	6.06E-01	5.51E-01
Pyrene	129-00-0	266	266	1,751	1.52E-01	1.52E-01	-	-	-	13,130	2.03E-02	2.03E-02
Toluene	108-88-3	100,000	10,000	42,987	2.33E+00	2.33E-01	80,700	1.24E+00	1.24E-01	276,426	3.62E-01	3.62E-02
Total Hazard Index - Urinary					**3**	**0.5**		**2**	**0.8**		**1**	**0.6**

Notes:

(a) Shading indicates an exceedance of target hazard quotient of 1 for the COPC concentration for the target organ for each receptor population.

(b) Maximum groundwater concentrations are included in **Appendix E-5, Table A**.

(c) Non-cancer RBSLs are calculated in **Appendix E-5, Table C3** (On-Site Utility Worker), **Appendix E-5, Table B1** (On-Site Industrial Worker), and **Appendix E-5, Table E3** (Resource Restoration).

Table 7 - Incremental Lifetime Cancer Risk for All On-Site Receptors at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations CPA Groundwater CMS

Chemical	CAS Number	Parameter Group	Detected Maximum Concentration (ug/L)	Proposed Final Remedial Goals (ug/L)	Resource Restoration			On Site Industrial Worker - Vapor Intrusion			On-Site Utility Worker		
					RBSL - Carcinogenic Endpoint (ug/L)	Estimated Incremental Lifetime Cancer Risk (Max Concentration)	Estimated Incremental Lifetime Cancer Risk (Final RGs)	RBSL - Carcinogenic Endpoint (ug/L)	Estimated Incremental Lifetime Cancer Risk (Max Concentration)	Estimated Incremental Lifetime Cancer Risk (Final RGs)	RBSL - Carcinogenic Endpoint (ug/L)	Estimated Incremental Lifetime Cancer Risk (Max Concentration)	Estimated Incremental Lifetime Cancer Risk (Final RGs)
Cyanide	57-12-5	CN	380	300	-	-	-	-	-	-	-	-	-
Arsenic	7440-38-2	Metal	538	40	35.63	1.5E-05	1.1E-06	-	-	-	6679.74	8.0E-08	6.0E-09
Chromium VI	18540-29-9	Metal	38.8	1.0	1.34	2.9E-05	7.5E-07	-	-	-	250.49	1.5E-07	4.0E-09
Iron	7439-89-6	Metal	205,000	205,000	-	-	-	-	-	-	-	-	-
Manganese	7439-96-5	Metal	6,392	6,392	-	-	-	-	-	-	-	-	-
Vanadium	7440-62-2	Metal	1,430	1,430	-	-	-	-	-	-	-	-	-
1,1-Biphenyl	92-52-4	SVOC	110	100	57.72	1.9E-06	1.7E-06	-	-	-	10821.75	1.0E-08	9.2E-09
2-Methylnaphthalene	91-57-6	SVOC	582	400	-	-	-	-	-	-	-	-	-
Benz[a]anthracene	56-55-3	SVOC	41.8	1.0	0.50	8.4E-05	2.0E-06	414.00	1.0E-07	2.4E-09	90.26	4.6E-07	1.1E-08
Benzo[a]pyrene	50-32-8	SVOC	24.2	0.16	0.03	7.3E-04	4.8E-06	-	-	-	6.21	3.9E-06	2.6E-08
Benzo[b]fluoranthene	205-99-2	SVOC	15.1	1.0	0.56	2.7E-05	1.8E-06	-	-	-	105.06	1.4E-07	9.5E-09
Benzo[k]fluoranthene	207-08-9	SVOC	12.2	12.2	3.41	3.6E-06	3.6E-06	-	-	-	639.47	1.9E-08	1.9E-08
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	18	1.0	0.76	2.4E-05	1.3E-06	-	-	-	142.41	1.3E-07	7.0E-09
Chrysene	218-01-9	SVOC	55.6	55.6	45.57	1.2E-06	1.2E-06	-	-	-	8544.44	6.5E-09	6.5E-09
Dibenz[a,h]anthracene	53-70-3	SVOC	2.9	0.16	0.03	8.4E-05	4.6E-06	-	-	-	6.50	4.5E-07	2.5E-08
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7	1.0	0.28	1.3E-05	3.6E-06	-	-	-	52.35	7.1E-08	1.9E-08
Naphthalene	91-20-3	SVOC	64,100	115	7.86	8.2E-03	1.5E-05	20.10	3.2E-03	5.7E-06	539.52	1.2E-04	2.1E-07
Pentachlorophenol	87-86-5	SVOC	2.8	2.8	0.45	6.2E-06	6.2E-06	-	-	-	85.28	3.3E-08	3.3E-08
Pyrene	129-00-0	SVOC	266	266	-	-	-	-	-	-	-	-	-
4-Chloroaniline	106-47-8	VOC	46.9	46.9	42.85	1.1E-06	1.1E-06	-	-	-	8034.20	5.8E-09	5.8E-09
Benzene	71-43-2	VOC	710,000	100	55.27	1.3E-02	1.8E-06	6.93	1.0E-01	1.4E-05	2059.99	3.4E-04	4.9E-08
Ethylbenzene	100-41-4	VOC	1,500	100	88.31	1.7E-05	1.1E-06	15.20	9.9E-05	6.6E-06	5975.14	2.5E-07	1.7E-08
Toluene	108-88-3	VOC	100,000	10,000	-	-	-	-	-	-	-	-	-
Xylenes	1330-20-7	VOC	21,000	1,000	-	-	-	-	-	-	-	-	-
Total Estimated Cumulative ILCR per Exposure Pathway						**2E-02**	**5.E-05**		**1E-01**	**3E-05**		**5E-04**	**5E-07**

Notes:

(a) Shading indicates an exceedance of target incremental lifetime cancer risk of 1E-5 for the COPC concentration for the target organ for each receptor population.

(b) Maximum groundwater concentrations are included in **Appendix E-5, Table A**.

(c) Cancer RBSLs are calculated in **Appendix E-5, Table C2** (On-Site Utility Worker), **Appendix E-5, Table B1** (On-Site Industrial Worker), and **Appendix E-5, Table E2** (Resource Restoration).

(d) The preliminary RBSL for the On-Site Industrial Worker is based on the USEPA's commercial scenario Vapor Intrusion Screening Levels (VISLs). VISLs are only calculated for chemicals that are volatile and have inhalation toxicity data, specifically those with a Henry's Law Constant greater than 1 × 10-5 atm-m3/mol or a Vapor Pressure (mmHg) greater than 1.

Table 8 - Non-Cancer Hazard Quotient and Index by Target Organ for Off-Site Receptors at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations CPA Groundwater CMS

Chemical	CAS Number	Detected Maximum Groundwater Concentration in Perimeter Well (ug/L)	Estimated Maximum Surface Water Concentration (ug/L)	Proposed Final Remedial Goal - Perimeter Well (ug/L)	Proposed Final Remedial Goal - Surface Water Concentration (ug/L)	Off-Site Recreational User		
						RBSL - Noncancer (ug/L)	Hazard Quotient (Max Concentration)	Hazard Quotient (Final RGs)
Body Weight - Target Organ								
Naphthalene	91-20-3	18,000	149	115	0.95	939	1.584E-01	1.012E-03
Xylenes	1330-20-7	4,800	40	1,000	8.26	56275	7.049E-04	1.469E-04
Total Hazard Index - Body Weight							**0.2**	**0.001**
Cardiovascular - Target Organ								
Arsenic	7440-38-2	537.6	4.4	40	0.33	4.0	1.120E+00	8.332E-02
Total Hazard Index - Cardiovascular							**1**	**0.08**
Dermal - Target Organ								
Arsenic	7440-38-2	537.6	4.4	40	0.33	4.0	1.120E+00	8.332E-02
Total Hazard Index - Dermal							**1**	**0.08**
Developmental - Target Organ								
Benzo[a]pyrene	50-32-8	5.2	0.043	0.16	0.0013	0.23	1.858E-01	5.622E-03
Ethylbenzene	100-41-4	373	3.1	100	0.83	3568	8.640E-04	2.316E-04
Total Hazard Index - Developmental							**0.2**	**0.01**
Gastrointestinal - Target Organ								
Chromium VI	18540-29-9	27.2	0.22	1.0	0.0083	60	3.777E-03	1.389E-04
Iron	7439-89-6	205,000	1694	22500	185.95	13886	1.220E-01	1.339E-02
Total Hazard Index - Gastrointestinal							**0.1**	**0.01**
Hepatic - Target Organ								
1,1-Biphenyl	92-52-4	18	0.15	18	0.15	4539	3.277E-05	3.277E-05
bis(2-Ethylhexyl)phthalate	117-81-7	2.4	0.020	1.0	0.008	135	1.470E-04	6.124E-05
Pentachlorophenol	87-86-5	0.42	0.0035	1.3	0.011	33	1.043E-04	3.228E-04
Ethylbenzene	100-41-4	373	3.1	100	0.83	3568	8.640E-04	2.316E-04
Total Hazard Index - Hepatic							**0.001**	**0.001**
Immune - Target Organ								
Benzene	71-43-2	150,000	1240	100	0.83	3720	3.332E-01	2.222E-04
Total Hazard Index - Immune							**0.3**	**0.0002**
Nervous - Target Organ								
Manganese	7439-96-5	4,433	37	4,433	36.64	238	1.54E-01	1.54E-01
Toluene	108-88-3	13,000	107	735	6.07	38159	2.82E-03	1.59E-04
Xylenes	1330-20-7	4,800	40	1,000	8.26	56275	7.05E-04	1.47E-04
Total Hazard Index - Nervous							**0.2**	**0.2**
Respiratory - Target Organ								
Chromium VI	18540-29-9	27.2	0.22	1.0	0.0083	60	3.78E-03	1.39E-04
2-Methylnaphthalene	91-57-6	281	2.3	400	3.31	213	1.09E-02	1.56E-02
Naphthalene	91-20-3	18,000	149	115	0.95	939	1.58E-01	1.01E-03
Total Hazard Index - Respiratory							**0.2**	**0.02**
Urinary - Target Organ								
1,1-Biphenyl	92-52-4	18	0.15	18	0.15	4539	3.28E-05	3.28E-05
Pyrene	129-00-0	18.2	0.15	13	0.11	79	1.90E-03	1.39E-03
Toluene	108-88-3	13,000	107	735	6.07	38159	2.82E-03	1.59E-04
Total Hazard Index - Urinary							**0.005**	**0.002**

Notes:

(a) Estimated surface water concentrations based on maximum detected groundwater concentration or Final RG maximum groundwater concentration multiplied by an Attenuation/Mixing Factor of 121.

(b) Maximum groundwater concentrations are included in **Appendix E-5, Table A**.

(c) 4-Chloroaniline was not detected in all perimeter well results. Therefore, it is excluded from the above table.

(d) Cyanide and vanadium do not have fish bioconcentration factors (BCF). Therefore, non-carcinogenic RBSLs were not calculated.

(e) Non-cancer RBSLs are calculated in **Appendix E-5, Table D3** (Off-Site Recreational User).

Table 9 - Incremental Lifetime Cancer Risk for Off-Site Receptors at Maximum Groundwater Concentrations and Final Remedial Goal Concentrations CPA Groundwater CMS

Chemical	CAS Number	Detected Maximum Groundwater Concentration in Perimeter Well (ug/L)	Estimated Maximum Surface Water Concentration (ug/L)	Proposed Final Remedial Goal - Perimeter Well (ug/L)		Proposed Final Remedial Goal - Surface Water Concentration (ug/L)	Off-Site Recreational User		
							RBSL - Carcinogenic Endpoint (ug/L)	Estimated Incremental Lifetime Cancer Risk (Max Concentrations)	Estimated Incremental Lifetime Cancer Risk (Final RGs)
Cyanide	57-12-5	96	0.79	75	a	0.62	-	-	-
Arsenic	7440-38-2	538	4.44	40	b	0.33	2.37E-02	2E-04	1E-05
Chromium VI	18540-29-9	27.2	0.22	1.0	b	0.008	1.07E-01	2E-06	8E-08
Iron	7439-89-6	205,000	1,694	22,500	a	186	-	-	-
Manganese	7439-96-5	4,433	36.64	4,433		36.64	-	-	-
Vanadium	7440-62-2	1,430	11.82	1,430		11.82	-	-	-
1,1-Biphenyl	92-52-4	18	0.15	18		0.149	3.06E+00	5E-08	5E-08
2-Methylnaphthalene	91-57-6	281	2.32	400	b	3.31	-	-	-
Benz[a]anthracene	56-55-3	6.0	0.050	1.0	b	0.008	4.11E-01	1E-07	2E-08
Benzo[a]pyrene	50-32-8	5.2	0.043	0.16	c	0.001	2.08E-03	2E-05	6E-07
Benzo[b]fluoranthene	205-99-2	7.5	0.062	1.0	b	0.008	3.53E-02	2E-06	2E-07
Benzo[k]fluoranthene	207-08-9	6.0	0.050	6.0		0.050	2.14E-01	2E-07	2E-07
bis(2-Ethylhexyl)phthalate	117-81-7	2.4	0.020	1.0	b	0.008	1.30E+00	2E-08	6E-09
Chrysene	218-01-9	4.6	0.038	4.6		0.038	3.37E+00	1E-08	1E-08
Dibenz[a,h]anthracene	53-70-3	0.52	0.0043	0.16	c	0.001	1.11E-03	4E-06	1E-06
Indeno[1,2,3-c,d]pyrene	193-39-5	1.2	0.010	1.0	b	0.008	8.77E-03	1E-06	9E-07
Naphthalene	91-20-3	18,000	149	115	b	0.950	1.05E+00	1E-04	9E-07
Pentachlorophenol	87-86-5	0.42	0.0035	0.42		0.003	4.48E-02	8E-08	8E-08
Pyrene	129-00-0	18.2	0.15	13	a	0.110	-	-	-
Benzene	71-43-2	150,000	1,240	100	b	0.826	4.55E+01	3E-05	2E-08
Ethylbenzene	100-41-4	373	3.1	373		3.083	1.75E+01	2E-07	2E-07
Toluene	108-88-3	13,000	107	735	a	6.07	-	-	-
Xylenes	1330-20-7	4,800	39.7	1,000	b	8.26	-	-	-
Total Estimated Cumulative ILCR per Exposure Pathway								**4E-04**	**2E-05**

Notes:

(a) Final Remedial Goal (RG) is the concentration required to comply with ecological criteria in perimeter wells.

(b) Basis for proposed Final RGs is estimated groundwater concentration necessary to achieve a target HI of 1 and/or a cumulative target risk of less that 1E-4 for on-site receptor populations.

(c) Basis of proposed Final RGs is perimeter well groundwater concentration needed to maintain compliance with Maryland Water Quality Standards with a groundwater to surface water attenuation factor of 121.

(d) Shading indicates an exceedance of target incremental lifetime cancer risk of 1E-5 for the COPC concentration for the target organ for each receptor population.

(e) Maximum groundwater concentrations are included in **Appendix E-5, Table A**.

(f) Cancer RBSLs are calculated in **Appendix E-5, Table D2** (Off-Site Recreational User).

Table 10 - Final Remedial Goals - Groundwater
CPA Groundwater CMS

Constituents of Concern			Proposed Final Remedial Goals (ug/L)			
Chemical	CAS	Parameter Group				
Point of Compliance			Site-Wide		Perimeter	
Arsenic	7440-38-2	Metal	40	b	--	
Iron (e)	7439-89-6	Metal	--		22,500	c
1,1-Biphenyl	92-52-4	SVOC	100	b	--	
2-Methylnaphthalene	91-57-6	SVOC	400	b	--	
Benz[a]anthracene	56-55-3	SVOC	1.0	b	--	
Benzo[a]pyrene	50-32-8	SVOC	0.16	b	0.16	d
Benzo[b]fluoranthene	205-99-2	SVOC	1.0	b	--	
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.0	b	--	
Dibenz[a,h]anthracene	53-70-3	SVOC	0.16	b	0.16	d
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	1.0		--	
Naphthalene	91-20-3	SVOC	115	b	--	
Pyrene	129-00-0	SVOC	--		13	c
Benzene	71-43-2	VOC	100	b	--	
Ethylbenzene	100-41-4	VOC	100	b	--	
Toluene	108-88-3	VOC	10,000	b	735	c
Xylenes	1330-20-7	VOC	1,000	b	--	

Notes:
(a) All Final Remedial Goals (RGs) are in ug/L.
(b) Basis for proposed Final RG is estimated groundwater concentration necessary to achieve a target HI of 1 and/or a cumulative target risk of less that 1E-4 for on-site receptor populations.
(c) Basis of proposed Final RG is the estimated perimeter well groundwater concentration needed to meet ecological criteria.
(d) Basis of proposed Final RG is perimeter well groundwater concentration needed to maintain compliance with Maryland Water Quality Standards with a groundwater to surface water attenuation factor of 121.
(e) Iron is a slag related COPCs.

Table 11 - Cyanide Groundwater Sampling Results
CPA Groundwater CMS

	Units	Sitewide Final RG	Shoreline Final RG	B18-007-PZ	B18-046-PZ	B18-061-PZ		B18-070-PZ	B18-071-PZ	B18-072-PZ	B18-074-PZ	B18-075-PZ	B18-076-PZ	B18-077-PZ	CO211-MWI	CO211-MWS
				12/13/2016	12/13/2016	12/13/2016	7/23/2020	12/14/2016	12/15/2016	12/14/2016	12/14/2016	12/14/2016	12/13/2016	8/10/2017	3/11/2020	3/11/2020
				GAA C	GAA C	GAA C		GAA D	GAA D	GAA D	GAA D	GAA D	GAA D	GAA C	GAA B	GAA B
				Shallow	Shallow	Shallow		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Intermediate	Shallow
9012B Cyanide, Total	µg/L	300	75	38	2.4 J	11	NA	10 U	10 U	130 *	84	8.8 J	110 *	4.1 J	33	150 *
Cyanide, Total	µg/L	300	75	NA	NA	NA	6.29	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide, Amenable	µg/L	300	75	NA	NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA

XX Sitewide Final Remedial Goal (RG) Exceedance
XX Shoreline Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed
* The shoreline Final RG is not applicable to wells not located along the shoreline.

GAA: Groundwater Assessment Area

Table 11 - Cyanide Groundwater Sampling Results
CPA Groundwater CMS

	Units	Sitewide Final RG	Shoreline Final RG	CO32-PZM041		CO35-PZM013	CO35-PZM056	CP17-MWI		CP17-PZM013	CP22-MWI		CP22-MWS		CP23-MWI	
				3/16/2020	7/23/2020	3/12/2020	3/12/2020	3/13/2020	7/23/2020	3/16/2020	2/28/2020	7/21/2020	2/28/2020	7/21/2020	3/13/2020	7/21/2020
				GAA B		GAA E	GAA E	GAA E		GAA E	GAA B		GAA B		GAA B	
				Intermediate		Shallow	Intermediate	Intermediate		Shallow	Intermediate		Shallow		Intermediate	
						Shoreline	Shoreline	Shoreline		Shoreline	Shoreline		Shoreline		Shoreline	
9012B Cyanide, Total	µg/L	300	75	12	NA	30	14	8 J	NA	8.7 J	12	NA	**96**	NA	14	NA
Cyanide, Total	µg/L	300	75	NA	6.64	NA	NA	NA	5 U	NA	NA	3.2 J	NA	**95.6**	NA	5 U
Cyanide, Amenable	µg/L	300	75	NA	10 U	NA	NA	NA	10 U	NA	NA	10 U	NA	10 U	NA	10 U

Table 11 - Cyanide Groundwater Sampling Results
CPA Groundwater CMS

	Units	Sitewide Final RG	Shoreline Final RG	CP23-MWS		CP24-MWI		CP24-MWS		CP25-MWI	CP25-MWS	CP26-MWI		CP26-MWS		SW13-PZM003
				3/13/2020	7/21/2020	2/28/2020	7/21/2020	2/28/2020	7/21/2020	3/16/2020	3/16/2020	3/11/2020	7/23/2020	3/11/2020	7/23/2020	3/28/2016
				GAA B		GAA A		GAA A		GAA A	GAA A	GAA E		GAA E		GAA C
				Shallow		Intermediate		Shallow		Intermediate	Shallow	Intermediate		Shallow		Shallow
				Shoreline		Shoreline		Shoreline				Shoreline		Shoreline		
9012B Cyanide, Total	µg/L	300	75	13	NA	38	NA	9.9 J	NA	75 *	35	16	NA	21	NA	9.9 J
Cyanide, Total	µg/L	300	75	NA	2.82 J	NA	**87.1**	NA	5 U	NA	NA	NA	2.99 J	NA	2.99 J	NA
Cyanide, Amenable	µg/L	300	75	NA	10 U	NA	10 U	NA	10 U	NA	NA	NA	10 U	NA	10 U	NA

Table 11 - Cyanide Groundwater Sampling Results
CPA Groundwater CMS

	Units	Sitewide Final RG	Shoreline Final RG	SW13-PZM025	SW13-PZM111	SW14-PZM004	SW18-PZM008	SW18-PZM053	SW-030-MWS
				2/19/2016	12/9/2015	3/31/2016	3/19/2020	3/12/2020	2/1/2016
				GAA C	GAA C	GAA D	GAA E	GAA E	GAA D
				Intermediate	Deep	Shallow	Shallow	Intermediate	Shallow
9012B Cyanide, Total	µg/L	300	75	10 U	10 U	10 U	15	380 *	64.6
Cyanide, Total	µg/L	300	75	NA	NA	NA	NA	NA	NA
Cyanide, Amenable	µg/L	300	75	NA	NA	NA	NA	NA	NA

Table 12 - Fall 2024 Supplemental GW Sampling - VOCs and SVOCs
CPA Groundwater CMS

SAMPLE ID:			CO02-PZM041	CO05A-PZM	CO18-PZM006	CO29-PZM010	CO152-PZM	CO184-MWI	CO185-MWI	CO188-MWI	CO193-MWI	CO194-MWS	CO206R-MWS	CO209-MWS
COLLECTION DATE:			10/31/2024	11/5/2024	11/4/2024	12/18/2024	10/31/2024	11/1/2024	11/1/2024	10/31/2024	11/1/2024	11/4/2024	11/4/2024	12/18/2024
GAA:			GAA B	GAA D	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA E	GAA B
ANALYTE	**CAS**	**Units**												
VOLATILE ORGANICS BY GC/MS														
Dichlorodifluoromethane	75-71-8	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	74-87-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	75-01-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromomethane	74-83-9	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	75-00-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	75-69-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	75-35-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	75-15-0	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	75-09-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	67-64-1	ug/L	9.1	ND	ND	ND	ND	ND	ND	ND	ND	42	ND	ND
trans-1,2-Dichloroethene	156-60-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl Acetate	79-20-9	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert butyl ether	1634-04-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	75-34-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	156-59-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	110-82-7	ug/L	1.6 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	67-66-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	56-23-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	71-55-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	78-93-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	71-43-2	ug/L	7.9	1,200	260,000	26	300	210,000	78,000	270,000	12,000	560	500	13
1,2-Dichloroethane	107-06-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	79-01-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	78-87-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	75-27-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	10061-01-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	108-88-3	ug/L	0.34 J	420	550 J	7.4	ND	52,000	18,000	37,000	ND	100	260	7.0 J
Tetrachloroethene	127-18-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	108-10-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	10061-02-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropene, Total	542-75-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	79-00-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	124-48-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	106-93-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	591-78-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	108-90-7	ug/L	0.94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	100-41-4	ug/L	0.36 J	53	ND	2.0	ND	670	220	1,100	32 J	3.9	14	2.2 J
p/m-Xylene	179601-23-1	ug/L	7.6	420	ND	9.9	ND	7,300	2,800	10,000	ND	38	240	27
o-Xylene	95-47-6	ug/L	2.2	180	ND	4.7	ND	2,800	1,100	3,700	ND	19	94	11
Xylenes, Total	1330-20-7	ug/L	9.8	600	ND	15	ND	10,000	3,900	14,000	ND	57	330	38
Styrene	100-42-5	ug/L	ND	70	ND	2.2 J	ND	ND	ND	ND	ND	3.8 J	91	9.5 J
Bromoform	75-25-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	98-82-8	ug/L	4.5	10 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	79-34-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	541-73-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	106-46-7	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 12 - Fall 2024 Supplemental GW Sampling - VOCs and SVOCs
CPA Groundwater CMS

SAMPLE ID:			CO02-PZM041	CO05A-PZM	CO18-PZM006	CO29-PZM010	CO152-PZM	CO184-MWI	CO185-MWI	CO188-MWI	CO193-MWI	CO194-MWS	CO206R-MWS	CO209-MWS
COLLECTION DATE:			10/31/2024	11/5/2024	11/4/2024	12/18/2024	10/31/2024	11/1/2024	11/1/2024	10/31/2024	11/1/2024	11/4/2024	11/4/2024	12/18/2024
GAA:			GAA B	GAA D	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA E	GAA B
ANALYTE	**CAS**	**Units**												
1,2-Dichlorobenzene	95-50-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	96-12-8	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	120-82-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	91-20-3	ug/L	NA	NA	NA	NA	NA	12,000	12,000	NA	320	NA	NA	NA
1,2,3-Trichlorobenzene	87-61-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
VOLATILE ORGANICS BY GC/MS-SIM														
1,4-Dioxane	123-91-1	ug/L	1.8 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	79-34-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SEMIVOLATILE ORGANICS BY GC/MS														
Benzaldehyde	100-52-7	ug/L	ND	ND	6.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenol	108-95-2	ug/L	0.7 J	27	66	3.4 J	2.2 J	5.4	20	40	110	3.0 J	5.8	ND
Bis(2-chloroethyl)ether	111-44-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	95-57-8	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylphenol	95-48-7	ug/L	ND	130	39	ND	ND	12	12	20	ND	ND	26	ND
Bis(2-chloroisopropyl)ether	108-60-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetophenone	98-86-2	ug/L	7.8	ND	69	ND	ND	44	23	56	ND	ND	ND	ND
n-Nitrosodi-n-propylamine	621-64-7	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol / 4-Methylphenol	108-39-4 / 106-44-5	ug/L	ND	91	14	1.8 J	ND	6.6	4.4 J	12	ND	2.3 J	31	ND
Hexachloroethane	67-72-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	98-95-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isophorone	78-59-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	105-67-9	ug/L	2.2 J	100	22	ND	ND	9.4	2.8 J	8.6	ND	ND	23	ND
Bis(2-chloroethoxy)methane	111-91-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.3 J
2,4-Dichlorophenol	120-83-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	91-20-3	ug/L	32	8,400	82	700	18	9,200	8,900	480	0.84 J	1,300	1,400	3300
4-Chloroaniline	106-47-8	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	87-68-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Caprolactam	105-60-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	91-57-6	ug/L	0.4 J	280	2.6	22	ND	250	130	9.5	ND	23	66	85
Hexachlorocyclopentadiene	77-47-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	95-94-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	88-06-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	95-95-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Biphenyl	92-52-4	ug/L	ND	28	1.3 J	13	1.0 J	18	11	7.4	0.59 J	12	7.6	18
2-Chloronaphthalene	91-58-7	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline	88-74-4	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	606-20-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	208-96-8	ug/L	ND	110	ND	7.4	0.76 J	160	83	4.8	ND	5.6	55	30
Acenaphthene	83-32-9	ug/L	14	53	ND	1.2 J	5.6	13	5.7	1.7 J	3.6	2.9	3.4	5
2,4-Dinitrophenol	51-28-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	121-14-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	58-90-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	84-66-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	86-73-7	ug/L	0.83 J	63	3.3	2.2	ND	32	22	3.3	8.1	1.7 J	16.0	13

Table 12 - Fall 2024 Supplemental GW Sampling - VOCs and SVOCs
CPA Groundwater CMS

SAMPLE ID:			CO02-PZM041	CO05A-PZM	CO18-PZM006	CO29-PZM010	CO152-PZM	CO184-MWI	CO185-MWI	CO188-MWI	CO193-MWI	CO194-MWS	CO206R-MWS	CO209-MWS
COLLECTION DATE:			10/31/2024	11/5/2024	11/4/2024	12/18/2024	10/31/2024	11/1/2024	11/1/2024	10/31/2024	11/1/2024	11/4/2024	11/4/2024	12/18/2024
GAA:			GAA B	GAA D	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA E	GAA B
ANALYTE	**CAS**	**Units**												
4-Nitroaniline	100-01-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NDPA/DPA	86-30-6	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	118-74-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	87-86-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	85-01-8	ug/L	2.9	61	1.7 J	1.6 J	ND	27	20	5.1	6.8	7.9	17	20
Anthracene	120-12-7	ug/L	ND	10	1.8 J	ND	ND	6.4	4.4	1.1 J	1.3 J	1.2 J	3.3	3.8
Carbazole	86-74-8	ug/L	0.48 J	300	2.5	3.3	ND	120	76	7.9	11.0	7.1	49	4.6
Di-n-butylphthalate	84-74-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	206-44-0	ug/L	ND	7.3	1.7 J	ND	ND	2.8	3.2	1.3 J	0.84 J	1.7 J	3.4	2.5
Pyrene	129-00-0	ug/L	ND	4.1	1.3 J	ND	0.56 J	1.6 J	1.7 J	0.71 J	0.52 J	0.92 J	2.0	1.4 J
3,3'-Dichlorobenzidine	91-94-1	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	56-55-3	ug/L	ND	ND	0.48 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	218-01-9	ug/L	ND	ND	0.58 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	117-81-7	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	117-84-0	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	205-99-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	207-08-9	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	50-32-8	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	53-70-3	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	191-24-2	ug/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SEMIVOLATILE ORGANICS BY GC/MS-SIM														
Naphthalene	91-20-3	ug/L	25	8,700	98	NA	29	NA	NA	770	1.0	1,400	1,800	NA
2-Methylnaphthalene	91-57-6	ug/L	0.32	350	2.9	NA	ND	NA	NA	15	0.07 J	22	82	NA
Acenaphthylene	208-96-8	ug/L	0.23	120	0.33	NA	1.9	NA	NA	8.1	0.32	6.7	65	NA
Acenaphthene	83-32-9	ug/L	11	72	0.34	NA	10	NA	NA	3.0	4.4	3.7	4.4	NA
Fluorene	86-73-7	ug/L	0.63	79	4.0	NA	0.21	NA	NA	5.6	9.7	2.0	16	NA
Phenanthrene	85-01-8	ug/L	2.6	87	2.4	NA	ND	NA	NA	8.8	8.1	9.5	19	NA
Anthracene	120-12-7	ug/L	0.1 J	12	2.3	NA	0.92	NA	NA	2.0	1.6	1.3	3.4	NA
Fluoranthene	206-44-0	ug/L	0.1 J	8.8 J	2.1	NA	0.4	NA	NA	2.6	0.99	2.2	3.7	NA
Pyrene	129-00-0	ug/L	0.05 J	4.8 J	1.6	NA	0.86	NA	NA	1.6	0.55	1.2	2.2	NA
Benzo(a)anthracene	56-55-3	ug/L	ND	ND	0.57	NA	0.1	NA	NA	ND	0.05	0.07	0.35	NA
Chrysene	218-01-9	ug/L	ND	ND	0.85	NA	0.07 J	NA	NA	ND	ND	0.08 J	0.23	NA
Benzo(b)fluoranthene	205-99-2	ug/L	ND	ND	0.64	NA	0.05 J	NA	NA	ND	0.04 J	ND	0.17	NA
Benzo(k)fluoranthene	207-08-9	ug/L	ND	ND	0.23	NA	ND	NA	NA	ND	ND	ND	0.09 J	NA
Benzo(a)pyrene	50-32-8	ug/L	ND	ND	0.34	NA	0.05 J	NA	NA	ND	0.03 J	ND	0.14	NA
Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	ND	ND	0.24	NA	ND	NA	NA	ND	ND	ND	0.11	NA
Dibenzo(a,h)anthracene	53-70-3	ug/L	ND	ND	0.07 J	NA	ND	NA	NA	ND	ND	ND	0.05	NA
Benzo(ghi)perylene	191-24-2	ug/L	ND	ND	0.27	NA	0.04 J	NA	NA	ND	ND	ND	0.1 J	NA

Acronyms:
ND: Not detected above the reporting limit
NA: Not Analyzed
J: Detected above the method detection limit but below the reporting limit

Table 12 - Fall 2024 Supplemental GW Sampling - VOCs and SVOCs
CPA Groundwater CMS

SAMPLE ID:			CO209-MWI	CO210-MWS	CO210-MWI	CO212-MWS	CP20-PZM011	CP22-MWS	CP23-MWS
COLLECTION DATE:			12/18/2024	12/18/2024	12/20/2024	11/5/2024	11/4/2024	12/19/2024	12/19/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA F	GAA B	GAA B
ANALYTE	**CAS**	**Units**							
VOLATILE ORGANICS BY GC/MS									
Dichlorodifluoromethane	75-71-8	ug/L	ND	ND	ND	ND	ND	ND	ND
Chloromethane	74-87-3	ug/L	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	75-01-4	ug/L	ND	ND	ND	ND	ND	ND	ND
Bromomethane	74-83-9	ug/L	ND	ND	ND	ND	ND	ND	ND
Chloroethane	75-00-3	ug/L	ND	ND	ND	ND	ND	ND	ND
Trichlorofluoromethane	75-69-4	ug/L	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	75-35-4	ug/L	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	75-15-0	ug/L	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	ug/L	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	75-09-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Acetone	67-64-1	ug/L	ND	ND	ND	ND	2.2 J	ND	42
trans-1,2-Dichloroethene	156-60-5	ug/L	ND	ND	ND	ND	ND	ND	ND
Methyl Acetate	79-20-9	ug/L	ND	ND	ND	ND	ND	ND	ND
Methyl tert butyl ether	1634-04-4	ug/L	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	75-34-3	ug/L	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	156-59-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	110-82-7	ug/L	ND	ND	ND	ND	ND	ND	ND
Chloroform	67-66-3	ug/L	ND	ND	ND	ND	ND	ND	ND
Carbon tetrachloride	56-23-5	ug/L	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	71-55-6	ug/L	ND	ND	ND	ND	ND	ND	ND
2-Butanone	78-93-3	ug/L	ND	ND	ND	ND	ND	ND	ND
Benzene	71-43-2	ug/L	2000	230	100	4,400	35	55	51
1,2-Dichloroethane	107-06-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	79-01-6	ug/L	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	78-87-5	ug/L	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	75-27-4	ug/L	ND	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	10061-01-5	ug/L	ND	ND	ND	ND	ND	ND	ND
Toluene	108-88-3	ug/L	5.1 J	44	1.0	5,300	0.63 J	6.5	35
Tetrachloroethene	127-18-4	ug/L	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	108-10-1	ug/L	ND	ND	ND	ND	ND	ND	ND
trans-1,3-Dichloropropene	10061-02-6	ug/L	ND	ND	ND	ND	ND	ND	ND
1,3-Dichloropropene, Total	542-75-6	ug/L	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	79-00-5	ug/L	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	124-48-1	ug/L	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromoethane	106-93-4	ug/L	ND	ND	ND	ND	ND	ND	ND
2-Hexanone	591-78-6	ug/L	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	108-90-7	ug/L	ND	ND	ND	9.2 J	ND	ND	ND
Ethylbenzene	100-41-4	ug/L	75	3.5 J	0.34 J	580	ND	0.77 J	4.2
p/m-Xylene	179601-23-1	ug/L	26	20	1.1	5,900	0.7 J	6.5	40
o-Xylene	95-47-6	ug/L	29	10	0.8 J	2,200	0.45 J	4.8	22
Xylenes, Total	1330-20-7	ug/L	55	30	1.9 J	8,100	1.2 J	11	62
Styrene	100-42-5	ug/L	ND	ND	ND	440	ND	ND	5.4
Bromoform	75-25-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	98-82-8	ug/L	ND	ND	ND	22	ND	ND	ND
1,1,2,2-Tetrachloroethane	79-34-5	ug/L	ND	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	541-73-1	ug/L	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	106-46-7	ug/L	ND	ND	ND	ND	ND	ND	ND

Table 12 - Fall 2024 Supplemental GW Sampling - VOCs and SVOCs
CPA Groundwater CMS

SAMPLE ID:			CO209-MWI	CO210-MWS	CO210-MWI	CO212-MWS	CP20-PZM011	CP22-MWS	CP23-MWS
COLLECTION DATE:			12/18/2024	12/18/2024	12/20/2024	11/5/2024	11/4/2024	12/19/2024	12/19/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA F	GAA B	GAA B
ANALYTE	**CAS**	**Units**							
1,2-Dichlorobenzene	95-50-1	ug/L	ND	ND	ND	ND	ND	ND	2.5 J
1,2-Dibromo-3-chloropropane	96-12-8	ug/L	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trichlorobenzene	120-82-1	ug/L	ND	ND	ND	ND	ND	ND	ND
Naphthalene	91-20-3	ug/L	NA	NA	NA	NA	NA	NA	NA
1,2,3-Trichlorobenzene	87-61-6	ug/L	ND	ND	ND	ND	ND	ND	ND
VOLATILE ORGANICS BY GC/MS-SIM									
1,4-Dioxane	123-91-1	ug/L	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	79-34-5	ug/L	ND	ND	ND	ND	ND	ND	ND
SEMIVOLATILE ORGANICS BY GC/MS									
Benzaldehyde	100-52-7	ug/L	ND	ND	ND	ND	ND	ND	ND
Phenol	108-95-2	ug/L	2.5 J	25	1.2 J	100	ND	1.6 J	36
Bis(2-chloroethyl)ether	111-44-4	ug/L	ND	ND	ND	ND	ND	ND	ND
2-Chlorophenol	95-57-8	ug/L	ND	ND	ND	ND	ND	ND	ND
2-Methylphenol	95-48-7	ug/L	3.0 J	ND	ND	66	ND	8.4	53
Bis(2-chloroisopropyl)ether	108-60-1	ug/L	ND	ND	ND	ND	ND	ND	ND
Acetophenone	98-86-2	ug/L	ND	ND	ND	9.6	ND	1.4 J	2.3 J
n-Nitrosodi-n-propylamine	621-64-7	ug/L	ND	ND	ND	ND	ND	ND	ND
3-Methylphenol / 4-Methylphenol	108-39-4 / 106-44-5	ug/L	ND	6.8	ND	120	ND	9.8	100
Hexachloroethane	67-72-1	ug/L	ND	ND	ND	ND	ND	ND	ND
Nitrobenzene	98-95-3	ug/L	ND	ND	ND	ND	ND	ND	ND
Isophorone	78-59-1	ug/L	ND	ND	ND	ND	ND	ND	1.8 J
2,4-Dimethylphenol	105-67-9	ug/L	ND	2.0 J	ND	54	ND	3.1 J	44
Bis(2-chloroethoxy)methane	111-91-1	ug/L	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	120-83-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Naphthalene	91-20-3	ug/L	18000	1800	38	3,700	8.4	440	880
4-Chloroaniline	106-47-8	ug/L	ND	ND	ND	ND	ND	ND	ND
Hexachlorobutadiene	87-68-3	ug/L	ND	ND	ND	ND	ND	ND	ND
Caprolactam	105-60-2	ug/L	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	91-57-6	ug/L	130	32	0.62 J	81	ND	16	36
Hexachlorocyclopentadiene	77-47-4	ug/L	ND	ND	ND	ND	ND	ND	ND
1,2,4,5-Tetrachlorobenzene	95-94-3	ug/L	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	88-06-2	ug/L	ND	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	95-95-4	ug/L	ND	ND	ND	ND	ND	ND	ND
Biphenyl	92-52-4	ug/L	9.2	8.2	ND	110	ND	2.4	12
2-Chloronaphthalene	91-58-7	ug/L	ND	ND	ND	ND	ND	ND	ND
2-Nitroaniline	88-74-4	ug/L	ND	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	606-20-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	208-96-8	ug/L	5	10	ND	9.0	ND	12	16
Acenaphthene	83-32-9	ug/L	76	2.3	ND	ND	ND	7.5	36
2,4-Dinitrophenol	51-28-5	ug/L	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	121-14-2	ug/L	ND	ND	ND	ND	ND	ND	ND
2,3,4,6-Tetrachlorophenol	58-90-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Diethyl phthalate	84-66-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Fluorene	86-73-7	ug/L	34	2	ND	8.0	ND	11	23

Table 12 - Fall 2024 Supplemental GW Sampling - VOCs and SVOCs
CPA Groundwater CMS

SAMPLE ID:			CO209-MWI	CO210-MWS	CO210-MWI	CO212-MWS	CP20-PZM011	CP22-MWS	CP23-MWS
COLLECTION DATE:			12/18/2024	12/18/2024	12/20/2024	11/5/2024	11/4/2024	12/19/2024	12/19/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA F	GAA B	GAA B
ANALYTE	**CAS**	**Units**							
4-Nitroaniline	100-01-6	ug/L	ND	ND	ND	ND	ND	ND	ND
NDPA/DPA	86-30-6	ug/L	ND	ND	ND	ND	ND	ND	ND
Hexachlorobenzene	118-74-1	ug/L	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	87-86-5	ug/L	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	85-01-8	ug/L	39	1.6 J	ND	7.9	ND	15	42
Anthracene	120-12-7	ug/L	1.4 J	ND	ND	1.2 J	ND	2.5	7.2
Carbazole	86-74-8	ug/L	66	4	ND	15	ND	13	24
Di-n-butylphthalate	84-74-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	206-44-0	ug/L	0.82 J	ND	ND	2.1	ND	3.7	8.3
Pyrene	129-00-0	ug/L	ND	ND	ND	ND	ND	2.2	4.4
3,3'-Dichlorobenzidine	91-94-1	ug/L	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	56-55-3	ug/L	ND	ND	ND	ND	ND	0.34 J	ND
Chrysene	218-01-9	ug/L	ND	ND	ND	ND	ND	ND	ND
Bis(2-ethylhexyl)phthalate	117-81-7	ug/L	ND	ND	ND	ND	ND	ND	ND
Di-n-octylphthalate	117-84-0	ug/L	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	205-99-2	ug/L	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	207-08-9	ug/L	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	50-32-8	ug/L	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	53-70-3	ug/L	ND	ND	ND	ND	ND	ND	ND
Benzo(ghi)perylene	191-24-2	ug/L	ND	ND	ND	ND	ND	ND	ND
SEMIVOLATILE ORGANICS BY GC/MS-SIM									
Naphthalene	91-20-3	ug/L	NA	NA	46	3,800	10	NA	NA
2-Methylnaphthalene	91-57-6	ug/L	NA	NA	0.79	110	0.15	NA	NA
Acenaphthylene	208-96-8	ug/L	NA	NA	0.1	13	0.08 J	NA	NA
Acenaphthene	83-32-9	ug/L	NA	NA	0.09 J	1.8	0.06 J	NA	NA
Fluorene	86-73-7	ug/L	NA	NA	0.07 J	11	0.04 J	NA	NA
Phenanthrene	85-01-8	ug/L	NA	NA	ND	10	0.1	NA	NA
Anthracene	120-12-7	ug/L	NA	NA	ND	1.2	0.12	NA	NA
Fluoranthene	206-44-0	ug/L	NA	NA	ND	2.2	0.13	NA	NA
Pyrene	129-00-0	ug/L	NA	NA	ND	1.4	0.14	NA	NA
Benzo(a)anthracene	56-55-3	ug/L	NA	NA	ND	0.17	0.1	NA	NA
Chrysene	218-01-9	ug/L	NA	NA	ND	0.09 J	0.06 J	NA	NA
Benzo(b)fluoranthene	205-99-2	ug/L	NA	NA	ND	0.04 J	0.11	NA	NA
Benzo(k)fluoranthene	207-08-9	ug/L	NA	NA	ND	ND	0.04 J	NA	NA
Benzo(a)pyrene	50-32-8	ug/L	NA	NA	ND	ND	0.07 J	NA	NA
Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	NA	NA	ND	ND	0.08 J	NA	NA
Dibenzo(a,h)anthracene	53-70-3	ug/L	NA	NA	ND	ND	ND	NA	NA
Benzo(ghi)perylene	191-24-2	ug/L	NA	NA	ND	ND	0.08 J	NA	NA

Acronyms:
ND: Not detected above the reporting limit
NA: Not Analyzed
J: Detected above the method detection limit but below the reporting limit

Table 13 - Fall 2024 Supplemental GW Sampling - Metals
CPA Groundwater CMS

	SAMPLE ID:		**B18-070R-MWS**
	COLLECTION DATE:		12/27/2024
ANALYTE	**CAS**	**Units**	Shallow, GAA D
METALS			
Aluminum	7429-90-5	ug/L	3,590
Antimony	7440-36-0	ug/L	*4.0 U*
Arsenic	7440-38-2	ug/L	3.357
Barium	7440-39-3	ug/L	160
Beryllium	7440-41-7	ug/L	*0.50 U*
Cadmium	7440-43-9	ug/L	0.4015
Chromium	7440-47-3	ug/L	9.062
Chromium VI	18540-29-9	ug/L	*50 U*
Cobalt	7440-48-4	ug/L	0.9449
Copper	7440-50-8	ug/L	23.32
Iron	7439-89-6	ug/L	4,560
Lead	7439-92-1	ug/L	125.5
Manganese	7439-96-5	ug/L	200.1
Nickel	7440-02-0	ug/L	13.06
Selenium	7782-49-2	ug/L	*5.0 U*
Silver	7440-22-4	ug/L	*0.40 U*
Thallium	7440-28-0	ug/L	*1.0 U*
Vanadium	7440-62-2	ug/L	17.38
Zinc	7440-66-6	ug/L	260

Acronyms:
U: Not detected above the reporting limit

Table 14 - Fall 2024 Supplemental GW Sampling - BTEX and Naphthalene
CPA Groundwater CMS

SAMPLE ID:			COA-MW-001	COA-MW-002	COA-MW-003	COA-MWI-004	COA-MWS-004	COA-MWI-006	COA-MWI-007	COA-MWI-009	COA-MWI-011	CELL 6 CENTRAL OP	CO02-PZM041	CO05A-PZM	CO08A-PZM
COLLECTION DATE:			6/5/2024	6/5/2024	6/5/2024	6/5/2024	6/5/2024	11/12/2024	11/11/2024	11/11/2024	11/11/2024	11/5/2024	10/31/2024	11/5/2024	9/17/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA E	GAA B	GAA D	GAA B
ANALYTE	**CAS**	**Units**	Shallow	Shallow	Shallow	Intermediate	Shallow	Intermediate	Intermediate	Intermediate	Intermediate	Shallow	Intermediate	Shallow	Shallow
VOCs by 8260															
Benzene	71-43-2	ug/L	3,500	66	1,200	16,000	16,000	18,000	1,300	940	680	16,000	7.9	1,200	510
Ethylbenzene	100-41-4	ug/L	210	1.1	7.5	400	460	63 J	39	1.3 J	1.4 J	150	0.36 J	53	240
Toluene	108-88-3	ug/L	2,600	14	38	8,800	9,200	1,200	950	140	110	5,800	0.34 J	420	1,800
Xylenes	1330-20-7	ug/L	2,100	15	45	4,700	5,500	740	450	25.0	22.0	1,600	9.8	600	4,100
Naphthalene	91-20-3	ug/L	13,000	230	270	2,900	2,900	100 J	1,900	900	830	1,700	25.0	8,700	3,100

Acronyms:
U: Not detected above the reporting limit

J: Detected above the method detection limit but below the reporting limit

D: Concentration of analyte was quantified from a diluted analysis.

Table 14 - Fall 2024 Supplemental GW Sampling - BTEX and Naphthalene
CPA Groundwater CMS

SAMPLE ID:			CO18-PZM006		CO19-PZM004	CO23-PZM008	CO24-PZM007	CO25-PZM008	CO26-PZM007	CO27-PZM012	CO27-PZM046	CO29-PZM010	CO30-PZM015	CO41-PZM001	CO41-PZM036
COLLECTION DATE:			9/18/2024	11/4/2024	9/17/2024	11/19/2024	11/19/2024	11/19/2024	11/20/2024	12/17/2024	12/17/2024	12/18/2024	11/20/2024	12/16/2024	12/17/2024
GAA:			GAA B		GAA B	GAA E	GAA E	GAA E	GAA E	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B
ANALYTE	CAS	Units	Shallow		Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Intermediate	Shallow	Shallow	Shallow	Intermediate
VOCs by 8260															
Benzene	71-43-2	ug/L	330,000	260,000	12.0	380	3.8 J	980	210	7,900	11,000	26.0	38,000	35,000	280,000
Ethylbenzene	100-41-4	ug/L	42 J	*1000 U*	0.92	21.00	2.9 J	32 J	5.70	84.00	140	2.00	76 J	750	830 J
Toluene	108-88-3	ug/L	520	550 J	4.50	210	2 J	940	110	2,600	4,000	7.40	3,200	18,000	90,000
Xylenes	1330-20-7	ug/L	780	*2000 U*	13.0	350	*10 U*	810	120	700	1,200	15.0	990	8,600	17,000
Naphthalene	91-20-3	ug/L	71 J	98	12.0	3,200	1,800	15,000	1,200	450.0	840.0	700	1,800	330	*2500 U*

Acronyms:
U: Not detected above the reporting limit

J: Detected above the method detection limit but below the reporting limit

D: Concentration of analyte was quantified from a diluted analysis.

Table 14 - Fall 2024 Supplemental GW Sampling - BTEX and Naphthalene
CPA Groundwater CMS

SAMPLE ID:			CO55-PZM000	CO56-PZP001	CO57-PZP002	CO58-PZM001	CO59-PZP002	CO88-PZM	CO100-PZM	CO121-PZM	CO152-PZM		CO159-PZM	CO167-PZM
COLLECTION DATE:			11/20/2024	11/20/2024	11/19/2024	11/20/2024	11/19/2024	9/17/2024	9/17/2024	9/19/2024	9/19/2024	10/31/2024	9/19/2024	9/19/2024
GAA:			GAA E	GAA E	GAA E	GAA E	GAA E	GAA B	GAA B	GAA B	GAA B		GAA B	GAA B
ANALYTE	**CAS**	**Units**	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow		Shallow	Shallow
VOCs by 8260														
Benzene	71-43-2	ug/L	65.0	120	1.8	150.0	14.0	86,000	0.86	1,600	440	300	57	120
Ethylbenzene	100-41-4	ug/L	1.60	5.40	*0.5 U*	8.00	1.00	310 J	0.3 J	56	1.3 J	*5 U*	5.1	2.4
Toluene	108-88-3	ug/L	26.00	21.00	1.50	59.00	2.80	330 J	0.27 J	1,400	4.2	*7.5 U*	3.0	9.2
Xylenes	1330-20-7	ug/L	21.0	110.0	0.42 J	140.0	15.0	1700 J	0.35 J	660	1.6 J	*10 U*	4.1 J	14
Naphthalene	91-20-3	ug/L	130	1,600	0.64 J	1,700	77	1,400	0.44 J	1,800	69	29	19	120

Acronyms:
U: Not detected above the reporting limit

J: Detected above the method detection limit but below the reporting limit

D: Concentration of analyte was quantified from a diluted analysis.

Table 14 - Fall 2024 Supplemental GW Sampling - BTEX and Naphthalene
CPA Groundwater CMS

SAMPLE ID:			CO184-MWI	CO185-MWI	CO186-MWS	CO187-MWS	CO188-MWI	CO189-MWS	CO193-MWI	CO194-MWS		CO195-MWS	CO196-MWS	CO198-MWS	CO201-MWS
COLLECTION DATE:			11/1/2024	11/1/2024	12/10/2024	9/18/2024	10/31/2024	9/17/2024	11/1/2024	11/4/2024	12/12/2024	11/20/2024	12/13/2024	12/13/2024	12/13/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B		GAA B	GAA B	GAA B	GAA B
ANALYTE	**CAS**	**Units**	Intermediate	Intermediate	Shallow	Shallow	Intermediate	Shallow	Intermediate	Shallow		Shallow	Shallow	Shallow	Shallow
VOCs by 8260															
Benzene	71-43-2	ug/L	210,000	78,000	140,000	710,000	270,000	290,000	12,000	560	370	24,000	3,200	230	600
Ethylbenzene	100-41-4	ug/L	670	220	240 J	*250 U*	1,100	*1000 U*	32 J	3.9	3.0 J	43 J	7.6 J	1.8 J	1.1 J
Toluene	108-88-3	ug/L	52,000	18,000	37,000	6,800	37,000	3,900	*75 U*	100	75	1,900	220	55	27
Xylenes	1330-20-7	ug/L	10,000	3,900	4,200	240 J	14,000	*2000 U*	*100 U*	57	39	520 J	82 J	26 J	14 J
Naphthalene	91-20-3	ug/L	12,000	12,000	*1000 U*	130 J	770	720 J	320	1,400	1,400	1,300	330	1,600	74

Acronyms:
U: Not detected above the reporting limit

J: Detected above the method detection limit but below the reporting limit

D: Concentration of analyte was quantified from a diluted analysis.

Table 14 - Fall 2024 Supplemental GW Sampling - BTEX and Naphthalene
CPA Groundwater CMS

SAMPLE ID:			CO206R-MWS		CO209-MWS	CO209-MWI	CO210-MWS	CO210-MWI	CO212-MWS	CO213-RW	CO214-RW	CO215-RW	CP20-PZM011	CP22-MWS	CP23-MWS
COLLECTION DATE:			11/4/2024	11/19/2024	12/18/2024	12/18/2024	12/18/2024	12/20/2024	11/5/2024	9/18/2024	9/18/2024	9/18/2024	11/4/2024	12/19/2024	12/19/2024
GAA:			GAA E		GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA F	GAA B	GAA B
ANALYTE	CAS	Units	Shallow		Shallow	Intermediate	Shallow	Intermediate	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
VOCs by 8260															
Benzene	71-43-2	ug/L	440	260	13	2,000	230	100	4,400	29,000	630,000	7.3	35.0	55	51
Ethylbenzene	100-41-4	ug/L	14	8.2 J	*5.0 U*	75	*5.0 U*	0.34 J	580	*120 U*	330 J	*0.5 U*	*0.5 U*	*1.2 U*	4.2
Toluene	108-88-3	ug/L	260	120	*7.5 U*	*15 U*	44	1.0	5,300	140 J	57,000	0.98	0.63 J	6.5	35
Xylenes	1330-20-7	ug/L	330	170	38	55	30	1.9 J	8,100	*250 U*	7,500	0.81 J	1.2 J	11	62
Naphthalene	91-20-3	ug/L	1,800	1,800	3,300	18,000	1,800	46	3,800	*250 U*	*1000 U*	*1 U*	10.0	440	880 D

Acronyms:
U: Not detected above the reporting limit

J: Detected above the method detection limit but below the reporting limit

D: Concentration of analyte was quantified from a diluted analysis.

Table 14 - Fall 2024 Supplemental GW Sampling - BTEX and Naphthalene
CPA Groundwater CMS

SAMPLE ID:			GD02-MWI
COLLECTION DATE:			12/16/2024
GAA:			
ANALYTE	**CAS**	**Units**	Intermediate
VOCs by 8260			
Benzene	71-43-2	ug/L	210,000
Ethylbenzene	100-41-4	ug/L	460 J
Toluene	108-88-3	ug/L	3,600
Xylenes	1330-20-7	ug/L	1400 J
Naphthalene	91-20-3	ug/L	570 J

Acronyms:
U: Not detected above the reporting limit

J: Detected above the method detection limit but below the reporting limit

D: Concentration of analyte was quantified from a diluted analysis.

Table 15 - NAPL Characterization Results
CPA Groundwater CMS

Well / TP ID	Location	Date	Benzene	Naphthalene	Benzene	Naphthalene
			mg/kg or ppm	mg/kg or ppm	%	%
Cell 6 (CO173)	NW Cell 6	Oct-22	75,000	NA	7.5%	NA
		Oct-24	53,000	28,000	5.3%	2.8%
COA-004-TP	NE Cell 6 / B18	Oct-22	0	NA	0%	NA
COA-005-TP	NW Cell 6	Oct-22	15,000	NA	1.5%	NA
COA-007-TP	SE Cell 6	Oct-22	4,500	NA	0.45%	NA
		Oct-24	2,800	120,000	0.28%	12.0%
COA-013-TP	NW Cell 6	Oct-24	1,200	4,100	0.12%	0.41%
COA-015-TP	SE Cell 6	Oct-24	28,000	100,000	2.8%	10.0%
COA-016-TP	S Cell 6	Oct-24	6,600	73,000	0.66%	7.3%
COA-027-TP	N Cell 6	Oct-24	960	13,000	0.096%	1.3%
COA-028-TP	N Cell 6	Oct-24	430	7,800	0.043%	0.78%
COA-013-MWS	NW Cell 6	Dec-24	82,000	15,000	8.2%	1.5%
B10-014-PZ	NW Cell 6	Dec-24	13,000	13,000	1.3%	1.3%

Acronyms:
NA = Not Analyzed
mg/kg = milligrams per kilogram
ppm = parts per million
TP = test pit

Table 16 - Fall 2024 Supplemental GW Sampling - Geochemical Parameters
CPA Groundwater CMS

	CAS #	Units	CO02-PZM041	CO05A-PZM	CO18-PZM006	CO29-PZM010	CP20-PZM011	CO206R-MWS	CO152-PZM	CO188-MWI	CO194-MWS	CO209-MWS	CO209-MWI
			10/31/2024	11/5/2024	11/4/2024	12/18/2024	11/4/2024	11/4/2024	10/31/2024	10/31/2024	11/4/2024	12/18/2024	12/18/2024
GAA			GAA B	GAA D	GAA B	GAA B	GAA F	GAA E	GAA B	GAA B	GAA B	GAA B	GAA B
GENERAL CHEMISTRY													
Iron, Ferric	7439-89-6	ug/L	16,000	870 J	240,000	500 U	380 J	500 U	500 U	500 J	500 U	430 J	520
Alkalinity, Total	471-34-1	ug/L	471,000	115,000	383,000	679,000	69,500	162,000	329,000	57,600	2,300,000	390,000	576,000
Alkalinity, Carbonate	3812-32-6	ug/L	ND	ND	ND	35,100	21,800	41,800	ND	50,600	88,600	27,700	284,000
Alkalinity, Bicarbonate	71-52-3	ug/L	471,000	115,000	383,000	ND	ND	ND	329,000	ND	ND	ND	292,000
Nitrogen, Nitrite	NONE	ug/L	20.7 J	50 U	24.1 J	107	111	20.7 J	50 U	50 U	568	46.7 J	50 U
Nitrogen, Nitrate	14797-55-8	ug/L	27.2 J	33.7 J	38.1 J	100 U	123	39.1 J	100 U	100 U	381	65.4 J	100 U
Chemical Oxygen Demand	COD	ug/L	200,000	71,000	1,600,000	28,000	15,000 J	15,000 J	250,000	680,000	13,000 J	54,000	240,000
BOD, 5 day	NONE	ug/L	36,000	17,000	290,000	ND	ND	7,700	31,000	ND	6,200	ND	12,000
Total Organic Carbon	7440-44-0	ug/L	55,000	24,000	220,000	4,000	4,700	8,500	31,000	34,000	6,800	1,300 J	18,000 J
Iron, Ferrous	7439-89-6	ug/L	2,900	60 J	110,000	60 J	80 J	3,800	250 J	60 J	500 U	150 J	520
TOTAL METALS													
Calcium, Total	7440-70-2	ug/L	40,400	381,000	405,000	303,000	142,000	414,000	80,900	34,500	728,000	282,000	61,500
Iron, Total	7439-89-6	ug/L	19,300	932	349,000	44.2 J	458	763	153	560	38.7 J	576	1,040
Magnesium, Total	7439-95-4	ug/L	7,710	9,880	53,500	61.3 J	1,540	152	5,480	41.5 J	100 U	605	90,200
Manganese, Total	7439-96-5	ug/L	199	20.3	8,360	6.69 J	62.8	199	51.3	9.1 J	10 U	94.2	77.2
Potassium, Total	7440-09-7	ug/L	50,000	10,600	25,600	42,700	31,700	144,000	46,900	19,300	78,200	34,600	54,700
Sodium, Total	7440-23-5	ug/L	304,000	69,800	92,200	282,000	79,000	92,600	67,400	80,100	236,000	607,000	990,000
ANIONS BY ION CHROMATOGRAPHY													
Chloride	16887-00-6	ug/L	409,000	63,600	66,200	502,000	102,000	152,000	35,400	126,000	230,000	1,170,000	1,770,000
Sulfate	14808-79-8	ug/L	1,430	1,070,000	1,110,000	71,600	398,000	1,190,000	25,900	73,400	25,200	172,000	5,360
DISSOLVED GASES BY GC													
Carbon Dioxide	124-38-9	ug/L	86,700	3000 U	366,000	3000 U	3000 U	3000 U	7,520	3000 U	3000 U	3000 U	3000 U

Acronyms:
ND, U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 16 - Fall 2024 Supplemental GW Sampling - Geochemical Parameters
CPA Groundwater CMS

	CAS #	Units	CO210-MWS	CO210-MWI	CO212-MWS	CP22-MWS	CP23-MWS
			12/18/2024	12/20/2024	11/5/2024	12/19/2024	12/19/2024
GAA			GAA B	GAA B	GAA B	GAA B	GAA B
GENERAL CHEMISTRY							
Iron, Ferric	7439-89-6	ug/L	500 U	500 U	500 U	590 J	500 U
Alkalinity, Total	471-34-1	ug/L	1,320,000	170,000	468,000	389,000	2,620,000
Alkalinity, Carbonate	3812-32-6	ug/L	50,600	164,000	141,000	32,600	185,000
Alkalinity, Bicarbonate	71-52-3	ug/L	ND	6,400	ND	ND	ND
Nitrogen, Nitrite	NONE	ug/L	109	50 U	27.7 J	40.1 J	50 U
Nitrogen, Nitrate	14797-55-8	ug/L	100 U	100 U	73 J	58 J	100 U
Chemical Oxygen Demand	COD	ug/L	45,000	34,000	110,000	46,000	79,000
BOD, 5 day	NONE	ug/L	ND	3,400	32,000	ND	11,000
Total Organic Carbon	7440-44-0	ug/L	3,600	4,800	11,000	4,300	8,200
Iron, Ferrous	7439-89-6	ug/L	ND	500 U	70 J	490 J	500 U
TOTAL METALS							
Calcium, Total	7440-70-2	ug/L	476,000	4,890	238,000	391,000	980,000
Iron, Total	7439-89-6	ug/L	19.3 J	25.4 J	30.5 J	1,080	45.3 J
Magnesium, Total	7439-95-4	ug/L	100 U	874	22.8 J	389	200 U
Manganese, Total	7439-96-5	ug/L	1.9 U	2.94 J	10 U	217	9.51 J
Potassium, Total	7440-09-7	ug/L	51,400	74,800	41,200	105,000	97,000
Sodium, Total	7440-23-5	ug/L	273,000	440,000	139,000	615,000	582,000
ANIONS BY ION CHROMATOGRAPHY							
Chloride	16887-00-6	ug/L	420,000	613,000	273,000	857,000	1,040,000
Sulfate	14808-79-8	ug/L	30,800	71,200	175,000	1,020,000	31,200
DISSOLVED GASES BY GC							
Carbon Dioxide	124-38-9	ug/L	3000 U	3000 U	3000 U	3000 U	3000 U

Acronyms:
ND, U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 17 - Fall 2024 Supplemental GW Sampling - Shoreline Monitoring Wells
CPA Groundwater CMS

SAMPLE ID:			CO29-PZM010	CO209-MWS	CO209-MWI	CO210-MWS	CO210-MWI	CP22-MWS	CP23-MWS
COLLECTION DATE:			12/18/2024	12/18/2024	12/18/2024	12/18/2024	12/20/2024	12/19/2024	12/19/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B
ANALYTE	**CAS**	**Units**							
VOLATILE ORGANICS BY GC/MS									
Dichlorodifluoromethane	75-71-8	ug/L	*12 U*	*50 U*	*100 U*	*50 U*	*5 U*	*12 U*	*25 U*
Chloromethane	74-87-3	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
Vinyl chloride	75-01-4	ug/L	*3 U*	*10 U*	*20 U*	*10 U*	*1 U*	*3 U*	*5 U*
Bromomethane	74-83-9	ug/L	*3 U*	*10 U*	*20 U*	*10 U*	*1 U*	*3 U*	*5 U*
Chloroethane	75-00-3	ug/L	*3 U*	*10 U*	*20 U*	*10 U*	*1 U*	*3 U*	*5 U*
Trichlorofluoromethane	75-69-4	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
1,1-Dichloroethene	75-35-4	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
Carbon disulfide	75-15-0	ug/L	*12 U*	*50 U*	*100 U*	*50 U*	*5 U*	*12 U*	*25 U*
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
Methylene chloride	75-09-2	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
Acetone	67-64-1	ug/L	*12 U*	*50 U*	*100 U*	*50 U*	*5 U*	*12 U*	42
trans-1,2-Dichloroethene	156-60-5	ug/L	*2 U*	*8 U*	*15 U*	*8 U*	*1 U*	*2 U*	*4 U*
Methyl Acetate	79-20-9	ug/L	*5 U*	*20 U*	*40 U*	*20 U*	*2 U*	*5 U*	*10 U*
Methyl tert butyl ether	1634-04-4	ug/L	*3 U*	*10 U*	*20 U*	*10 U*	*1 U*	*3 U*	*5 U*
1,1-Dichloroethane	75-34-3	ug/L	*2 U*	*8 U*	*15 U*	*8 U*	*1 U*	*2 U*	*4 U*
cis-1,2-Dichloroethene	156-59-2	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
Cyclohexane	110-82-7	ug/L	*25 U*	*100 U*	*200 U*	*100 U*	*10 U*	*25 U*	*50 U*
Chloroform	67-66-3	ug/L	*2 U*	*8 U*	*15 U*	*8 U*	*1 U*	*2 U*	*4 U*
Carbon tetrachloride	56-23-5	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
1,1,1-Trichloroethane	71-55-6	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
2-Butanone	78-93-3	ug/L	*12 U*	*50 U*	*100 U*	*50 U*	*5 U*	*12 U*	*25 U*
Benzene	71-43-2	ug/L	26	13	2,000	230	100	55	51
1,2-Dichloroethane	107-06-2	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
Trichloroethene	79-01-6	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
1,2-Dichloropropane	78-87-5	ug/L	*3 U*	*10 U*	*20 U*	*10 U*	*1 U*	*3 U*	*5 U*
Bromodichloromethane	75-27-4	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
cis-1,3-Dichloropropene	10061-01-5	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
Toluene	108-88-3	ug/L	7.4	7 J	5.1 J	44	1.0	6.5	35
Tetrachloroethene	127-18-4	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
4-Methyl-2-pentanone	108-10-1	ug/L	*12 U*	*50 U*	*100 U*	*50 U*	*5 U*	*12 U*	*25 U*
trans-1,3-Dichloropropene	10061-02-6	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
1,3-Dichloropropene, Total	542-75-6	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
1,1,2-Trichloroethane	79-00-5	ug/L	*2 U*	*8 U*	*15 U*	*8 U*	*1 U*	*2 U*	*4 U*
Dibromochloromethane	124-48-1	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
1,2-Dibromoethane	106-93-4	ug/L	*5 U*	*20 U*	*40 U*	*20 U*	*2 U*	*5 U*	*10 U*
2-Hexanone	591-78-6	ug/L	*12 U*	*50 U*	*100 U*	*50 U*	*5 U*	*12 U*	*25 U*
Chlorobenzene	108-90-7	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
Ethylbenzene	100-41-4	ug/L	2.0	2.2 J	75	3.5 J	0.34 J	0.77 J	4.2
p/m-Xylene	179601-23-1	ug/L	9.9	27	26	20	1.1	6.5	40
o-Xylene	95-47-6	ug/L	4.7	11	29	10	0.8 J	4.8	22

Table 17 - Fall 2024 Supplemental GW Sampling - Shoreline Monitoring Wells
CPA Groundwater CMS

SAMPLE ID:			CO29-PZM010	CO209-MWS	CO209-MWI	CO210-MWS	CO210-MWI	CP22-MWS	CP23-MWS
COLLECTION DATE:			12/18/2024	12/18/2024	12/18/2024	12/18/2024	12/20/2024	12/19/2024	12/19/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B
ANALYTE	**CAS**	**Units**							
Xylenes, Total	1330-20-7	ug/L	15	38	55	30	1.9 J	11	62
Styrene	100-42-5	ug/L	2.2 J	9.5 J	*20 U*	*10 U*	*1 U*	*3 U*	5.4
Bromoform	75-25-2	ug/L	*5 U*	*20 U*	*40 U*	*20 U*	*2 U*	*5 U*	*10 U*
Isopropylbenzene	98-82-8	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
1,1,2,2-Tetrachloroethane	79-34-5	ug/L	*1 U*	*5 U*	*10 U*	*5 U*	*1 U*	*1 U*	*3 U*
1,3-Dichlorobenzene	541-73-1	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
1,4-Dichlorobenzene	106-46-7	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
1,2-Dichlorobenzene	95-50-1	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	2.5 J
1,2-Dibromo-3-chloropropane	96-12-8	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
1,2,4-Trichlorobenzene	120-82-1	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
1,2,3-Trichlorobenzene	87-61-6	ug/L	*6 U*	*25 U*	*50 U*	*25 U*	*3 U*	*6 U*	*12 U*
VOLATILE ORGANICS BY GC/MS-SIM									
1,4-Dioxane	123-91-1	ug/L	*8 U*	*30 U*	*60 U*	*30 U*	*3 U*	*8 U*	*15 U*
1,1,2,2-Tetrachloroethane	79-34-5	ug/L	*0 U*	*1 U*	*1 U*	*1 U*	*0 U*	*0 U*	*0 U*
SEMIVOLATILE ORGANICS BY GC/MS									
Benzaldehyde	100-52-7	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Phenol	108-95-2	ug/L	3.4 J	*5 U*	2.5 J	25	1.2 J	1.6 J	36
Bis(2-chloroethyl)ether	111-44-4	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
2-Chlorophenol	95-57-8	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
2-Methylphenol	95-48-7	ug/L	*5 U*	*5 U*	3 J	*5 U*	*5 U*	8.4	53
Bis(2-chloroisopropyl)ether	108-60-1	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Acetophenone	98-86-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	1.4 J	2.3 J
n-Nitrosodi-n-propylamine	621-64-7	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
3-Methylphenol/4-Methylphenol	108-39-4/106-44-5	ug/L	1.8 J	*5 U*	*5 U*	6.8	*5 U*	9.8	100
Hexachloroethane	67-72-1	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Nitrobenzene	98-95-3	ug/L	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Isophorone	78-59-1	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	1.8 J
2,4-Dimethylphenol	105-67-9	ug/L	*5 U*	*5 U*	*5 U*	2 J	*5 U*	3.1 J	44
Bis(2-chloroethoxy)methane	111-91-1	ug/L	*5 U*	2.3 J	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
2,4-Dichlorophenol	120-83-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Naphthalene	91-20-3	ug/L	700	3,300	18,000	1,800	38	440	880
4-Chloroaniline	106-47-8	ug/L	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*
Hexachlorobutadiene	87-68-3	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Caprolactam	105-60-2	ug/L	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*
2-Methylnaphthalene	91-57-6	ug/L	22	85	130	32	0.62 J	16	36
Hexachlorocyclopentadiene	77-47-4	ug/L	*20 U*	*20 U*	*20 U*	*20 U*	*20 U*	*20 U*	*20 U*
1,2,4,5-Tetrachlorobenzene	95-94-3	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
2,4,6-Trichlorophenol	88-06-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*

Table 17 - Fall 2024 Supplemental GW Sampling - Shoreline Monitoring Wells
CPA Groundwater CMS

SAMPLE ID:			CO29-PZM010	CO209-MWS	CO209-MWI	CO210-MWS	CO210-MWI	CP22-MWS	CP23-MWS
COLLECTION DATE:			12/18/2024	12/18/2024	12/18/2024	12/18/2024	12/20/2024	12/19/2024	12/19/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B
ANALYTE	**CAS**	**Units**							
2,4,5-Trichlorophenol	95-95-4	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Biphenyl	92-52-4	ug/L	13	18	9.2	8.2	*2 U*	2.4	12
2-Chloronaphthalene	91-58-7	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
2-Nitroaniline	88-74-4	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
2,6-Dinitrotoluene	606-20-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Acenaphthylene	208-96-8	ug/L	7.4	30	5	10	*2 U*	12	16
Acenaphthene	83-32-9	ug/L	1.2 J	5.0	76	2.3	*2 U*	7.5	36
2,4-Dinitrophenol	51-28-5	ug/L	*20 U*	*20 U*	*20 U*	*20 U*	*20 U*	*20 U*	*20 U*
2,4-Dinitrotoluene	121-14-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
2,3,4,6-Tetrachlorophenol	58-90-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Diethyl phthalate	84-66-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Fluorene	86-73-7	ug/L	2.2	13	34	2.0	*2 U*	11	23
4-Nitroaniline	100-01-6	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
NDPA/DPA	86-30-6	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Hexachlorobenzene	118-74-1	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Pentachlorophenol	87-86-5	ug/L	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*
Phenanthrene	85-01-8	ug/L	1.6 J	20	39	1.6 J	*2 U*	15	42
Anthracene	120-12-7	ug/L	*2 U*	3.8	1.4 J	*2 U*	*2 U*	2.5	7.2
Carbazole	86-74-8	ug/L	3.3	4.6	66	4.0	*2 U*	13	24
Di-n-butylphthalate	84-74-2	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Fluoranthene	206-44-0	ug/L	*2 U*	2.5	0.82 J	*2 U*	*2 U*	3.7	8.3
Pyrene	129-00-0	ug/L	*2 U*	1.4 J	*2 U*	*2 U*	*2 U*	2.2	4.4
3,3'-Dichlorobenzidine	91-94-1	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Benzo(a)anthracene	56-55-3	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	0.34 J	*2 U*
Chrysene	218-01-9	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Bis(2-ethylhexyl)phthalate	117-81-7	ug/L	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*
Di-n-octylphthalate	117-84-0	ug/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Benzo(b)fluoranthene	205-99-2	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Benzo(k)fluoranthene	207-08-9	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Benzo(a)pyrene	50-32-8	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Dibenzo(a,h)anthracene	53-70-3	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
Benzo(ghi)perylene	191-24-2	ug/L	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*2 U*
SEMIVOLATILE ORGANICS BY GC/MS-SIM									
Naphthalene	91-20-3	ug/L	NA	NA	NA	NA	46	NA	NA
2-Methylnaphthalene	91-57-6	ug/L	NA	NA	NA	NA	0.79	NA	NA
Acenaphthylene	208-96-8	ug/L	NA	NA	NA	NA	0.1	NA	NA
Acenaphthene	83-32-9	ug/L	NA	NA	NA	NA	0.09 J	NA	NA

Table 17 - Fall 2024 Supplemental GW Sampling - Shoreline Monitoring Wells
CPA Groundwater CMS

SAMPLE ID:			CO29-PZM010	CO209-MWS	CO209-MWI	CO210-MWS	CO210-MWI	CP22-MWS	CP23-MWS
COLLECTION DATE:			12/18/2024	12/18/2024	12/18/2024	12/18/2024	12/20/2024	12/19/2024	12/19/2024
GAA:			GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B
ANALYTE	**CAS**	**Units**							
Fluorene	86-73-7	ug/L	NA	NA	NA	NA	0.07 J	NA	NA
Phenanthrene	85-01-8	ug/L	NA	NA	NA	NA	*0.05 U*	NA	NA
Anthracene	120-12-7	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA
Fluoranthene	206-44-0	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA
Pyrene	129-00-0	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA
Benzo(a)anthracene	56-55-3	ug/L	NA	NA	NA	NA	*0.05 U*	NA	NA
Chrysene	218-01-9	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA
Benzo(b)fluoranthene	205-99-2	ug/L	NA	NA	NA	NA	*0.05 U*	NA	NA
Benzo(k)fluoranthene	207-08-9	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA
Benzo(a)pyrene	50-32-8	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA
Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA
Dibenzo(a,h)anthracene	53-70-3	ug/L	NA	NA	NA	NA	*0.05 U*	NA	NA
Benzo(ghi)perylene	191-24-2	ug/L	NA	NA	NA	NA	*0.1 U*	NA	NA

Acronyms:
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Notes:
(a) For all wells except CO210-MWI, SIM PAHs was unable to be analyzed due to the elevated naphthalene concentrations.

Table 18 - 2025 Supplemental GW Sampling - SVOCs
CPA Groundwater CMS

Sample ID:		CO178-MWI	CO178-MWS	CO180-MWI	CO180-MWS	CO203-MWS	CO30-PZM015	CO30-PZM060	CO58-PZM001
Sample Date:		2/11/2025	2/11/2025	2/11/2025	2/11/2025	2/10/2025	2/10/2025	2/10/2025	2/11/2025
Parameter	**Units**	Intermediate, shoreline, GAA B	Shallow, shoreline, GAA B	Intermediate, shoreline, GAA B	Shallow, shoreline, GAA B	Shallow, shoreline, GAA E	Shallow, shoreline, GAA B	Intermediate, shoreline, GAA B	Shallow, shoreline, GAA E
SVOCs by 8270									
1,1-Biphenyl	µg/L	*2 U*	4.0	1.4 J	1.9 J	11.0	11.0	*2 U*	4.8
2,4-Dimethylphenol	µg/L	*5 U*	8.1	*5 U*	2.5 J	17.0	7.5	*5 U*	11.0
2,6-Dinitrotoluene	µg/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
2-Methylnaphthalene	µg/L	0.05 J	16.0	18.0	24.0	91	54	*0.1 U*	36
2-Methylphenol	µg/L	*5 U*	21	4 J	11.0	43	17.0	*5 U*	17.0
4-Chloroaniline	µg/L	*3.7 U*	*3.7 U*	*3.7 U*	*3.7 U*	*3.7 U*	*3.7 U*	*3.7 U*	*3.7 U*
Acenaphthene	µg/L	*0.1 U*	0.83	2.7	2.3	5.7	6.4	*0.1 U*	3.3
Benz[a]anthracene	µg/L	*0.05 U*	0.04 J	0.05	*0.05 U*	0.16	0.08	*0.05 U*	0.05 J
Benzaldehyde	µg/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*
Benzo[a]pyrene	µg/L	*0.1 U*	0.05 J	0.03 J	*0.1 U*	0.04 J	0.04 J	*0.1 U*	*0.1 U*
Benzo[b]fluoranthene	µg/L	*0.05 U*	0.10	0.04 J	*0.05 U*	0.07	0.05	*0.05 U*	*0.05 U*
Benzo[k]fluoranthene	µg/L	*0.1 U*	0.04 J	0.03 J	*0.1 U*	*0.1 U*	*0.1 U*	*0.1 U*	*0.1 U*
bis(2-Ethylhexyl)phthalate	µg/L	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	*3 U*	2.4 JB
Chrysene	µg/L	*0.1 U*	0.04 J	0.05 J	*0.1 U*	0.09 J	0.05 J	*0.1 U*	*0.1 U*
Dibenz[a,h]anthracene	µg/L	*0.05 U*	*0.05 U*	0.03 J	*0.05 U*	*0.05 U*	*0.05 U*	*0.05 U*	*0.05 U*
Fluoranthene	µg/L	0.03 J	0.42	0.5	0.3	3.0	1.4	*0.1 U*	1.3
Fluorene	µg/L	*0.1 U*	1.6	3.5	4.0	23	12.0	*0.1 U*	8.5
Indeno[1,2,3-c,d]pyrene	µg/L	*0.1 U*	0.05 J	0.03 J	*0.1 U*	*0.1 U*	*0.1 U*	*0.1 U*	*0.1 U*
Naphthalene	µg/L	0.30	510	610	700	2,900	3,300	0.20	1,100
Pentachlorophenol	µg/L	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*
Pyrene	µg/L	0.07 J	0.25	0.31	0.18	1.7	0.81	*0.1 U*	0.68

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
-- No Preliminary RBSL for the selected parameter

Table 19 - 2025 Supplemental GW Sampling - Metals
CPA Groundwater CMS

Sample ID:		CO02-PZM041	CO04-PZM048	CO05A-PZM	CO159-PZM	CO16-PZM006	CO178-MWI	CO178-MWS	CO180-MWI	CO180-MWS	CO189-MWS	CO18-PZM006	CO193-MWI	CO193-MWS
Sample Date:		2/13/2025	2/13/2025	2/13/2025	2/13/2025	2/14/2025	2/11/2025	2/11/2025	2/11/2025	2/11/2025	2/13/2025	2/14/2025	2/10/2025	2/10/2025
Parameter	Units	Intermediate, GAA B	Intermediate, GAA D	Shallow, GAA D	Shallow, GAA B	Shallow, GAA B	Intermediate, Shoreline, GAA B	Shallow, Shoreline, GAA B	Intermediate, Shoreline, GAA B	Shallow, Shoreline, GAA B	Shallow, GAA B	Shallow, GAA B	Intermediate, GAA B	Shallow, GAA B
Metals														
Aluminum	µg/L	6.28 J	16.4	14	3.47 J	213	75.6 J	288	*100 U*	62.7 J	7.44 J	*50 U*	6.42 J	144
Antimony	µg/L	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*40 U*	*40 U*	*40 U*	*40 U*	*4 U*	*20 U*	*4 U*	*4 U*
Arsenic	µg/L	1.109	0.5655	9.511	0.27 J	8.846	30.22	3.945 J	*5 U*	*5 U*	1.772	2.615	62.95	1.605
Barium	µg/L	30.54	3.525	54.88	81.1	33.2	27.8	68.92	154.9	88.74	44.86	59.61	96.3	45.06
Beryllium	µg/L	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*0.5 U*	*2.5 U*	*0.5 U*	*0.5 U*
Cadmium	µg/L	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*2 U*	*2 U*	*2 U*	*2 U*	*0.2 U*	*1 U*	*0.2 U*	*0.2 U*
Calcium	µg/L	10,000	19,200	377,000	104,000	55,000	52,200	148,000	668,000	299,000	13,200	358,000	64,800	198,000
Chromium	µg/L	*1 U*	15.62	0.3691 J	*1 U*	*1 U*	*10 U*	*10 U*	*10 U*	*10 U*	*1 U*	1.331 J	0.2017 J	*1 U*
Cobalt	µg/L	0.398 J	0.172 J	1.543	*0.5 U*	0.2776 J	*5 U*	*5 U*	*5 U*	*5 U*	0.5659	*2.5 U*	0.3423 J	0.4734 J
Copper	µg/L	*1 U*	1.618	*1 U*	*1 U*	0.4673 J	*10 U*	*10 U*	*10 U*	*10 U*	*1 U*	*10 U*	*1 U*	*1 U*
Iron	µg/L	31.4 J	*50 U*	717	66.3	58.5	*500 U*	*500 U*	*500 U*	*500 U*	65.6	143,000	80.2	73.9
Lead	µg/L	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*10 U*	*10 U*	*10 U*	*10 U*	*1 U*	*5 U*	*1 U*	*1 U*
Magnesium	µg/L	6,800	410	9,140	6,030	*70 U*	2,300	*700 U*	*700 U*	*700 U*	6,000	53,600	5,360	32.8 J
Manganese	µg/L	4.195	*1 U*	25.55	56.67	*1 U*	4.427 J	*10 U*	*10 U*	*10 U*	13.68	6,392	225.4	*1 U*
Mercury	µg/L	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*
Nickel	µg/L	0.6386 J	*2 U*	0.9048 J	*2 U*	2.054	*20 U*	*20 U*	*20 U*	*20 U*	1.052 J	*10 U*	0.7394 J	1.476 J
Potassium	µg/L	15,600	3,610	9,080	13,800	58,200	27,300	34,700	108,000	49,900	33,300	19,800	46,100	53,200
Selenium	µg/L	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*50 U*	*50 U*	*50 U*	*50 U*	*5 U*	*25 U*	*5 U*	*5 U*
Silver	µg/L	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*0.4 U*	*2 U*	*0.4 U*	*0.4 U*
Sodium	µg/L	50,600	12,800	70,400	42,400	56,900	320,000	205,000	3,010,000	554,000	127,000	78,700	139,000	124,000
Thallium	µg/L	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*10 U*	*10 U*	*10 U*	*10 U*	*1 U*	*5 U*	*1 U*	*1 U*
Vanadium	µg/L	1.739 J	8.794	1.602 J	*5 U*	531.6	*50 U*	*50 U*	23.55 J	90.96	12.81	13.89 J	*5 U*	15.15
Zinc	µg/L	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*100 U*	*100 U*	*100 U*	*100 U*	*10 U*	*50 U*	*10 U*	*10 U*

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 19 - 2025 Supplemental GW Sampling - Metals
CPA Groundwater CMS

Sample ID:		CO197-MWS	CO203-MWS	CO206R-MWS	CO209-MWI	CO209-MWS	CO210-MWI	CO210-MWS	CO24-PZM007	CO26-PZM007	CO26-PZM032	CO28-PZM010	CO28-PZM048	CO30-PZM015
Sample Date:		2/10/2025	2/10/2025	2/11/2025	2/10/2025	2/10/2025	2/10/2025	2/10/2025	2/13/2025	2/10/2025	2/10/2025	2/11/2025	2/11/2025	2/10/2025
Parameter	Units	Shallow, GAA B	Shallow, Shoreline, GAA E	Shallow, GAA E	Intermediate, Shoreline, GAA B	Shallow, Shoreline, GAA B	Intermediate, Shoreline, GAA B	Shallow, Shoreline, GAA B	Shallow, GAA E	Shallow, Shoreline, GAA E	Intermediate, Shoreline, GAA E	Shallow, Shoreline, GAA B	Intermediate, Shoreline, GAA B	Shallow, Shoreline, GAA B
Metals														
Aluminum	µg/L	134	110	48.6	4.79 J	79	7.64 J	30.5	10.8 J	97.2	*10 U*	*100 U*	37.9 J	96.1
Antimony	µg/L	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	6.039 J	23.67 J	*4 U*
Arsenic	µg/L	1.445	1.497	1.992	0.8402	0.6995	0.496 J	0.9195	1.072	1.097	2.312	2.685 J	537.6	1.298
Barium	µg/L	75.69	55.23	53.86	45.12	166.5	18.16	537.8	28.53	105.4	66.37	30.29	64.24	151.8
Beryllium	µg/L	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*5 U*	*5 U*	*0.5 U*
Cadmium	µg/L	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*2 U*	*2 U*	*0.2 U*
Calcium	µg/L	436,000	352,000	515,000	52,200	293,000	30,600	490,000	464,000	239,000	132,000	92,100	30,900	208,000
Chromium	µg/L	*1 U*	0.1782 J	0.2361 J	*1 U*	*1 U*	0.6794 J	0.2262 J	*1 U*	*1 U*	*1 U*	14.59	*10 U*	0.2878 J
Cobalt	µg/L	0.6382	0.7465	0.7205	0.5239	0.213 J	0.411 J	0.1705 J	1.972	0.5429	2.345	*5 U*	*5 U*	*0.5 U*
Copper	µg/L	*1 U*	0.4362 J	*1 U*	*1 U*	*1 U*	*1 U*	0.3896 J	*1 U*	*1 U*	*1 U*	*10 U*	*10 U*	*1 U*
Iron	µg/L	142	361	145	*50 U*	81.3	80.3	57.2	385	157	4,660	*500 U*	*500 U*	57.9
Lead	µg/L	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*10 U*	*10 U*	*1 U*
Magnesium	µg/L	41.2 J	62.1 J	42.1 J	3,840	81.8	20,600	26.6 J	1,170	*70 U*	382,000	134,000	*700 U*	*70 U*
Manganese	µg/L	*8 U*	*10 U*	0.6515 J	*1 U*	0.9054 J	106.8	2.383	38.68	*1 U*	4,433	*10 U*	*10 U*	0.8388 J
Mercury	µg/L	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	0.113 J	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*
Nickel	µg/L	1.347 J	1.772 J	1.4 J	2.812	1.474 J	1.499 J	4.311	1.132 J	2.243	0.94 J	*20 U*	*20 U*	3.446
Potassium	µg/L	83,000	109,000	140,000	35,100	38,100	35,700	50,200	73,100	151,000	74,500	53,600	37,600	49,000
Selenium	µg/L	*5 U*	2.75 J	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	*5 U*	1.77 J	*5 U*	*50 U*	*50 U*	*5 U*
Silver	µg/L	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*4 U*	*4 U*	*0.4 U*
Sodium	µg/L	1,040,000	116,000	95,300	553,000	901,000	772,000	352,000	20,500	96,900	2,940,000	1,530,000	134,000	80,000
Thallium	µg/L	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*10 U*	*10 U*	*1 U*
Vanadium	µg/L	16.8	1,430	702	6.599	68.26	1.71 J	6.377	498	193	*5 U*	64.38	*50 U*	13.52
Zinc	µg/L	*10 U*	7.128 J	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*10 U*	*100 U*	*100 U*	*10 U*

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 19 - 2025 Supplemental GW Sampling - Metals
CPA Groundwater CMS

Sample ID:		CO30-PZM060	CO34-PZM048	CO36-PZM008	CO36-PZM043	CO37-PZM003	CO38-PZM006	CO38-PZM043	CO39-PZM007	CO39-PZM042	CO58-PZM001	CO59-PZP002	COA-MW-001	COA-MWI-004
Sample Date:		2/10/2025	2/13/2025	2/13/2025	2/13/2025	2/14/2025	2/11/2025	2/11/2025	2/14/2025	2/14/2025	2/11/2025	2/11/2025	2/14/2025	2/14/2025
Parameter	Units	Intermediate, Shoreline, GAA B	Intermediate, GAA E	Shallow, Shoreline, GAA B	Intermediate, Shoreline, GAA B	Shallow, Shoreline, GAA B	Shallow, GAA B	Intermediate, GAA B	Shallow, GAA B	Intermediate, GAA B	Shallow, Shoreline, GAA E	Shallow, GAA E	Shallow, GAA C	Intermediate, GAA B
Metals														
Aluminum	µg/L	8.97 J	5.84 J	148	295	14	77.8 J	*100 U*	76.7	59.4	19.1	19.1	16.7	1,010
Antimony	µg/L	*4 U*	1.019 J	*4 U*	*40 U*	*4 U*	*40 U*	*40 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*	*4 U*
Arsenic	µg/L	78.71	0.6304	0.8027	6.382	1.015	13.67	*5 U*	1.853	5.069	1.103	0.9593	0.8526	2.416
Barium	µg/L	229.7	4.606	72.57	53.81	277.9	28.15	191.3	30.81	35.08	92.55	22.64	89.23	78.12
Beryllium	µg/L	*0.5 U*	*0.5 U*	*0.5 U*	*5 U*	*0.5 U*	*5 U*	*5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*	*0.5 U*
Cadmium	µg/L	*0.2 U*	*0.2 U*	*0.2 U*	*2 U*	*0.2 U*	*2 U*	*2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*
Calcium	µg/L	132,000	55,300	146,000	304,000	753,000	278,000	87,100	583,000	76,100	265,000	286,000	128,000	155,000
Chromium	µg/L	0.7384 J	2.439	7.268	*10 U*	0.1918 J	*10 U*	*10 U*	*1 U*	*1 U*	0.7747 J	1.45	0.2408 J	0.2247 J
Cobalt	µg/L	0.7162	0.1725 J	0.1706 J	*5 U*	0.5633	*5 U*	*5 U*	*0.5 U*	0.1913 J	0.6001	0.3646 J	0.2592 J	*0.5 U*
Copper	µg/L	0.7904 J	2.184	3.93	*10 U*	3.445	*10 U*	*10 U*	*2 U*	*2 U*	0.8123 J	1.0	*2 U*	*2 U*
Iron	µg/L	50,100	*50 U*	*50 U*	*500 U*	*50 U*	*500 U*	*500 U*	*50 U*	*50 U*	131	44.7 J	147	*50 U*
Lead	µg/L	*1 U*	*1 U*	*1 U*	*10 U*	1.624	*10 U*	*10 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Magnesium	µg/L	190,000	12,600	*70 U*	*700 U*	33.1 J	1,550	16,000	174	44.2 J	46.8 J	4,000	21,600	*70 U*
Manganese	µg/L	3,414	16.62	0.4807 J	*10 U*	0.8098 J	39.35	60.31	*1 U*	*1 U*	*1 U*	0.901 J	115	*1 U*
Mercury	µg/L	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	*0.2 U*	0.154 J
Nickel	µg/L	0.8255 J	*2 U*	1.025 J	*20 U*	10.68	*20 U*	*20 U*	0.6559 J	0.6598 J	1.09 J	0.8634 J	0.7854 J	0.6001 J
Potassium	µg/L	50,700	2,090	33,700	45,800	14,000	26,200	31,400	30,600	21,500	101,000	94,400	14,200	25,500
Selenium	µg/L	*5 U*	*5 U*	*5 U*	*50 U*	2.22 J	*50 U*	*50 U*	*5 U*	*5 U*	*5 U*	2.36 J	*5 U*	10.5
Silver	µg/L	*0.4 U*	*0.4 U*	*0.4 U*	*4 U*	*0.4 U*	*4 U*	*4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*	*0.4 U*
Sodium	µg/L	1,860,000	6,980	201,000	767,000	34,600	147,000	255,000	74,800	120,000	103,000	88,800	31,200	108,000
Thallium	µg/L	*1 U*	*1 U*	*1 U*	*10 U*	*1 U*	*10 U*	*10 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*	*1 U*
Vanadium	µg/L	*5 U*	6.836	247.4	25.85 J	*5 U*	*50 U*	*50 U*	*5 U*	*5 U*	425	625	1.817 J	32.64
Zinc	µg/L	4.051 J	*10 U*	*10 U*	*100 U*	8.335 J	*100 U*	*100 U*	*10 U*	*10 U*	*10 U*	*10 U*	4.413 J	*10 U*

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 19 - 2025 Supplemental GW Sampling - Metals
CPA Groundwater CMS

Sample ID:		COA-MWS-004	SW-085-MWS
Sample Date:		2/14/2025	2/17/2025
Parameter	Units	Shallow, GAA B	Shallow, Shoreline, GAA C
Metals			
Aluminum	µg/L	300	54.8
Antimony	µg/L	*4 U*	3.406 J
Arsenic	µg/L	0.862	1.677
Barium	µg/L	95.96	145.6
Beryllium	µg/L	*0.5 U*	*0.5 U*
Cadmium	µg/L	*0.2 U*	*0.2 U*
Calcium	µg/L	182,000	276,000
Chromium	µg/L	*1 U*	0.7047 J
Cobalt	µg/L	*0.5 U*	0.5016
Copper	µg/L	*2 U*	0.548 J
Iron	µg/L	*50 U*	63.9
Lead	µg/L	*1 U*	2.324
Magnesium	µg/L	*70 U*	67,100
Manganese	µg/L	*1 U*	362.9
Mercury	µg/L	0.109 J	*0.2 U*
Nickel	µg/L	*2 U*	1.746 J
Potassium	µg/L	28,800	8,790
Selenium	µg/L	7.33	381
Silver	µg/L	*0.4 U*	*0.4 U*
Sodium	µg/L	105,000	56,900
Thallium	µg/L	*1 U*	*1 U*
Vanadium	µg/L	*5 U*	2.753 J
Zinc	µg/L	*10 U*	*10 U*

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 20 - NAPL / VOC Removal Amounts
CPA Groundwater CMS

Groundwater Assessment Area	Remedial Area Description	Completed Interim Measures	Report Reference Section
GAA B	Cell 1 Air Sparge / Soil Vapor Extraction	2022 and prior: 16,591 lbs of VOCs removed 2023: 68 lbs of VOCs removed 2024: 76 lbs of VOCs removed **Total Cell 1: 16,735 lbs of VOCs**	Section 5.1
	Cell 2 AS / SVE	2014 - 2018: **282 lbs of VOCs**	Section 5.2
	Cell 2 Groundwater Pump & Treat	2022 and prior: 37,832 lbs of VOCs removed 2023: system offline 2024: 400 lbs of VOCs removed **Total Cell 2: 38,232 lbs of VOCs**	Section 5.2
	Cell 3 Air Sparge / Soil Vapor Extraction	2022 and prior: 2,302 lbs of VOCs removed 2023: 26 lbs of VOCs removed 2024: 18 lbs of VOCs removed **Total Cell 3: 2,346 lbs of VOCs**	Section 5.3
	Cell 6 Area	Manual skimming and bailing (2010-2019): **16,162 gallons / 118,436 lbs**	Section 5.6.1
		LNAPL Multi phase extraction System (2016-2023): **7,643 gallons / 56,009 lbs VOCs**	Section 5.6.1
		CO173 (2020-2022): 7,540 gallons LNAPL / 55,253 lbs VOCs 2023: 815 gallons LNAPL / 5,972 lbs VOCs 2024: 464 gallons LNAPL / 3,398 lbs VOCs **Total CO173: 8,819 gallons LNAPL / 64,623 lbs VOCs**	Section 5.6.1
		Hotspot Removal / Treatment: **628 CY** impacted soil excavated, treated if needed, transported, disposed	Section 5.6.2
		Test Pits (2022): 1,631 gallons LNAPL / 11,952 lbs VOCs 2023: 812 gallons LNAPL / 5,950 lbs VOCs 2024: 2,522 gallons LNAPL / 18,481 lbs VOCs **Total Test Pits: 4,965 gallons LNAPL / 36,384 lbs VOCs**	Section 5.6.2
GAA D	Northern Container Terminal Test Pits	CT-004-TP, CT-006-TP, COA-019-TP, COA-021-TP, COA-022-TP): approximately **33.5 gallons LNAPL / 321 lbs VOCs**	Section 5.7.2
	CT-004-TP, CT-006-TP, CT-007-TP	Approximately **118 CY impacted soil** excavated and transported to Greys Landfill	Section 5.7.2

Table 20 - NAPL / VOC Removal Amounts
CPA Groundwater CMS

Groundwater Assessment Area	Remedial Area Description	Completed Interim Measures	Report Reference Section
GAA E	Cell 4 Pneumatic Skimmer Pumps	2015 - 2022: **1,586 gallons DNAPL / 15,221 lbs of DNAPL removed**	Section 5.4.1
	Cell 4 DNAPL Excavation	18,165 tons of impacted soils transported to Greys LF – or approximately **336,000 lbs of naphthalene**	Section 5.4.2
	Cell 5 Dual Phase Extraction System	2022 and prior: 2,141 lbs of VOCs removed 2023: 263 lbs of VOCs removed 2024: 141 lbs of VOCs removed **Total Cell 5: 2,545 lbs of VOCs**	Section 5.5
Total lbs VOCs removed thru 2024 (including Cell 4 excavation and all LNAPL converted to lbs VOCs):			**687,134**
Total CY impacted soil removed thru 2024 (Cell 6 hotspot excavation, northern CT TPs):			**746**

Acronyms:
GAA = Groundwater Assessment Area
VOC = volatile organic compounds
DNAPL = Dense non-aqueous phase liquid
LNAPL = light non-aqueous phase liquid
lbs = pounds
CY = cubic yards
TP = test pit

Table 21A - Groundwater Exceedances for GAA A Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Units	Human Health / Non-Residential		Resource Restoration	CP05-PZM008				CP05-PZM019				CP05-PZM28			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024
Groundwater Zone:					Shallow				Intermediate				Intermediate			
Location:					Shoreline				Shoreline				Shoreline			
2,6-Dinitrotoluene	µg/L	1,171	-	6.24	5 U	5 U	8.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benz[a]anthracene	µg/L	90.3	417	0.495	0.07	0.05 U	0.03 J	0.04 J	0.05	0.05 U	0.04 J	0.04 J	0.09	0.02 J	0.03 J	0.05
Benzene	µg/L	1,701	6.93	55	10	5.2	4.9	5.6	45	39	44	1.6	27	29	31	34
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.04 J	0.1 U	0.1 U	0.1 U	0.03 J	0.03 J	0.1 U	0.1 U	0.07 J	0.02 J	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	3 U	3 U	3 U	3 U	3 U	3 U	1.7 J	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.02 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.02 J	0.05 U	0.05 U	0.05 U
Naphthalene	µg/L	148	20.1	7.86	16	9.0	8.0	8.6	81	50	58	28	46	36	37	34

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 21A - Groundwater Exceedances for GAA A Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Units	Human Health / Non-Residential		Resource Restoration	CP09-PZM010				CP09-PZM047				CP10-PZM008	CP11-PZM010			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/17/2023	10/11/2023	5/13/2024	10/2/2024	4/17/2023	10/19/2023	5/13/2024	10/2/2024	10/28/2021	4/18/2023	10/13/2023	5/20/2024	10/3/2024
Groundwater Zone:					Shallow				Intermediate				Shallow	Shallow			
Location:					Shoreline				Shoreline					Shoreline			
2,6-Dinitrotoluene	µg/L	1,171	-	6.24	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.96 U	5 U	5 U	5 U	5 U
Benz[a]anthracene	µg/L	90.3	417	0.495	0.05 U	0.02 J	0.05 U	0.05 U	0.13	0.05 J	0.02 J	0.05 U	0.96 U	0.08	0.18	0.08	0.05 J
Benzene	µg/L	1,701	6.93	55	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	8.7	12	7.8	9.6	5.5
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	0.1 U	0.1 U	0.1 U	0.96 U	0.1 U	0.03 J	0.02 J	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	2.4 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.96 U	0.05 U	0.05 U	0.05 U	0.05 U
Naphthalene	µg/L	148	20.1	7.86	0.1 U	0.28	0.1 U	0.19	0.1 U	0.08 J	0.13	0.15	**391**	32	30	38	13

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 21A - Groundwater Exceedances for GAA A Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Units	Human Health / Non-Residential		Resource Restoration	CP15-PZM020				CP15-PZM042				CP24-MWI	CP24-MWS	CP25-MWI	CP25-MWS
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/18/2023	10/12/2023	5/14/2024	10/3/2024	4/18/2023	10/12/2023	5/14/2024	10/3/2024	2/28/2020	2/28/2020	3/16/2020	3/16/2020
Groundwater Zone:					Shallow				Intermediate				Intermediate	Shallow	Intermediate	Shallow
Location:					Shoreline				Shoreline				Shoreline	Shoreline		
2,6-Dinitrotoluene	µg/L	1,171	-	6.24	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	0.99 U	0.98 U	0.98 U	0.98 U
Benz[a]anthracene	µg/L	90.3	417	0.495	0.07	0.06	0.07	0.05 U	0.05 U	0.03 J	0.05 U	0.05 U	0.075 J	0.072 J	0.24	0.1
Benzene	µg/L	1,701	6.93	55	6.8	6.6	6.2	5.3	0.43 J	1.8	1.1	4.2	1.2	3.4	3.3	2.8
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.099 U	0.02 J	0.093 J	0.078 J
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	0.99 U	0.98 U	0.98 U	0.45 J
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.099 U	0.098 U	0.098 U	0.098 UJ
Naphthalene	µg/L	148	20.1	7.86	48	70	52	32	1.5	5.2	3.4	8.7	41.6	48.3	**564**	0.39

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 21B - Groundwater Exceedances for GAA A Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CP05-PZM008				CP05-PZM019				CP05-PZM28			
				4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024
Groundwater Zone:				Shallow				Intermediate				Intermediate			
Location:				Shoreline				Shoreline				Shoreline			
2,6-Dinitrotoluene	µg/L	39.2	2,700	5 U	5 U	8.3	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benz[a]anthracene	µg/L	0.157	42.4	0.07	0.05 U	0.03 J	0.04 J	0.05	0.05 U	0.04 J	0.04 J	0.09	0.02 J	0.03 J	0.05
Benzene	µg/L	6,171	9,750	10	5.2	4.9	5.6	45	39	44	1.6	27	29	31	34
Benzo[a]pyrene	µg/L	0.0157	2.42	**0.04 J**	0.1 U	0.1 U	0.1 U	**0.03 J**	**0.03 J**	0.1 U	0.1 U	**0.07 J**	**0.02 J**	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	3 U	3 U	3 U	3 U	3 U	3 U	1.7 J	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	**0.02 J**	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**0.02 J**	0.05 U	0.05 U	0.05 U
Naphthalene	µg/L	127	169	16	9.0	8.0	8.6	81	50	58	28	46	36	37	34

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 21B - Groundwater Exceedances for GAA A Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CP09-PZM010				CP09-PZM047				CP11-PZM010				CP15-PZM020			
				4/17/2023	10/11/2023	5/13/2024	10/2/2024	4/17/2023	10/19/2023	5/13/2024	10/2/2024	4/18/2023	10/13/2023	5/20/2024	10/3/2024	4/18/2023	10/12/2023	5/14/2024	10/3/2024
Groundwater Zone:				Shallow				Intermediate				Shallow				Shallow			
Location:				Shoreline				Shoreline				Shoreline				Shoreline			
2,6-Dinitrotoluene	µg/L	39.2	2,700	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benz[a]anthracene	µg/L	0.157	42.4	0.05 U	0.02 J	0.05 U	0.05 U	0.13	0.05 J	0.02 J	0.05 U	0.08	**0.18**	0.08	0.05 J	0.07	0.06	0.07	0.05 U
Benzene	µg/L	6,171	9,750	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	12	7.8	9.6	5.5	6.8	6.6	6.2	5.3
Benzo[a]pyrene	µg/L	0.0157	2.42	0.1 U	0.1 U	0.1 U	0.1 U	**0.02 J**	0.1 U	0.1 U	0.1 U	0.1 U	**0.03 J**	**0.02 J**	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Naphthalene	µg/L	127	169	0.1 U	0.28	0.1 U	0.19	0.1 U	0.08 J	0.13	0.15	32	30	38	13	48	70	52	32

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 21B - Groundwater Exceedances for GAA A Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CP15-PZM042				CP24-MWI		CP24-MWS	
				4/18/2023	10/12/2023	5/14/2024	10/3/2024	2/28/2020		2/28/2020	
Groundwater Zone:				Intermediate				Intermediate		Shallow	
Location:				Shoreline				Shoreline		Shoreline	
2,6-Dinitrotoluene	µg/L	39.2	2,700	5 U	5 U	5 U	5 U	0.99 U		0.98 U	
Benz[a]anthracene	µg/L	0.157	42.4	0.05 U	0.03 J	0.05 U	0.05 U	0.075 J		0.072 J	
Benzene	µg/L	6,171	9,750	0.43 J	1.8	1.1	4.2	1.2		3.4	
Benzo[a]pyrene	µg/L	0.0157	2.42	0.1 U	0.1 U	0.1 U	0.1 U	0.099 U		**0.02**	**J**
Bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	3 U	3 U	3 U	3 U	0.99 U		0.98 U	
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	0.05 U	0.05 U	0.05 U	0.05 U	0.099 U		0.098 U	
Naphthalene	µg/L	127	169	1.5	5.2	3.4	8.7	41.6		48.3	

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO02-PZM006		CO02-PZM041			CO03-PZM005		CO07-PZM008		CO07-PZM050	CO08A-PZM		CO08B-PZM	CO08C-PZM
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/10/2015	12/17/2020	6/9/2015	3/9/2020	10/31/2024	6/10/2015	3/9/2020	6/10/2015	3/10/2020	3/10/2020	5/20/2021	9/17/2024	5/19/2021	5/19/2021
Groundwater Zone:					Shallow	Shallow	Intermediate			Shallow		Shallow		Intermediate	Shallow		Shallow	Intermediate
Location:																		
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	3.4	NA	0.32 J	NA	0.32	0.25 J	NA	6.5	NA	NA	122 J	NA	82.8 J	1.3 J
Benz[a]anthracene	µg/L	90.3	417	0.495	0.2 J	NA	0.11 U	NA	0.05 U	0.11 U	NA	0.11 U	NA	NA	0.51	NA	4.5 J	0.014 J
Benzene	µg/L	1,701	6.93	55.3	**168,000**	**134,000**	36.4	12.0	7.9	0.25 U	5.0 U	**27,000**	**30,000**	5.0 U	452	510	**5,240**	1.0 U
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.062 U	NA	0.063 U	NA	0.1 U	0.063 U	NA	0.063 U	NA	NA	0.3	NA	2.4	0.015 J
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.26 J	NA	0.16 U	NA	0.05 U	0.21 J	NA	0.17 U	NA	NA	0.33	NA	2.1	0.021 J
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.11 U	NA	0.11 U	NA	0.05 U	0.11 U	NA	0.11 U	NA	NA	0.046 J	NA	0.37	0.067 U
Ethylbenzene	µg/L	5,975	15.2	88.3	374	248	3.7 J	6.6	0.36 J	0.3 U	5.0 U	96.5 J	90.9	5.0 U	342	240	211	1.0 U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.13 U	NA	0.13 U	NA	0.1 U	0.13 U	NA	0.13 U	NA	NA	0.17	NA	1.4	0.012 J
Naphthalene	µg/L	148	20.1	7.86	**201**	**173**	114	NA	25	24.5	NA	140	**319**	10.0 U	**5,190**	**3,100**	**1,490**	15.9
Pentachlorophenol	µg/L	85.3	-	0.45	1.5 J	NA	0.11 U	NA	10 U	0.11 U	NA	0.11 U	NA	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	156	99.1	1.0	5.0 U	0.34 J	0.26 U	5.0 U	1,020	763	5.0 U	2,590	1,800	2,470	1.0 U
Xylenes	µg/L	5,160	162	8,919	753	252	9.9	10.2 J	9.8	0.66 U	15.0 U	132 U	349	15.0 U	**8,040**	4,100	1,480	2.4 J

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
B: Analyte was detected in the associated method blank.
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO08D-PZM	CO08-PZM005	CO08-PZM036	CO09-PZM007	CO100-PZM		CO101-PZM	CO102-PZM	CO103-PZM	CO104-PZM	CO121-PZM		
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	5/19/2021	6/10/2015	6/11/2015	6/10/2015	10/7/2019	9/17/2024	12/17/2020	12/17/2020	12/17/2020	12/16/2020	6/10/2015	10/8/2019	9/19/2024
Groundwater Zone:					Intermediate	Shallow	Intermediate	Shallow	Shallow		Shallow	Shallow	Shallow	Shallow	Shallow		
Location:											Shoreline			Shoreline	Shoreline		
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	0.17 J	8.7	58.4	32.1	NA	NA	NA	NA	NA	NA	25.5	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	0.021 J	0.11 U	0.11 U	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA
Benzene	µg/L	1,701	6.93	55.3	9.0	**15,000**	**35,300**	358	**7,080**	0.86	**5,480**	**13,500**	1,100	4.3	**1,970**	1,230	1,600
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.013 J	0.063 U	0.063 U	0.063 U	NA	NA	NA	NA	NA	NA	0.063 U	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.015 J	0.17 U	0.16 U	0.16 U	NA	NA	NA	NA	NA	NA	0.17 U	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.067 U	0.11 U	0.11 U	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	1.0 U	198	1,070	21.9 J	603	0.30 J	4.9	18.1	2.3	1.0 U	61.7	52.4	56.0
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.095 U	0.13 U	0.13 U	0.13 U	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA
Naphthalene	µg/L	148	20.1	7.86	1.4 J	**257**	**2,170**	**810**	**1,270**	0.44 J	**179**	**874**	88.4	2.0 U	**324**	**2,010**	**1,800**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	1.9 J	1.6 J	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA
Toluene	µg/L	46,071	8,070	7,165	1.5	6,150	17,700	279	54.2	0.27 J	385	964	59.6	1.0 U	1,650	1,100	1,400
Xylenes	µg/L	5,160	162	8,919	3.0 U	2,760	**8,770**	401	268	0.35 J	64.8	194	30.5	3.0 U	642	597	660

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
B: Analyte was detected in the associated method blank.
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO152-PZM			CO159-PZM		CO15-PZM005	CO167-PZM		CO16-PZM006		CO177-MWI	CO177-MWS	CO178-MWI	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/10/2020	9/19/2024	10/31/2024	4/10/2020	9/19/2024	6/9/2015	4/10/2020	9/19/2024	6/9/2015	10/8/2019	9/27/2019	9/27/2019	10/14/2019	2/11/2025
Groundwater Zone:					Shallow			Shallow		Shallow	Shallow		Shallow		Shallow	Shallow	Intermediate	
Location:															Shoreline	Shoreline	Shoreline	
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	1.0 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2 U
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	0.1 U	NA	NA	0.59 J	NA	NA	9.3	NA	NA	NA	NA	0.05 J
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	0.1	NA	NA	0.29 J	NA	NA	0.11 U	NA	NA	NA	NA	0.05 U
Benzene	µg/L	1,701	6.93	55.3	1,520	440	300	64.7	57.0	**169,000**	5.6	120	**119,000**	**78,000**	**4,900**	**5,950**	**40,800**	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	0.05 J	NA	NA	0.24 J	NA	NA	0.063 U	NA	NA	NA	NA	0.1 U
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	0.05 J	NA	NA	0.4 J	NA	NA	0.17 U	NA	NA	NA	NA	0.05 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	0.05 U	NA	NA	0.11 U	NA	NA	0.11 U	NA	NA	NA	NA	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	9.8	1.3 J	5.0 U	8.4	5.1	121	2.3 J	2.4	387	250	19.4	31.5	268	NA
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	0.1 U	NA	NA	0.13 U	NA	NA	0.13 U	NA	NA	NA	NA	0.1 U
Naphthalene	µg/L	148	20.1	7.86	37.3	69.0	29.0	54.6	19.0	47.9	82.6	120	**244**	**503**	125	**161**	**1,270**	0.3
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	10.0 U	NA	NA	2.6 U	NA	NA	2.0 J	NA	NA	NA	NA	10 U
Toluene	µg/L	46,071	8,070	7,165	2.7 J	4.2	7.5 U	5.0 U	3.0	10,300	5.6	9.2	9,660	5,270	19.5	147	5,820	NA
Xylenes	µg/L	5,160	162	8,919	15.0 U	1.6 J	10.0 U	8.4 J	4.1 J	740	13.8 J	14.0	3,020	1,940	125	220	1,870	NA

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

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NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO178-MWS		CO179-MWI	CO179-MWS	CO180-MWI		CO180-MWS		CO181-MWI	CO181-MWS	CO182-MWI		CO183-MWI
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	10/11/2019	2/11/2025	10/2/2019	6/13/2023	5/23/2023	2/11/2025	5/23/2023	2/11/2025	5/24/2023	5/24/2023	8/9/2023	12/10/2024	9/27/2019
Groundwater Zone:					Shallow		Intermediate	Shallow	Intermediate		Shallow		Intermediate	Shallow	Intermediate		Intermediate
Location:					Shoreline		Shoreline	Shoreline	Shoreline		Shoreline		Shoreline	Shoreline			
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	4.0	NA	NA	NA	1.4 J	NA	1.9 J	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	16	NA	NA	NA	18	NA	24	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	0.04 J	NA	NA	NA	0.05	NA	0.05 U	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	**14,200**	NA	**28,500**	**4,700**	**18,000**	NA	**17,000**	NA	**23,000**	**21,000**	**250,000**	**22,000**	**146,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	0.05 J	NA	NA	NA	0.03 J	NA	0.1 U	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	0.10	NA	NA	NA	0.04 J	NA	0.05 U	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	0.05 U	NA	NA	NA	0.03 J	NA	0.05 U	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	242	NA	373	230	78.0 J	NA	86.0	NA	120	130	1,100	100	743
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	0.05 J	NA	NA	NA	0.03 J	NA	0.1 U	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**1,500**	**510**	**6,280**	**1,200**	**880**	**610**	**1,200**	**700**	**1,800**	**1,700**	**220 J**	73.0 J	**757**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	10 U	NA	NA	NA	10 U	NA	10.0 U	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	7,920	NA	13,000	2,800	3,900	NA	4,700	NA	5,500	6,300	17,000	2,500	**51,200**
Xylenes	µg/L	5,160	162	8,919	1,950	NA	2,990	2,300	1,200	NA	1,500	NA	1,800	2,000	**9,500**	1,300	**16,700**

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
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Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO184-MWI		CO185-MWI		CO185-MWS	CO186-MWS		CO187-MWS		CO188-MWI		CO189-MWS	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	10/8/2019	11/1/2024	2/5/2020	11/1/2024	10/8/2019	6/13/2023	12/10/2024	10/7/2019	9/18/2024	10/8/2019	10/31/2024	10/8/2019	9/17/2024
Groundwater Zone:					Intermediate		Intermediate		Shallow	Shallow		Shallow		Intermediate		Shallow	
Location:																	
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	18.0	NA	11.0	NA	NA	NA	NA	NA	NA	7.4	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	250	NA	130	NA	NA	NA	NA	NA	NA	15.0	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	2.0 U	NA	2.0 U	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA
Benzene	µg/L	1,701	6.93	55.3	**209,000**	**210,000**	**75,300**	**78,000**	**2,610**	**9,500**	**140,000**	**353,000**	**710,000**	**320,000**	**270,000**	**311,000**	**290,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	2.0 U	NA	2.0 U	NA	NA	NA	NA	NA	NA	1.0 U	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	2.0 U	NA	2.0 U	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	2.0 U	NA	2.0 U	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	554	670	241	220	7.0	22.0 J	240 J	42.3	250.0 U	991	1,100	223	1,000 U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	2.0 U	NA	2.0 U	NA	NA	NA	NA	NA	NA	1.0 U	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**64,100**	**9,200**	**27,800**	**8,900**	**581**	100 U	1,000 U	**172**	130 J	**1,120**	**770**	**625**	**720** J
Pentachlorophenol	µg/L	85.3	-	0.45	NA	10 U	NA	10 U	NA	NA	NA	NA	NA	NA	10 U	NA	NA
Toluene	µg/L	46,071	8,070	7,165	**51,200**	**52,000**	15,700	18,000	257	460	37,000	8,380	6,800	38,000	37,000	20,600	3,900
Xylenes	µg/L	5,160	162	8,919	**12,000**	**10,000**	3,890	3,900	101	150 J	4,200	527	240 J	**13,600**	**14,000**	3,100	2,000 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
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NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO18-PZM006				CO190-MWS						CO191-MWS		CO192-MWS	CO193-MWI	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/9/2015	12/28/2020	9/18/2024	11/4/2024	8/15/2023	11/28/2023	3/12/2024	6/20/2024	8/14/2024	12/17/2024	5/30/2023	6/7/2024	10/7/2019	2/6/2020	11/1/2024
Groundwater Zone:					Shallow				Shallow						Shallow		Shallow	Intermediate	
Location:																			
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	1.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.59 J
2-Methylnaphthalene	µg/L	670	-	80.5	1.1	NA	NA	2.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.07 J
Benz[a]anthracene	µg/L	90.3	417	0.495	0.96 J	NA	NA	0.57	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05
Benzene	µg/L	1,701	6.93	55.3	**13,200**	**510,000**	**330,000**	**260,000**	**35,000**	**160,000**	**270,000**	**550,000**	**96,000**	**290,000**	**67,000**	**34,000**	**72,900**	**34,800**	**12,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.7 J	NA	NA	0.34	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03 J
Benzo[b]fluoranthene	µg/L	105	-	0.56	1.7	NA	NA	0.64	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.04 J
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.11 U	NA	NA	0.07 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	4.7 J	93.8	42.0 J	1,000 U	200 U	500 U	1,200 U	2,000 U	500 U	1,000 U	220 J	110	221	61.4	32.0 J
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.26 J	NA	NA	0.24 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U
Naphthalene	µg/L	148	20.1	7.86	20.2	**427**	71.0 J	98.0	400 U	**330** J	2,500 U	4,000 U	**320** J	2,000 U	**290 J**	**190 J**	**301**	**47,600**	1.00
Pentachlorophenol	µg/L	85.3	-	0.45	0.11 U	NA	NA	10.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10.0 U
Toluene	µg/L	46,071	8,070	7,165	237	18,100	520.0	550 J	1,600	10,000	16,000	35,000	5,300	14,000	6,700	2,700	2,470	49.6	75.0 U
Xylenes	µg/L	5,160	162	8,919	380	2,410	780.0	2,000 U	400 U	1,000 U	2,500 U	4,000 U	1,000 U	2,000 U	2,200	900	475	150	100.0 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

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Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO193-MWS	CO194-MWS					CO195-MWS						CO196-MWS			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	10/1/2019	5/30/2023	11/8/2023	6/6/2024	11/4/2024	12/12/2024	8/11/2023	11/8/2023	3/8/2024	6/6/2024	8/12/2024	11/20/2024	5/31/2023	11/8/2023	6/6/2024	12/13/2024
Groundwater Zone:					Shallow	Shallow					Shallow						Shallow			
Location:																				
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	12.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	22.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	**33,700**	600	98	320	560	370	**45,000**	**30,000**	**17,000**	**22,000**	**30,000**	**24,000**	**6,000**	**2,500**	**3,900**	**3,200**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	0.10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	50.9	6.3 J	0.79 J	2.4 J	3.9	3.0 J	73.0 J	55.0 J	34.0 J	43.0 J	58.0 J	43.0 J	14.0 J	6.1 J	11.0 J	7.6 J
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	0.10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**1,170**	**1,900**	**470**	**760**	**1,400**	**1,400**	**1,600**	**2,000**	**1,200**	**1,300**	**1,700**	**1,300**	**600**	**320**	**550**	**330**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	10.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	3,320	130	19.0	65.0	100	75.0	3,100	2,700	1,400	1,900	2,400	1,900	490	200	290	220
Xylenes	µg/L	5,160	162	8,919	599	78.0	9.6	34.0	57.0	39.0	830 J	700 J	400 J	550 J	720 J	520 J	160 J	74	110	82 J

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

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Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO197-MWS	CO198-MWS				CO199-MWS	CO19-PZM004		CO200-MWS	CO201-MWS				CO202-MWS
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	10/1/2019	5/19/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019	6/10/2015	9/17/2024	9/30/2019	5/31/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019
Groundwater Zone:					Shallow	Shallow				Shallow	Shallow		Shallow	Shallow				Shallow
Location:						Shoreline				Shoreline			Shoreline	Shoreline				Shoreline
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	NA	NA	0.19 U	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	NA	NA	0.12 U	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	**5,680**	190	310	280	230	**34,200**	409	12.0	**34,100**	1,100	330	42.0	600	**1,780**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	NA	NA	0.064 U	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	NA	NA	0.17 U	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	10.8	1.7 J	10.0 U	2.6 J	1.8 J	71.7	7.90	0.92	44.1	3.9 J	0.94 J	0.21 J	1.1 J	3.3
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**3,250**	**1,300**	**1,900**	**1,700**	**1,600**	**12,200**	0.19 U	12.0	**1,130**	**180**	44.0	11.0	74	**886**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	NA	NA	0.12 U	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	420	42.0	79.0	72.0	55	2,650	2.40 J	4.5	2,840	79.0	6.9	2.0	27	134
Xylenes	µg/L	5,160	162	8,919	116	22.0 J	34.0 J	34.0	26 J	1,150	2.60 U	13.0	575	56.0	11.0 J	3.1	14 J	42.1

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

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Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO209-MWI		CO209-MWS		CO210-MWI		CO210-MWS		CO211-MWI	CO211-MWS	CO212-MWI	CO212-MWS		CO213-RIW	CO214-RIW
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/2/2023	12/18/2024	6/2/2023	12/18/2024	2/5/2020	12/20/2024	2/5/2020	12/18/2024	3/11/2020	3/11/2020	2/6/2020	2/6/2020	11/5/2024	9/18/2024	9/18/2024
Groundwater Zone:					Intermediate		Shallow		Intermediate		Shallow		Intermediate	Shallow	Intermediate	Shallow		Shallow	Shallow
Location:					Shoreline		Shoreline		Shoreline		Shoreline								
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	9.2	NA	18.0	NA	2.0 U	NA	8.2	0.98 U	0.98 U	NA	NA	**110**	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	130	NA	85.0	NA	0.79	NA	32.0	0.18	0.17	NA	NA	81.0	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	2.0 U	NA	2.0 U	NA	0.05 U	NA	2.0 U	0.044 J	2.0	NA	NA	0.17	NA	NA
Benzene	µg/L	1,701	6.93	55.3	**2,300**	**2,000**	180	13	277	100	97	230	42.1	369	3.4	**10,600**	**4,400**	**29,000**	**630,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	2.0 U	NA	2.0 U	NA	0.1 U	NA	2.0 U	0.02 J	2.0	NA	NA	0.10 U	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	2.0 U	NA	2.0 U	NA	0.05 U	NA	2.0 U	0.035 J	2.5	NA	NA	0.04 J	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	2.0 U	NA	2.0 U	NA	0.05 U	NA	2.0 U	0.10 U	0.37	NA	NA	0.05 U	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	71.0	75.0	5.7 J	2.2 J	5.0 U	0.34 J	2.5 J	3.5 J	1.00 U	0.94 J	1.0 U	727	580	120 U	330 J
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	2.0 U	NA	2.0 U	NA	0.1 U	NA	2.0 U	0.098 U	1.1	NA	NA	0.1 U	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**13,000**	**18,000**	**2,400**	**3,300**	**291**	46	**1,140**	**1,800**	0.70	4.9	16.3	**19,000**	**3,800**	250 U	1,000 U
Pentachlorophenol	µg/L	85.3	-	0.45	NA	10.0 U	NA	10.0 U	NA	10.0 U	NA	10.0 U	2.40 U	2.4 U	NA	NA	10.0 U	NA	NA
Toluene	µg/L	46,071	8,070	7,165	340	5.1 J	170	7.0 J	11.4	1.0	20.9	44.0	1.00 U	1.0 U	0.61 J	7,930	5,300	140 J	**57,000**
Xylenes	µg/L	5,160	162	8,919	140 J	55.0	82.0 J	38.0	6.9 J	1.9 J	18.5	30.0	3.00 U	3.0 U	3.0 U	**7,790**	**8,100**	250 U	**7,500**

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
B: Analyte was detected in the associated method blank.
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO215-RIW	CO27-PZM012					CO27-PZM046					CO28-PZM010		CO28-PZM048	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	9/18/2024	8/9/2023	11/13/2023	3/4/2024	8/13/2024	12/17/2024	8/9/2023	11/14/2023	3/4/2024	8/13/2024	12/17/2024	6/9/2015	5/24/2023	6/9/2015	5/24/2023
Groundwater Zone:					Shallow	Shallow					Intermediate					Shallow		Intermediate	
Location:						Shoreline					Shoreline					Shoreline		Shoreline	
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.30	NA	30.1	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.10 U	NA	0.11 U	NA
Benzene	µg/L	1,701	6.93	55.3	7.3	**5,500**	**13,000**	**10,000**	**10,000**	**7,900**	**19,000**	**50,000**	**52,000**	**14,000**	11,000	**20,900**	0.19 J	**291,000**	**93,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.06 U	NA	0.063 U	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17 U	NA	0.17 U	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA	0.11 U	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	0.5 U	64.0	170	110	120	84	180	260	280	140	140	36.6	0.5 U	525	260 J
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13 U	NA	0.13 U	NA
Naphthalene	µg/L	148	20.1	7.86	1.0 U	**470**	**1,100**	**760**	**570**	**450**	**910**	**1,000**	**750**	**700**	**840**	**627**	1.0 U	**1,250 B**	**1,600**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA	0.11 U	NA
Toluene	µg/L	46,071	8,070	7,165	0.98	1,100	4,900	3,500	2,700	2,600	4,200	5,000	6,600	4,600	4,000	1,080	0.8 U	34,300	1,900
Xylenes	µg/L	5,160	162	8,919	0.81 J	480	1,400	940	920	700	1,400	1,600	1,800	1,200	1,200	436	1.0 U	**6,610**	4,800

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
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NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO29-PZM010			CO29-PZM051		CO30-PZM015						
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/10/2015	12/19/2019	12/18/2024	6/9/2015	12/19/2019	8/11/2023	11/8/2023	3/8/2024	6/6/2024	8/12/2024	11/20/2024	2/10/2025
Groundwater Zone:					Shallow			Intermediate		Shallow						
Location:					Shoreline			Shoreline		Shoreline						
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	13.0	NA	NA	NA	NA	NA	NA	NA	NA	11
2-Methylnaphthalene	µg/L	670	-	80.5	12.1	NA	22.0	0.18 U	NA	NA	NA	NA	NA	NA	NA	54
Benz[a]anthracene	µg/L	90.3	417	0.495	0.11 U	NA	2.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.08
Benzene	µg/L	1,701	6.93	55.3	15.1 J	13.8	26.0	0.29 J	1.8	**56,000**	**40,000**	**34,000**	**32,000**	**23,000**	**38,000**	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.064 U	NA	2.0 U	0.062 U	NA	NA	NA	NA	NA	NA	NA	0.04 J
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.17 U	NA	2.0 U	0.16 U	NA	NA	NA	NA	NA	NA	NA	0.05
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.11 U	NA	2.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	7.5 U	1.9	2.0	0.30 U	1.0 U	110 J	72.0 J	76.0 J	75.0 J	45.0 J	76.0 J	NA
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.13 U	NA	2.0 U	0.13 U	NA	NA	NA	NA	NA	NA	NA	0.1 U
Naphthalene	µg/L	148	20.1	7.86	**193**	**573**	**700**	2.0	14.2	**2,300**	**2,000**	**2,100**	**1,800**	**1,400**	**1,800**	**3,300**
Pentachlorophenol	µg/L	85.3	-	0.45	0.11 U	NA	10.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	10 U
Toluene	µg/L	46,071	8,070	7,165	6.5 U	5.2	7.4	0.26 U	0.4 J	4,000	3,000	2,700	2,600	1,900	3,200	NA
Xylenes	µg/L	5,160	162	8,919	16.5 U	14.7	15.0	0.66 U	3.0 U	1,300 J	920	910	950	510 J	990	NA

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

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Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO30-PZM060			CO32-PZM004		CO32-PZM041		CO36-PZM008	CO36-PZM043	CO37-PZM003			CO37-PZM038			CO38-PZM006
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	5/19/2023	6/6/2024	2/10/2025	6/11/2015	3/29/2020	6/9/2015	3/16/2020	8/10/2023	8/10/2023	8/8/2023	11/20/2023	3/12/2024	8/8/2023	11/20/2023	3/11/2024	8/8/2023
Groundwater Zone:					Intermediate			Shallow		Intermediate		Shallow	Intermediate	Shallow			Intermediate			Shallow
Location:					Shoreline							Shoreline	Shoreline	Shoreline			Shoreline			
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	2 U	NA	NA	NA	0.909 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	0.1 U	0.18 U	NA	0.20 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	0.05 U	0.11 U	NA	0.12 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	7.5	99.0	NA	0.35 J	12.9	0.25 U	1.0 U	**15,000**	**16,000**	24.0	**4,200**	66	**12,000**	**12,000**	**17,000**	**2,800**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	0.1 U	0.063 U	NA	0.069 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	0.05 U	0.16 U	NA	0.18 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	0.05 U	0.11 U	NA	0.12 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	0.5 U	0.3 J	NA	0.30 U	1.0 U	0.30 U	1.0 U	60.0	46.0 J	2.9	25.0	5.3	210	180	230	29.0
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	0.1 U	0.13 U	NA	0.14 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	1.0 U	5.3	0.2	0.19 U	NA	0.32 J	0.690	**530**	**550**	9.1	**200**	75	**1,500**	**1,100**	**1,300**	**590**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	10 U	0.11 U	NA	0.12 U	2.5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	0.8 U	6.7	NA	0.26 U	0.6 J	0.26 U	1.0 U	3,200	2,100	42.0	1,200	52.0	6,300	6,000	7,800	470
Xylenes	µg/L	5,160	162	8,919	1.0 U	3.3 J	NA	0.66 U	3.0 U	0.66 U	3.0 U	970	660	30.0	340	77.0	1,800	1,500	2,000	200

Preliminary Risk Based Screening Level (RBSL) Exceedances:
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Industrial Worker: Underline
Resource Restoration: Yellow

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Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO38-PZM043	CO39-PZM007	CO39-PZM042	CO40-PZM008	CO41-PZM001						
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	8/8/2023	8/8/2023	8/8/2023	8/9/2023	6/9/2015	8/2/2023	11/14/2023	3/4/2024	6/7/2024	8/13/2024	12/16/2024
Groundwater Zone:					Intermediate	Shallow	Intermediate	Shallow	Shallow						
Location:															
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	8.3	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	0.71	380	**4,200**	740	**76,200**	690	**11,000**	56	550	**2,000**	**35,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	0.063 U	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	0.16 U	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	0.5 U	2.2	49.0	5.6	990	14.0	130	1.7	3.0	27.0	760
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	1.0 U	**240**	**870**	**150**	**326**	11	49.0 J	0.3 J	3.1 J	10.0 J	**330**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	0.75 U	43.0	1,400	110	42,600	180	3,200	7.5	29.0	590	18,000
Xylenes	µg/L	5,160	162	8,919	0.70 J	12.0	390	44	**16,300**	110	1,300	3.6 J	13.0 J	240	**8,600**

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
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Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO41-PZM036							CO42-PZM004				CO43-PZM048	CO44-PZM048	CO45-PZM047	CO46-PZM047
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/9/2015	8/2/2023	11/14/2023	3/4/2024	6/7/2024	8/13/2024	12/17/2024	6/9/2015	5/25/2023	11/20/2023	3/4/2024	6/30/2022	6/30/2022	6/30/2022	6/30/2022
Groundwater Zone:					Shallow							Shallow				Intermediate	Intermediate	Intermediate	Intermediate
Location:																Shoreline	Shoreline	Shoreline	Shoreline
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	4.2	NA	NA	NA	NA	NA	NA	6.5	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	0.1 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	**616,000**	**290,000**	**180,000**	**290,000**	**290,000**	**320,000**	**280,000**	650	140	580	0.78	**4,200**	300	85	**24,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.06 U	NA	NA	NA	NA	NA	NA	0.063 U	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.19 J	NA	NA	NA	NA	NA	NA	0.16 U	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	1,260	990 J	520	970	740 J	1,100	830 J	103	19	56	0.5 U	8.0 J	1.0 J	0.2 J	280
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.13 U	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**181**	**770** J	**390** J	**260** J	**580** J	2,000 U	2,500 U	94.8	65	**170**	1.0 U	39.0 J	7.2	1.0	**820**
Pentachlorophenol	µg/L	85.3	-	0.45	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	**138,000**	**94,000**	**57,000**	**100,000**	**84,000**	**100,000**	**90,000**	1,310	160	190	0.7 J	30.0 U	2.3	0.2 J	6,500
Xylenes	µg/L	5,160	162	8,919	**30,000**	**18,000**	**10,000**	**19,000**	**13,000**	**21,000**	**17,000**	908	140	290	1.0 U	25.0 J	4.3 J	1.0 U	1,900

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

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NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	CO47-PZM046	CO48-PZM044	CO79-PZM	CO88-PZM			CO93-PZM							COA-MW-003	COA-MWI-004
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/30/2022	6/30/2022	6/9/2015	6/9/2015	10/8/2019	9/17/2024	6/9/2015	8/15/2023	11/27/2023	3/12/2024	6/18/2024	8/13/2024	12/10/2024	6/5/2024	6/5/2024
Groundwater Zone:					Intermediate	Intermediate	Shallow	Shallow			Shallow							Shallow	Intermediate
Location:					Shoreline	Shoreline													
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	0.3 J	6.2	NA	NA	27.9	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	0.5 J	0.11 U	NA	NA	1.9	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	**22,000**	**20,000**	1,380	**166,000**	**207,000**	**86,000**	**302,000**	**170,000**	**180,000**	**140,000**	**200,000**	**170,000**	**130,000**	1,200	**16,000**
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	0.6 J	0.062 U	NA	NA	1.8	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	1.6	0.16 U	NA	NA	3.2	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	1.0 U	0.11 U	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	290	340	7.5 U	535	378	310 J	2,970	1,500	1,400	1,000	1,400	1,200	1,200	7.5	400
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	0.2 J	0.13 U	NA	NA	0.31 J	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**990**	**1,200**	9.3	**172**	**719**	**1,400**	**1,740**	**1,900** J	**2,100**	**1,700**	**1,900**	**1,700**	**1,700**	**270**	**2,900**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	2.6 U	0.11 U	NA	NA	2.8	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	46,071	8,070	7,165	6,600	10,000	43.3	10,600	1,300	330 J	**51,800**	**58,000**	**57,000**	**50,000**	**65,000**	**59,000**	40,000	38.0	8,800
Xylenes	µg/L	5,160	162	8,919	2,200	2,500	33.0 J	4,060	2,600	1,700 J	**37,000**	**16,000**	**17,000**	**12,000**	**17,000**	**15,000**	**13,000**	45.0	4,700

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
B: Analyte was detected in the associated method blank.
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 22A - Groundwater Exceedances for GAA B Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health		Resource Restoration	COA-MWI-006	COA-MWI-007	COA-MWI-009	COA-MWI-011	COA-MWS-004	CP22-MWI	CP22-MWS		CP23-MWI	CP23-MWS		TS06-PPM008
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	11/12/2024	11/11/2024	11/11/2024	11/11/2024	6/5/2024	2/28/2020	2/28/2020	12/19/2024	3/13/2020	3/13/2020	12/19/2024	6/11/2015
Groundwater Zone:					Intermediate	Intermediate	Intermediate	Intermediate	Shallow	Intermediate	Shallow		Intermediate	Shallow		Shallow
Location:						Shoreline		Shoreline		Shoreline	Shoreline		Shoreline	Shoreline		Shoreline
1,1-Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	0.98 U	1.7	2.4	0.99 U	5.5	12.0	NA
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	NA	0.15	9.4	16.0	0.11	10.7	36.0	0.13 U
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	NA	0.098 U	0.24	0.34 J	0.099 U	0.098 U	2.0 U	0.21 U
Benzene	µg/L	1,701	6.93	55.3	**18,000**	1,300	940	680	**16,000**	1.0 U	78.8	55.0	1.0 U	55.3	51.0	7.30 J
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	NA	0.013 J	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.20 U
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	NA	0.098 U	0.032 J	2.0 U	0.099 U	0.098 U	2.0 U	0.20 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	NA	NA	NA	NA	NA	0.098 U	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.17 U
Ethylbenzene	µg/L	5,975	15.2	88.3	63.0 J	39.0	1.3 J	1.4 J	460	1.0 U	1.0	0.77 J	1.0 U	4.0 J	4.2	10.00 U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	NA	0.098 U	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.14 U
Naphthalene	µg/L	148	20.1	7.86	100 J	**1,900**	**900**	**830**	**3,700**	1.4	**424**	**440**	0.85	**898**	**880**	3.4 J
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	NA	2.5 U	2.5 U	10.0 U	2.5 U	2.5 U	10.0 U	0.2 U
Toluene	µg/L	46,071	8,070	7,165	1,200	950	140	110	9,200	1.0 U	6.3	6.5	1.0 U	33.5	35.0	2.9 J
Xylenes	µg/L	5,160	162	8,919	740	450	25.0	22.0	**5,500**	3.0 U	16.2	11.0	3.0 U	58.0	62.0	20.0 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
B: Analyte was detected in the associated method blank.
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 22B - Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO101-PZM	CO104-PZM	CO121-PZM			CO177-MWI	CO177-MWS	CO-178-MWI		CO178-MWS		CO179-MWI	CO179-MWS
				12/17/2020	12/16/2020	6/10/2015	10/8/2019	9/19/2024	9/27/2019	9/27/2019	10/14/2019	2/11/2025	10/11/2019	2/11/2025	10/2/2019	6/13/2023
			Groundwater Zone:	Shallow	Shallow	Shallow			Intermediate	Shallow	Intermediate	Intermediate	Shallow	Shallow	Intermediate	Shallow
			Location:	Shoreline	Shoreline	Shoreline			Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline
1,1-Biphenyl	µg/L	370	3,675	NA	NA	NA	NA	NA	NA	NA	NA	2 U	NA	4.0	NA	NA
2-Methylnaphthalene	µg/L	3,215	3,900	NA	NA	25.5	NA	NA	NA	NA	NA	0.05 J	NA	16	NA	NA
Benz[a]anthracene	µg/L	0.157	42.4	NA	NA	0.11 U	NA	NA	NA	NA	NA	0.05 U	NA	0.04 J	NA	NA
Benzene	µg/L	6,171	9,750	5,480	4.3	1,970	1,230	1,600	4,900	5,950	**40,800**	NA	**14,200**	NA	**28,500**	4,700
Benzo[a]pyrene	µg/L	0.0157	2.42	NA	NA	0.063 U	NA	NA	NA	NA	NA	0.1 U	NA	**0.05 J**	NA	NA
Benzo[b]fluoranthene	µg/L	0.157	7.26	NA	NA	0.17 U	NA	NA	NA	NA	NA	0.05 U	NA	0.10	NA	NA
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	NA	NA	0.11 U	NA	NA	NA	NA	NA	0.05 U	NA	NA	NA	NA
Ethylbenzene	µg/L	254,100	548	4.9	1.0 U	61.7	52.4	56.0	19.4	31.5	268	NA	242	NA	373	230
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	NA	NA	0.13 U	NA	NA	NA	NA	NA	0.1 U	NA	0.05 J	NA	NA
Naphthalene	µg/L	127	169	**179**	2.0 U	**324**	**2,010**	**1,800**	125	**161**	**1,270**	0.3	**1,500**	**510**	**6,280**	**1,200**
Pentachlorophenol	µg/L	363	593	NA	NA	0.11 U	NA	NA	NA	NA	NA	10 U	NA	NA	NA	NA
Toluene	µg/L	1,815,000	735	385	1.0 U	1,650	1,100	1,400	20	147	5,820	NA	7,920	NA	13,000	2,800
Xylenes	µg/L	1,134,880	5,025	64.8	3.0 U	642	597	660	125	220	1,870	NA	1,950	NA	2,990	2,300

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreational User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte was detected in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 22B - Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO180-MWI		CO180-MWS		CO181-MWI	CO181-MWS	CO198-MWS				CO199-MWS	CO200-MWS
				5/23/2023	2/11/2025	5/23/2023	2/11/2025	5/24/2023	5/24/2023	5/19/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019	9/30/2019
			Groundwater Zone:	Intermediate	Intermediate	Shallow	Shallow	Intermediate	Shallow	Shallow				Shallow	Shallow
			Location:	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline					Shoreline	Shoreline
1,1-Biphenyl	µg/L	370	3,675	NA	1.4 J	NA	1.9 J	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	3,215	3,900	NA	18	NA	24	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	0.157	42.4	NA	0.05	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	6,171	9,750	**18,000**	NA	**17,000**	NA	**23,000**	**21,000**	190	310	280	230	**34,200**	**34,100**
Benzo[a]pyrene	µg/L	0.0157	2.42	NA	**0.03 J**	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	0.157	7.26	NA	0.04 J	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	NA	**0.03 J**	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	254,100	548	78.0 J	NA	86.0	NA	120.0	130.0	1.7 J	10.0 U	2.6 J	1.8 J	71.7	44.1
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	NA	0.03 J	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	127	169	**880**	**610**	**1,200**	**700**	**1,800**	**1,700**	**1,300**	**1,900**	**1,700**	**1,600**	**12,200**	**1,130**
Pentachlorophenol	µg/L	363	593	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	1,815,000	735	3,900	NA	4,700	NA	5,500	6,300	42.0	79.0	72.0	55	2,650	2,840
Xylenes	µg/L	1,134,880	5,025	1,200	NA	1,500	NA	1,800	2,000	22.0 J	34.0 J	34.0	26 J	1,150	575

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreational User: **Bold**
Ecological: Blue

Acronyms:
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U: Not detected above the reporting limit
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B: Analyte was detected in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 22B - Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO201-MWS				CO202-MWS	CO209-MWI		CO209-MWS		CO210-MWI		CO210-MWS	
				5/31/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019	6/2/2023	12/18/2024	6/2/2023	12/18/2024	2/5/2020	12/20/2024	2/5/2020	12/18/2024
Groundwater Zone:				Shallow				Shallow	Intermediate		Shallow		Intermediate		Shallow	
Location:				Shoreline				Shoreline	Shoreline		Shoreline		Shoreline		Shoreline	
1,1-Biphenyl	µg/L	370	3,675	NA	NA	NA	NA	NA	NA	9.2	NA	18.0	NA	2.0 U	NA	8.2
2-Methylnaphthalene	µg/L	3,215	3,900	NA	NA	NA	NA	NA	NA	130	NA	85.0	NA	0.79	NA	32.0
Benz[a]anthracene	µg/L	0.157	42.4	NA	NA	NA	NA	NA	NA	2.0 U	NA	2.0 U	NA	0.05 U	NA	2.0 U
Benzene	µg/L	6,171	9,750	1,100	330	42.0	600	1,780	2,300	2,000	180	13.0	277	100	97.0	230
Benzo[a]pyrene	µg/L	0.0157	2.42	NA	NA	NA	NA	NA	NA	2.0 U	NA	2.0 U	NA	0.1 U	NA	2.0 U
Benzo[b]fluoranthene	µg/L	0.157	7.26	NA	NA	NA	NA	NA	NA	2.0 U	NA	2.0 U	NA	0.05 U	NA	2.0 U
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	NA	NA	NA	NA	NA	NA	2.0 U	NA	2.0 U	NA	0.05 U	NA	2.0 U
Ethylbenzene	µg/L	254,100	548	3.9 J	0.9 J	0.2 J	1.1 J	3.3	71.0	75.0	5.7 J	2.2 J	5.0 U	0.34 J	2.5 J	3.5 J
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	NA	NA	NA	NA	NA	NA	2.0 U	NA	2.0 U	NA	0.1 U	NA	2.0 U
Naphthalene	µg/L	127	169	**180**	44.0	11.0	74	**886**	**13,000**	**18,000**	**2,400**	**3,300**	**291**	46	**1,140**	**1,800**
Pentachlorophenol	µg/L	363	593	NA	NA	NA	NA	NA	NA	10.0 U	NA	10.0 U	NA	10.0 U	NA	10.0 U
Toluene	µg/L	1,815,000	735	79.0	6.9	2.0	27	134	340	5.1 J	170	7.0 J	11.4	1.0	20.9	44.0
Xylenes	µg/L	1,134,880	5,025	56.0	11.0 J	3.1	14 J	42.1	140 J	55.0	82.0 J	38.0	6.9 J	1.9 J	18.5	30.0

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreational User: **Bold**
Ecological: Blue

Acronyms:
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U: Not detected above the reporting limit
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B: Analyte was detected in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 22B - Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO27-PZM012					CO27-PZM046					CO28-PZM010	
				8/9/2023	11/13/2023	3/4/2024	8/13/2024	12/17/2024	8/9/2023	11/14/2023	3/4/2024	8/13/2024	12/17/2024	6/9/2015	5/24/2023
Groundwater Zone:				Shallow					Intermediate					Shallow	
Location:				Shoreline					Shoreline					Shoreline	
1,1-Biphenyl	µg/L	370	3,675	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	3,215	3,900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.30	NA
Benz[a]anthracene	µg/L	0.157	42.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.10 U	NA
Benzene	µg/L	6,171	9,750	5,500	**13,000**	**10,000**	**10,000**	**7,900**	**19,000**	**50,000**	**52,000**	**14,000**	**11,000**	**20,900**	0.19 J
Benzo[a]pyrene	µg/L	0.0157	2.42	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.06 U	NA
Benzo[b]fluoranthene	µg/L	0.157	7.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17 U	NA
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA
Ethylbenzene	µg/L	254,100	548	64.0	170	110	120	84	180	260	280	140	140	36.6	0.5 U
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13 U	NA
Naphthalene	µg/L	127	169	**470**	**1,100**	**760**	**570**	**450**	**910**	**1,000**	**750**	**700**	**840**	**627**	1.0 U
Pentachlorophenol	µg/L	363	593	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA
Toluene	µg/L	1,815,000	735	1,100	4,900	3,500	2,700	2,600	4,200	5,000	6,600	4,600	4,000	1,080	0.8 U
Xylenes	µg/L	1,134,880	5,025	480	1,400	940	920	700	1,400	1,600	1,800	1,200	1,200	436	1.0 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreational User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte was detected in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 22B - Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO28-PZM048		CO29-PZM010			CO29-PZM051		CO30-PZM015						
				6/9/2015	5/24/2023	6/10/2015	12/19/2019	12/18/2024	6/9/2015	12/19/2019	8/11/2023	11/8/2023	3/8/2024	6/6/2024	8/12/2024	11/20/2024	2/10/2025
Groundwater Zone:				Shallow		Shallow			Intermediate		Shallow						
Location:				Shoreline		Shoreline			Shoreline		Shoreline						
1,1-Biphenyl	µg/L	370	3,675	NA	NA	NA	NA	13.0	NA	NA	NA	NA	NA	NA	NA	NA	11
2-Methylnaphthalene	µg/L	3,215	3,900	30.1	NA	12.1	NA	22.0	0.18 U	NA	NA	NA	NA	NA	NA	NA	54
Benz[a]anthracene	µg/L	0.157	42.4	0.11 U	NA	0.11 U	NA	2.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.08
Benzene	µg/L	6,171	9,750	**291,000**	**93,000**	15.1 J	13.8	26.0	0.29 J	1.8	**56,000**	**40,000**	**34,000**	**32,000**	**23,000**	**38,000**	NA
Benzo[a]pyrene	µg/L	0.0157	2.42	0.063 U	NA	0.064 U	NA	2.0 U	0.062 U	NA	NA	NA	NA	NA	NA	NA	**0.04 J**
Benzo[b]fluoranthene	µg/L	0.157	7.26	0.17 U	NA	0.17 U	NA	2.0 U	0.16 U	NA	NA	NA	NA	NA	NA	NA	0.05
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	0.11 U	NA	0.11 U	NA	2.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.05 U
Ethylbenzene	µg/L	254,100	548	525	260 J	7.5 U	1.9	2.0	0.30 U	1.0 U	110.0 J	72.0 J	76.0 J	75.0 J	45.0 J	76.0 J	NA
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	0.13 U	NA	0.13 U	NA	2.0 U	0.13 U	NA	NA	NA	NA	NA	NA	NA	0.1 U
Naphthalene	µg/L	127	169	**1,250 B**	**1,600**	**193**	**573**	**700**	2.0	14.2	**2,300**	**2,000**	**2,100**	**1,800**	**1,400**	**1,800**	**3,300**
Pentachlorophenol	µg/L	363	593	0.11 U	NA	0.11 U	NA	10.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	10 U
Toluene	µg/L	1,815,000	735	34,300	1,900	6.5 U	5.2	7.4	0.26 U	0.4 J	4,000	3,000	2,700	2,600	1,900	3,200	NA
Xylenes	µg/L	1,134,880	5,025	6,610	4,800	16.5 U	14.7	15.0	0.66 U	3.0 U	1,300 J	920	910	950	510 J	990	NA

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreational User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte was detected in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 22B - Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO30-PZM060			CO36-PZM008	CO36-PZM043	CO37-PZM003			CO37-PZM038			CO43-PZM048	CO44-PZM048
				5/19/2023	6/6/2024	2/10/2025	8/10/2023	8/10/2023	8/8/2023	11/20/2023	3/12/2024	8/8/2023	11/20/2023	3/11/2024	6/30/2022	6/30/2022
Groundwater Zone:				Intermediate			Shallow	Intermediate	Shallow			Intermediate			Intermediate	Intermediate
Location:				Shoreline			Shoreline	Shoreline	Shoreline			Shoreline			Shoreline	Shoreline
1,1-Biphenyl	µg/L	370	3,675	NA	NA	2 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	3,215	3,900	NA	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	0.157	42.4	NA	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	6,171	9,750	7.5	99.0	NA	**15,000**	**16,000**	24.0	4,200	66.0	**12,000**	**12,000**	**17,000**	4,200	300
Benzo[a]pyrene	µg/L	0.0157	2.42	NA	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	0.157	7.26	NA	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	NA	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	254,100	548	0.5 U	0.3 J	NA	60.0	46.0 J	2.9	25.0	5.3	210	180	230	8.0 J	1.0 J
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	NA	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	127	169	1.0 U	5.3	0.2	**530**	**550**	9.1	**200**	75.0	**1,500**	**1,100**	**1,300**	39.0 J	7.2
Pentachlorophenol	µg/L	363	593	NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	1,815,000	735	0.8 U	6.7	NA	3,200	2,100	42.0	1,200	52.0	6,300	6,000	7,800	30.0 U	2.3
Xylenes	µg/L	1,134,880	5,025	1.0 U	3.3 J	NA	970	660	30.0	340.0	77.0	1,800	1,500	2,000	25.0 J	4.3 J

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreational User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte was detected in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 22B - Groundwater Exceedances for GAA B Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area B COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO45-PZM047	CO46-PZM047	CO47-PZM046	CO48-PZM044	COA-MWI-007	COA-MWI-011	CP22-MWI	CP22-MWS		CP23-MWI	CP23-MWS		TS06-PPM008
				6/30/2022	6/30/2022	6/30/2022	6/30/2022	11/11/2024	11/11/2024	2/28/2020	2/28/2020	12/19/2024	3/13/2020	3/13/2020	12/19/2024	6/11/2015
			Groundwater Zone:	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Shallow		Intermediate	Shallow		Shallow
			Location:	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline		Shoreline	Shoreline		Shoreline
1,1-Biphenyl	µg/L	370	3,675	NA	NA	NA	NA	NA	NA	0.98 U	1.7	2.4	0.99 U	5.5	12.0	NA
2-Methylnaphthalene	µg/L	3,215	3,900	NA	NA	NA	NA	NA	NA	0.15	9.4	16.0	0.11	10.7	36.0	0.13 U
Benz[a]anthracene	µg/L	0.157	42.4	NA	NA	NA	NA	NA	NA	0.098 U	**0.24**	**0.34 J**	0.099 U	0.098 U	2.0 U	0.21 U
Benzene	µg/L	6,171	9,750	85.0	**24,000**	**22,000**	**20,000**	1,300	680	1.0 U	78.8	55.0	1.0 U	55.3	51.0	7.30 J
Benzo[a]pyrene	µg/L	0.0157	2.42	NA	NA	NA	NA	NA	NA	0.013 J	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.20 U
Benzo[b]fluoranthene	µg/L	0.157	7.26	NA	NA	NA	NA	NA	NA	0.098 U	0.032 J	2.0 U	0.099 U	0.098 U	2.0 U	0.20 U
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	NA	NA	NA	NA	NA	NA	0.098 U	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.17 U
Ethylbenzene	µg/L	254,100	548	0.2 J	280	290	340	39.0	1.4 J	1.0 U	1.0	0.77 J	1.0 U	4.0 J	4.2	10.00 U
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	NA	NA	NA	NA	NA	NA	0.098 U	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.14 U
Naphthalene	µg/L	127	169	1.0	**820**	**990**	**1,200**	**1,900**	**830**	1.4	**424**	**440**	0.85	**898**	**880**	3.4 J
Pentachlorophenol	µg/L	363	593	NA	NA	NA	NA	NA	NA	2.5 U	2.5 U	10.0 U	2.5 U	2.5 U	10.0 U	0.2 U
Toluene	µg/L	1,815,000	735	0.2 J	6,500	6,600	10,000	950	110	1.0 U	6.3	6.5	1.0 U	33.5	35.0	2.9 J
Xylenes	µg/L	1,134,880	5,025	1.0 U	1,900.0	2,200	2,500	450	22.0	3.0 U	16.2	11.0	3.0 U	58.0	62.0	20.0 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreational User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte was detected in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 23A - Groundwater Exceedances for GAA C Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area C COCs	Units	Human Health / Non-Residential		Resource Restoration	B18-007-PZ	B18-044-PZ	B18-046-PZ	B18-061-PZ	B18-077-PZ	B18-078-PZ	B18-079-PZ	B18-080-PZ	B18-081-PZ
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	12/13/2016	11/30/2018	11/29/2018	12/13/2016	11/29/2018	11/30/2018	11/29/2018	11/28/2018	11/28/2018
Groundwater Zone:					Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
Location:													
1,1 -Biphenyl	µg/L	18.1	13.9	57.7	1.4	**30.3**	3.4	1 U	0.98 U	3.1	7.3	7.1	10.6
2-Methylnaphthalene	µg/L	670	-	80.5	11.5	582	66.3	0.028 J	0.098 U	16.5	138	85.9	206
4-Chloroaniline	µg/L	2,869	-	42.8	1 U	6.9 J	1.9	1 U	0.98 U	0.98 U	3.3	0.98 U	0.98 U
Benz[a]anthracene	µg/L	90.3	417	0.495	0.043 J	41.8	0.098 U	0.1 U	0.098 U	0.095 J	0.11	1.6	1.6
Benzene	µg/L	1,701	6.93	55.3	67.2	6.6	6.4	1 U	1 U	2.9	22	41.4	55.9
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.01 J	**24.2**	0.098 U	0.1 U	0.098 U	0.029 J	0.014 J	1.2	1.2
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.1 U	15.1	0.098 U	0.1 U	0.098 U	0.058 J	0.099 U	1.8	1.7
Benzo[k]fluoranthene	µg/L	639	-	3.41	0.1 U	12.2	0.098 U	0.1 U	0.098 U	0.047 J	0.099 U	0.61	0.53
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	1 U	9.8 U	0.98 U	1 U	0.3 J	0.98 U	0.99 U	0.25 J	0.98 U
Chrysene	µg/L	8,544	-	45.6	0.033 J	55.6	0.051 J	0.1 U	0.098 U	0.076 J	0.099 U	1.4	1.3
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.1 U	2.9 J	0.098 U	0.1 U	0.098 U	0.098 U	0.099 U	0.25	0.2
Ethylbenzene	µg/L	5,975	15.2	88.3	1.8	4.6	1.2	1 U	1 U	0.64 J	1.6	2.0	5.8
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.1 U	3.7 J	0.098 U	0.1 U	0.098 U	0.098 U	0.099 U	0.52	0.5
Naphthalene	µg/L	148	20.1	7.86	**411**	**159**	**314**	0.48	0.043 J	127	**1,310**	**587**	**2,520**
Pentachlorophenol	µg/L	85.3	-	0.45	0.75 J	24.5 U	2.5 U	2.5 U	2.5 U	1.1 J	1.5 J	0.98 J	1.1 J
Pyrene	µg/L	2,188	-	292	0.5	266	0.6	0.017 J	0.098 U	0.44	0.6	3.5	5.9
Xylenes	µg/L	5,160	162	8,919	29.3	16.8	23.6	3 U	3 U	10.1	33.8	41	102

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 23A - Groundwater Exceedances for GAA C Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area C COCs	Units	Human Health / Non-Residential		Resource Restoration	B18-082-PZ		B18-083-PZ		BA-81-7945		BA-81-7946		COA-MW-001	COA-MW-002	SW-085-MWS		SW-086-MWS	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	11/29/2018		11/28/2018		11/30/2018		11/29/2018		6/5/2024	6/5/2024	11/28/2018		11/28/2018	
Groundwater Zone:					Shallow		Shallow		Shallow		Shallow		Shallow	Shallow	Shallow		Shallow	
Location:															Shoreline		Shoreline	
1,1 -Biphenyl	µg/L	18.1	13.9	57.7	**44.4**	**J**	1	U	0.98	U	12.1	J	NA	NA	0.99	U	0.83	J
2-Methylnaphthalene	µg/L	670	-	80.5	508		0.15		0.098	U	228		NA	NA	92.4		281	
4-Chloroaniline	µg/L	2,869	-	42.8	46.9	J	1	U	0.98	U	48.8	U	NA	NA	0.99	U	0.98	U
Benz[a]anthracene	µg/L	90.3	417	0.495	0.28		0.1	U	0.098	U	0.28		NA	NA	6.0		0.59	
Benzene	µg/L	1,701	6.93	55.3	**2,440**		1	U	1	U	91.5		**3,500**	66	8.2		25.3	
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.16		0.1	U	0.015	U	0.098		NA	NA	5.2		0.32	
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.48		0.1	U	0.098	U	0.17		NA	NA	7.5		0.54	
Benzo[k]fluoranthene	µg/L	639	-	3.41	0.39		0.1	U	0.098	U	0.14		NA	NA	6.0		0.44	
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	49	U	0.2	J	0.98	U	48.8	U	NA	NA	0.39	J	0.98	U
Chrysene	µg/L	8,544	-	45.6	0.3		0.1	U	0.098	U	0.19		NA	NA	4.6		0.46	
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.098	U	0.1	U	0.098	U	0.098	U	NA	NA	0.52		0.028	J
Ethylbenzene	µg/L	5,975	15.2	88.3	149		1	U	1	U	7.9		210	1.1	2.2		3.5	
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.075	J	0.1	U	0.098	U	0.098	U	NA	NA	1.2		0.13	
Naphthalene	µg/L	148	20.1	7.86	**15,300**		0.63		0.067	J	**3,860**		**13,000**	**230**	90.4		**625**	
Pentachlorophenol	µg/L	85.3	-	0.45	123	U	2.6	U	2.5	U	122	U	NA	NA	2.5	U	2.5	U
Pyrene	µg/L	2,188	-	292	1.1		0.1	U	0.098	U	2.2		NA	NA	18.2		3.6	
Xylenes	µg/L	5,160	162	8,919	2,010		3	U	3	U	97.2		2,100	15	6.6		10.1	

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 23A - Groundwater Exceedances for GAA C Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area C COCs	Units	Human Health / Non-Residential		Resource Restoration	SW13-PZM003		SW13-PZM025		SW13-PZM111	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	3/28/2016		2/19/2016		12/9/2015	
				Groundwater Zone:	Shallow		Intermediate		Deep	
				Location:						
1,1 -Biphenyl	µg/L	18.1	13.9	57.7	1.2		1	U	1	U
2-Methylnaphthalene	µg/L	670	-	80.5	12.2		0.1	U	0.1	
4-Chloroaniline	µg/L	2,869	-	42.8	1	U	1	U	1	UJ
Benz[a]anthracene	µg/L	90.3	417	0.495	0.33		0.1	U	0.1	U
Benzene	µg/L	1,701	6.93	55.3	20.4		1	U	1	U
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.04	J	0.1	U	0.1	U
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.11		0.1	U	0.1	U
Benzo[k]fluoranthene	µg/L	639	-	3.41	0.11		0.1	U	0.1	U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	1	U	1	UJ	1.1	
Chrysene	µg/L	8,544	-	45.6	0.29		0.1	U	0.1	U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.1	U	0.1	U	0.1	U
Ethylbenzene	µg/L	5,975	15.2	88.3	2.0		1	U	1	U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.1	U	0.1	U	0.1	U
Naphthalene	µg/L	148	20.1	7.86	**169**		0.1	U	0.14	
Pentachlorophenol	µg/L	85.3	-	0.45	2.5	U	2.5	U	2.5	U
Pyrene	µg/L	2,188	-	292	2.4		0.1	U	0.029	J
Xylenes	µg/L	5,160	162	8,919	47.7		3	U	3	U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Table 23B - Groundwater Exceedances for GAA C Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area C COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	SW-085-MWS		SW-086-MWS	
				11/28/2018		11/28/2018	
			Groundwater Zone:	Shallow		Shallow	
			Location:	Shoreline		Shoreline	
1,1 -Biphenyl	µg/L	370	3,675	0.99	U	0.83	J
2-Methylnaphthalene	µg/L	3,215	3,900	92.4		281	
4-Chloroaniline	µg/L	926	60.0	0.99	U	0.98	U
Benz[a]anthracene	µg/L	0.157	42.4	**6.0**		**0.59**	
Benzene	µg/L	6,171	9,750	8.2		25.3	
Benzo[a]pyrene	µg/L	0.0157	2.42	**5.2**		**0.32**	
Benzo[b]fluoranthene	µg/L	0.157	7.26	**7.5**		**0.54**	
Benzo[k]fluoranthene	µg/L	1.57	7.26	**6.0**		0.44	
Bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	0.39	J	0.98	U
Chrysene	µg/L	2.18	42.4	**4.6**		0.46	
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	**0.52**		**0.028**	**J**
Ethylbenzene	µg/L	254,100	548	2.2		3.5	
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	**1.2**		0.13	
Naphthalene	µg/L	127	169	90.4		**625**	
Pentachlorophenol	µg/L	363	593	2.5	U	2.5	U
Pyrene	µg/L	3,630	13.3	18.2		3.6	
Xylenes	µg/L	1,134,880	5,025	6.6		10.1	

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 24A - Groundwater Exceedances for GAA D Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area D COCs	Units	Human Health (Off-Site Recreational User)		Resource Restoration	B18-070-PZ	B18-071-PZ	B18-072-PZ	B18-074-PZ	B18-075-PZ	B18-076-PZ	CO04-PZM048		CO05A-PZM	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	12/14/2016	12/14/2016	12/14/2016	12/14/2016	12/14/2016	12/13/2016	6/10/2015	3/10/2020	5/19/2021	11/5/2024
Groundwater Zone:					Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Intermediate		Shallow	
Location:														
1,1 -Biphenyl	µg/L	18.1	13.9	57.7	1.00 U	1.00 U	1.00 U	0.49 J	1.00 U	1.00 U	NA	NA	NA	**28.0**
2-Methylnaphthalene	µg/L	670	-	80.5	0.30 J	0.10 UJ	0.10 U	3.50	0.21	0.10 U	0.18 U	NA	506 J	350
Benz[a]anthracene	µg/L	90.3	417	0.495	0.063 B	0.026 B	0.10 U	0.067 B	0.07 J	0.034 B	0.48 J	NA	94.8 U	5.00 U
Benzene	µg/L	1,701	6.93	55.3	0.55 J	1.00 U	1.00 U	2.80	1.00 U	1.00 U	NA	4.30 J	1,330	1,200
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.013 J	0.014 J	0.10 U	0.049 J	0.024 J	0.0093 J	0.063 U	NA	2.50	10.0 U
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.018 J	0.10 U	0.10 U	0.031 J	0.028 J	0.10 U	0.26 J	NA	2.10	5.0 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	1.00 U	0.59 J	1.00 U	1.00 J	1.00 U	0.22 J	0.22 J	NA	NA	3.0 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.11 U	NA	0.33	5.0 U
Ethylbenzene	µg/L	5,975	15.2	88.3	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NA	5.00 U	71.8	53.0
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.10 UJ	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.13 U	NA	1.20	10.0 U
Naphthalene	µg/L	148	20.1	7.86	0.13	0.019 B	0.064 B	3.00	1.60	0.049 B	0.19 U	8.80 J	**16,600**	**8,700**
Pentachlorophenol	µg/L	85.3	-	0.45	2.50 U	2.50 U	0.74 J	2.50 U	2.50 U	2.60 U	NA	NA	NA	10.0 U
Xylenes	µg/L	5,160	162	8,919	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	NA	15.00 U	1,080	600

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 24A - Groundwater Exceedances for GAA D Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area D COCs	Units	Human Health (Off-Site Recreational User)		Resource Restoration	CO05B-PZM	CO05C-PZM	CO05-PZM006	CO10-PZM006	CO20-PZM004	CO212A-PZM	CO216-MWS	SW-030-MWS	SW14-PZM004
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	5/20/2021	5/19/2021	6/10/2015	6/11/2015	6/10/2015	5/20/2021	4/10/2020	2/1/2016	3/31/2016
				Groundwater Zone:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
				Location:				Shoreline					
1,1 -Biphenyl	µg/L	18.1	13.9	57.7	NA	NA	NA	NA	NA	NA	NA	1.00 U	2.20
2-Methylnaphthalene	µg/L	670	-	80.5	236 J	9.40 UJ	63.8	0.18 U	12.10	0.055 J	NA	0.10 U	12.80 J
Benz[a]anthracene	µg/L	90.3	417	0.495	11.0 J	0.58	0.57 J	0.11 U	0.53 J	0.094 U	NA	0.10 U	0.33
Benzene	µg/L	1,701	6.93	55.3	**2,550**	3.80	**1,850**	0.32 J	70.9	1.00 U	53.4	1.00 U	1.00 U
Benzo[a]pyrene	µg/L	6.21	-	0.033	5.80 J	0.47	0.27 J	0.06 U	0.064 U	0.094 U	NA	0.10 U	0.035 J
Benzo[b]fluoranthene	µg/L	105	-	0.56	5.90 J	0.43	0.54 J	0.17 U	0.19 J	0.094 U	NA	0.10 U	0.089 J
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	NA	NA	0.29 J	0.13 U	0.13 U	NA	NA	1.00 U	1.00 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.035	0.68 J	0.067	1.00 U	0.11 U	0.11 U	0.066 U	NA	0.10 U	0.10 U
Ethylbenzene	µg/L	5,975	15.2	88.3	163	1.00	109	0.30 U	7.5 U	1.00 U	2.40 J	1.00 U	1.00 U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	2.60	0.28	1.00 U	0.13 U	0.13 U	0.094 U	NA	0.10 U	0.10 U
Naphthalene	µg/L	148	20.1	7.86	**12,500**	7.40 J	**2,810**	1.90	**231 B**	1.20	**2,850**	0.027 B	49.5
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	2.60 U	0.11 U	2.60 U	NA	NA	2.60 U	2.60 U
Xylenes	µg/L	5,160	162	8,919	296	3.00 U	483	0.66 U	16.5 U	3.00 U	10.30 J	3.00 U	3.00 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
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B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 24B - Groundwater Exceedances for GAA D Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area D COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO10-PZM006	
				6/11/2015	
			Groundwater Zone:	Shallow	
			Location:	Shoreline	
1,1 -Biphenyl	µg/L	370	3,675	NA	
2-Methylnaphthalene	µg/L	3,215	3,900	1.00	U
4-Chloroaniline	µg/L	926	60.0	NA	
Benz[a]anthracene	µg/L	0.157	42.4	1.00	U
Benzene	µg/L	6,171	9,750	0.32	J
Benzo[a]pyrene	µg/L	0.0157	2.42	1.00	U
Benzo[b]fluoranthene	µg/L	0.157	7.26	1.00	U
Bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	1.00	U
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	1.00	U
Ethylbenzene	µg/L	254,100	548	1.00	U
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	1.00	U
Naphthalene	µg/L	127	169	1.90	
Pentachlorophenol	µg/L	363	593	2.60	U
Xylenes	µg/L	1,134,880	5,025	2.00	U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO203-MWS		CO204-MWS	CO205-MWS	CO206R-MWS				CO207-MWS	CO208-MWS
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	7/25/2023	2/10/2025	5/18/2023	7/25/2023	2/15/2024	6/7/2024	8/20/2024	11/4/2024	7/26/2023	10/10/2019
Groundwater Zone:					Shallow		Shallow	Shallow	Shallow				Shallow	Shallow
Location:					Shoreline			Shoreline					Shoreline	Shoreline
2-Methylnaphthalene	µg/L	670	-	80.5	NA	91	NA	NA	NA	NA	NA	82	NA	NA
Benzene	µg/L	1,701	6.93	55.3	380	NA	760	380	140	230	260	440	200	202
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	0.16	NA	NA	NA	NA	NA	0.35	NA	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	0.04 J	NA	NA	NA	NA	NA	0.14	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	0.07	NA	NA	NA	NA	NA	0.17	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	NA	3 U	NA	NA	NA	NA	NA	3 U	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	9.8 J	NA	17 J	10	7.9	8.5 J	10	14	9.7	9.9
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	0.1 U	NA	NA	NA	NA	NA	0.11	NA	NA
Naphthalene	µg/L	148	20.1	7.86	4,600	2,900	6,900	2,400	2,900	2,300	1,800	1,800	1,600	1,390
Pentachlorophenol	µg/L	85.3	-	0.45	NA	10 U	NA	NA	NA	NA	NA	10 U	NA	NA
Xylenes	µg/L	5,160	162	8,919	210	NA	440	230	200	190	210	330	180	153

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO23-PZM008							CO24-PZM007						
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/10/2015	8/15/2023	11/15/2023	3/5/2024	6/7/2024	8/20/2024	11/19/2024	6/10/2015	8/15/2023	11/15/2023	3/11/2024	6/7/2024	8/20/2024	11/19/2024
Groundwater Zone:					Shallow							Shallow						
Location:																		
2-Methylnaphthalene	µg/L	670	-	80.5	27.5	NA	NA	NA	NA	NA	NA	86.8	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	NA	320	320	410	840	390	380	NA	3.9 J	7.7	3.5 J	1,700	3.2 J	3.8 J
Benz[a]anthracene	µg/L	90.3	417	0.495	0.32 J	NA	NA	NA	NA	NA	NA	2.5	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.063 U	NA	NA	NA	NA	NA	NA	2.0	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.3 J	NA	NA	NA	NA	NA	NA	3.8	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	1.5	NA	NA	NA	NA	NA	NA	0.68 J	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	NA	20	16	24	24	21	21	NA	4.2 J	7	2.5 J	14	3.2 J	2.9 J
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.13 U	NA	NA	NA	NA	NA	NA	0.58 J	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**886**	**2,900**	**2,600**	**3,200**	**3,800**	**3,200**	**3,200**	**1,220**	**2,000**	**2,000**	**1,600**	**1,200**	**1,400**	**1,800**
Pentachlorophenol	µg/L	85.3	-	0.45	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Xylenes	µg/L	5,160	162	8,919	NA	320	270	390	420	360	350	NA	20 U	14	10 U	250	3.4 J	10 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
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U: Not detected above the reporting limit
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NA: Not Analyzed

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO25-PZM008						CO26-PZM007							CO26-PZM032	
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	5/18/2023	11/28/2023	3/5/2024	6/7/2024	8/20/2024	11/19/2024	6/10/2015	8/14/2023	11/15/2023	3/5/2024	6/7/2024	8/14/2024	11/20/2024	6/10/2015	8/3/2022
Groundwater Zone:											Shallow							Intermediate	
Location:											Shoreline							Shoreline	
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	NA	NA	80.1	NA	NA	NA	NA	NA	NA	0.18 U	NA
Benzene	µg/L	1,701	6.93	55.3	1400	1000	950	830	1100	980	NA	120	240	39	210	160	210	NA	0.5 U
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	NA	NA	0.062 U	NA	NA	NA	NA	NA	NA	0.062 U	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	NA	NA	0.17 U	NA	NA	NA	NA	NA	NA	0.16 U	NA
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	0.21 J	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	32 J	25 J	28 J	24 J	36 J	32 J	NA	1.8	4.4	1.6 J	7.9 J	3.7 J	5.7	NA	0.5 U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	0.13 U	NA
Naphthalene	µg/L	148	20.1	7.86	**15,000**	**14,000**	**17,000**	**14,000**	**13,000**	**15,000**	**400**	**400**	**660**	**400**	**2,600**	**800**	**1,200**	0.93 J	1 U
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	NA	NA	1.9 J	NA	NA	NA	NA	NA	NA	0.11 U	NA
Xylenes	µg/L	5,160	162	8,919	830	640	680	640	920	810	NA	38	93	36	190	79	120	NA	1 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
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NA: Not Analyzed

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO34-PZM048	CO35-PZM013		CO35-PZM056		CO55-PZM000					
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/10/2015	6/11/2015	7/26/2023	6/11/2015	3/12/2020	8/10/2023	11/16/2023	3/8/2024	6/7/2024	8/15/2024	11/20/2024
Groundwater Zone:					Intermediate	Shallow		Intermediate		Shallow					
Location:						Shoreline		Shoreline							
2-Methylnaphthalene	µg/L	670	-	80.5	0.18 U	9.0	NA	0.29 J	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	0.25 U	109	110	21.2	37.6	2.8	48	0.5 U	6.6	1.4	65
Benz[a]anthracene	µg/L	90.3	417	0.495	0.11 U	0.11 U	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	0.063 U	0.063 U	NA	0.063 U	0.014 J	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	0.17 U	0.17 U	NA	0.16 U	0.097 U	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	0.29 J	0.27 J	NA	0.13 U	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	0.3 U	2.8 J	2.8	6.3	3.6	0.17 J	1.1	0.5 U	0.3 J	0.5 U	1.6
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	0.13 U	0.13 U	NA	0.13 U	0.097 U	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	0.56 J	**210**	**420**	6.6 B	29.2	12	130	1 U	24	1.2	130
Pentachlorophenol	µg/L	85.3	-	0.45	0.11 U	0.42 J	NA	0.11 U	2.4 U	NA	NA	NA	NA	NA	NA
Xylenes	µg/L	5,160	162	8,919	0.66 U	38.4	38	70.1	36.9	1.9 J	16	1 U	2.9 J	0.42 J	21

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
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U: Not detected above the reporting limit
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B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO56-PZP001						CO57-PZP002						
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	8/10/2023	11/15/2023	3/5/2024	6/7/2024	8/14/2024	11/20/2024	6/10/2015	8/14/2023	11/16/2023	3/8/2024	6/7/2024	8/19/2024	11/19/2024
Groundwater Zone:					Shallow						Shallow						
Location:																	
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	NA	NA	0.3 J	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	160	230	100	94	94	120	NA	0.16 J	0.32 J	0.5 U	270	0.26 J	1.8
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	NA	NA	0.063 U	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	NA	NA	0.17 U	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	8	7.5 J	6.8	5.4	4.8 J	5.4	NA	0.5 U	0.5 U	0.5 U	6.3	0.5 U	0.5 U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**1,900**	**1,900**	**1,700**	**1,200**	**1,200**	**1,600**	4.9	1 U	1 U	1 U	**220**	0.62 J	0.64 J
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Xylenes	µg/L	5,160	162	8,919	170	170	150	110	110	110	NA	1 U	1 U	1 U	130	1 U	0.42 J

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO58-PZM001							CO59-PZP002							CO60-PZP001
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	8/14/2023	11/14/2023	3/5/2024	6/7/2024	8/15/2024	11/20/2024	2/11/2025	6/10/2015	8/10/2023	11/16/2023	3/11/2024	6/7/2024	8/19/2024	11/19/2024	5/12/2022
Groundwater Zone:					Shallow							Shallow							Shallow
Location:					Shoreline														Shoreline
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	NA	NA	36	23.7	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	110	70	36	33	29	150	NA	NA	2.5	5.9	0.5 U	300	0.19 J	14	57.2
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	NA	NA	0.05 J	0.11 U	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	NA	NA	0.1 U	0.063 U	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	NA	NA	0.05 U	0.16 U	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	NA	NA	NA	NA	NA	NA	2.4 JB	0.24 J	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	5.4	2.8	3.0	1.5	1.2	8.0	NA	NA	1.3	0.46 J	0.5 U	5.1	0.5 U	1.0	2.2
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	NA	NA	0.1 U	0.13 U	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**850**	**380**	**220**	**230**	**170**	**1,700**	**1,100**	**642**	5.7	24	1 U	130	0.9 J	77	**360**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	NA	NA	10 U	0.11 U	NA	NA	NA	NA	NA	NA	NA
Xylenes	µg/L	5,160	162	8,919	84	44	27	21	23	140	NA	NA	7.4	5.4	1 U	110	1 U	15	40.1

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO61-PZM007	CO62-PZM007	CO63-PZM007		CO64-PZM006		CO65-PZM005		CO66-PZM005		CO67-PZM006		CO68-PZM005		CO69-PZM005
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/22/2023	6/22/2023	6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023
Groundwater Zone:					Shallow	Shallow	Shallow		Shallow		Shallow		Shallow		Shallow		Shallow		Shallow
Location:																			
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	µg/L	1,701	6.93	55.3	380	200	260	350	260	350	250	360	250	370	250	220	120	170	220
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	5,975	15.2	88.3	28 J	10	13	17	12	17 J	12	17 J	12	21	10 J	11 J	4.7	8.8	8.1
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	148	20.1	7.86	**12,000**	**2,100**	**3,200**	**4,600**	**2,900**	**6,600**	**2,900**	**7,800**	**3,400**	**8,500**	**3,400**	**4,700**	**810**	**2,300**	**1,500**
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylenes	µg/L	5,160	162	8,919	730	170	260	400	250	380	240	410	260	580	250	260	110	200	170

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 25A - Groundwater Exceedances for GAA E Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health / Non-Residential		Resource Restoration	CO70-PZM005	CO71-PZM006	CO72-PZM005	CP17-MWI	CP17-PZM013	CP26-MWI	CP26-MWS	CT-037-GW-12.5	CT-037-GW-41	SW18-PZM008	SW18-PZM053
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	6/22/2023	6/22/2023	6/22/2023	3/13/2020	3/16/2020	3/11/2020	3/11/2020	2/6/2024	2/6/2024	3/19/2020	3/12/2020
Groundwater Zone:					Shallow	Shallow	Shallow	Intermediate	Shallow	Intermediate	Shallow	Shallow	Intermediate	Shallow	Intermediate
Location:								Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline		
2-Methylnaphthalene	µg/L	670	-	80.5	NA	NA	NA	0.061 J	4.9	NA	1	NA	NA	4.6 J	0.049 J
Benzene	µg/L	1,701	6.93	55.3	0.76	0.5 U	300	1 U	22.5	0.83 J	59.9	280	320	24.8	1.3
Benz[a]anthracene	µg/L	90.3	417	0.495	NA	NA	NA	0.098 U	0.099 U	0.057	0.069 J	NA	NA	0.097 U	0.099 U
Benzo[a]pyrene	µg/L	6.21	-	0.033	NA	NA	NA	0.098 U	0.099 U	0.074 J	0.11	NA	NA	0.097 U	0.099 U
Benzo[b]fluoranthene	µg/L	105	-	0.56	NA	NA	NA	0.098 U	0.099 U	0.087 J	0.13	NA	NA	0.097 U	0.099 U
bis(2-Ethylhexyl)phthalate	µg/L	57.00	-	0.760	NA	NA	NA	0.98 U	0.99 U	0.97 U	0.98 U	NA	NA	0.97 U	0.99 U
Ethylbenzene	µg/L	5,975	15.2	88.3	0.5 U	0.5 U	10 J	1 U	1.8	1 U	0.72 J	9.3	10	1.1	1 U
Indeno[1,2,3-c,d]pyrene	µg/L	52.3	-	0.28	NA	NA	NA	0.098 U	0.097 U	0.045 J	0.061 J	NA	NA	0.097 U	0.099 U
Naphthalene	µg/L	148	20.1	7.86	1	1 U	**2,900**	0.15	**193**	2.1	70.5	**1,600**	**2,600**	**253**	1.5
Pentachlorophenol	µg/L	85.3	-	0.45	NA	NA	NA	2.5 U	2.5 U	2.4 U	2.4 U	NA	NA	2.4 U	2.5 U
Xylenes	µg/L	5,160	162	8,919	1 U	1 U	230	3 U	21.3	3 U	5.5	190	230	10.7	3 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Table 25B - Groundwater Exceedances for GAA E Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO203-MWS		CO205-MWS	CO207-MWS	CO208-MWS	CO26-PZM007							CO26-PZM032	
				7/25/2023	2/10/2025	7/25/2023	7/26/2023	10/10/2019	6/10/2015	8/14/2023	11/15/2023	3/5/2024	6/7/2024	8/14/2024	11/20/2024	6/10/2015	8/3/2022
Groundwater Zone:				Shallow		Shallow	Shallow	Shallow	Shallow							Intermediate	
Location:				Shoreline		Shoreline	Shoreline	Shoreline	Shoreline							Shoreline	
2-Methylnaphthalene	µg/L	3,215	3,900	NA	91	NA	NA	NA	80.1	NA	NA	NA	NA	NA	NA	0.18 U	NA
Benzene	µg/L	6,171	9,750	380	NA	380	200	202	NA	120	240	39	210	160	210	NA	0.5 U
Benz[a]anthracene	µg/L	0.157	42.35	NA	**0.16**	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA
Benzo[a]pyrene	µg/L	0.0157	2.42	NA	**0.04 J**	NA	NA	NA	0.062 U	NA	NA	NA	NA	NA	NA	0.062 U	NA
Benzo[b]fluoranthene	µg/L	0.157	7.26	NA	0.07	NA	NA	NA	0.17 U	NA	NA	NA	NA	NA	NA	0.16 U	NA
bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	0.21 J	NA
Ethylbenzene	µg/L	254,100	548	9.8 J	NA	10	9.7	9.9	NA	1.8	4.4	1.6 J	7.9 J	3.7 J	5.7	NA	0.5 U
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	NA	0.1 U	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	0.13 U	NA
Naphthalene	µg/L	127	169	**4,600**	**2,900**	**2,400**	**1,600**	**1,390**	**400**	**400**	**660**	**400**	**2,600**	**800**	**1,200**	0.93 J	1 U
Pentachlorophenol	µg/L	363	593	NA	10 U	NA	NA	NA	1.9 J	NA	NA	NA	NA	NA	NA	0.11 U	NA
Xylenes	µg/L	1,134,880	5,025	210	NA	230	180	153	NA	38	93	36	190	79	120	NA	1 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 25B - Groundwater Exceedances for GAA E Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CO35-PZM013		CO35-PZM056		CO58-PZM001							CO60-PZP001	CP17-MWI
				6/10/2015	7/26/2023	6/11/2015	3/12/2020	8/14/2023	11/14/2023	3/5/2024	6/7/2024	8/15/2024	11/20/2024	2/11/2025	5/12/2022	3/13/2020
Groundwater Zone:				Shallow		Intermediate									Shallow	Intermediate
Location:				Shoreline		Shoreline									Shoreline	Shoreline
2-Methylnaphthalene	µg/L	3,215	3,900	9.0	NA	0.29 J	NA	NA	NA	NA	NA	NA	NA	36	NA	NA
Benzene	µg/L	6,171	9,750	109	110	21.2	37.6	110	70	36	33	29	150	NA	57.2	1 U
Benz[a]anthracene	µg/L	0.157	42.35	0.11 U	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.05 J	NA	NA
Benzo[a]pyrene	µg/L	0.0157	2.42	0.063 U	NA	0.063 U	0.014 J	NA	NA	NA	NA	NA	NA	0.1 U	NA	0.098 U
Benzo[b]fluoranthene	µg/L	0.157	7.26	0.17 U	NA	0.16 U	0.097 U	NA	NA	NA	NA	NA	NA	0.05 U	NA	0.098 U
bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	0.27 J	NA	0.13 U	NA	NA	NA	NA	NA	NA	NA	2.4 JB	NA	NA
Ethylbenzene	µg/L	254,100	548	2.8 J	2.8	6.3	3.6	5.4	2.8	3	1.5	1.2	8	NA	2.2	1 U
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	0.13 U	NA	0.13 U	0.097 U	NA	NA	NA	NA	NA	NA	0.1 U	NA	0.098 U
Naphthalene	µg/L	127	169	**210**	**420**	6.6 B	29.2	**850**	**380**	**220**	**230**	**170**	**1,700**	**1,100**	**360**	0.15
Pentachlorophenol	µg/L	363	593	0.42 J	NA	0.11 U	2.4 U	NA	NA	NA	NA	NA	NA	10 U	NA	2.5 U
Xylenes	µg/L	1,134,880	5,025	38.4	38	70.1	36.9	84	44	27	21	23	140	NA	40.1	3 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 25B - Groundwater Exceedances for GAA E Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CP17-PZM013	CP26-MWI	CP26-MWS	CT-037-GW-12.5	CT-037-GW-41
				3/16/2020	3/11/2020	3/11/2020	2/6/2024	2/6/2024
			Groundwater Zone:	Shallow	Intermediate	Shallow	Shallow	Intermediate
			Location:	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline
2-Methylnaphthalene	µg/L	3,215	3,900	NA	NA	NA	NA	NA
Benzene	µg/L	6,171	9,750	22.5	0.83 J	59.9	280	320
Benz[a]anthracene	µg/L	0.157	42.35	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.0157	2.42	0.099 U	**0.074 J**	**0.11**	NA	NA
Benzo[b]fluoranthene	µg/L	0.157	7.26	0.099 U	0.087 J	0.13	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	NA	NA	NA	NA	NA
Ethylbenzene	µg/L	254,100	548	1.8	1 U	0.72 J	9.3	10
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	1.45	0.097 U	0.045 J	0.061 J	NA	NA
Naphthalene	µg/L	127	169	**193**	2.1	70.5	**1,600**	**2,600**
Pentachlorophenol	µg/L	363	593	2.5 U	2.4 U	2.4 U	NA	NA
Xylenes	µg/L	1,134,880	5,025	21.3	3 U	5.5	190	230

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 26A - Groundwater Exceedances for GAA F Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Units	Human Health / Non-Residential		Resource Restoration	CP02-PZM007				CP02-PZM026				CP07-PZM006			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/19/2023	10/17/2023	5/16/2024	10/9/2024	4/19/2023	10/17/2023	5/16/2024	10/9/2024	4/24/2023	10/23/2023	5/20/2024	10/11/2024
Groundwater Zone:					Shallow				Intermediate				Shallow			
Location:																
Benzene	µg/L	1,701	6.93	55	0.28 J	0.5 U	0.26 J	0.16 J	0.5 U	0.5 U	0.5 U	0.5 U	390	400	390	360
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.1 U	0.1 U	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U	0.04 J	0.1 U	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.06	0.05 U	0.05 U	0.05 U	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	3.2	2.7	2.3	3.3
Naphthalene	µg/L	148	20.1	7.86	0.07 J	0.1 U	1.7	0.06 J	0.1 U	0.1 U	0.1 U	0.1 U	56	53	62	93
Pentachlorophenol	µg/L	85.3	-	0.45	0.1 U	10 U	10 U	10 U	0.1 U	10 U	10 U	10 U	0.3	10 U	10 U	10 U
Xylenes	µg/L	5,160	162	8,919	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	36	28	24	34

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 26A - Groundwater Exceedances for GAA F Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Units	Human Health / Non-Residential		Resource Restoration	CP08R-PZM008				CP08R-PZM034				CP12-PZM012			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/25/2023	10/18/2023	5/22/2024	10/9/2024	4/25/2023	10/18/2023	5/22/2024	10/9/2024	4/17/2023	10/23/2023	5/22/2024	10/3/2024
Groundwater Zone:					Shallow				Intermediate				Shallow			
Location:													Shoreline			
Benzene	µg/L	1,701	6.93	55	**2,100**	1,500	**2,700**	1,000	1.9	12	3.2	12	2.4	17	12	0.5 U
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.03 J	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	27	46	29	16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 J	0.26 J	0.5 U
Naphthalene	µg/L	148	20.1	7.86	68	77	56	33	0.4	0.31	0.48	0.41	3.0	8.9	2.6	0.1 U
Pentachlorophenol	µg/L	85.3	-	0.45	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U
Xylenes	µg/L	5,160	162	8,919	580	880	680	320	1.9 J	0.87 J	1.2	0.72 J	0.48 J	3.7	2.9	1 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 26A - Groundwater Exceedances for GAA F Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Units	Human Health / Non-Residential		Resource Restoration	CP12-PZM052				CP14-PZM009				CP14-PZM062			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/17/2023	10/23/2023	5/22/2024	10/4/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024
Groundwater Zone:					Intermediate				Shallow				Intermediate			
Location:					Shoreline				Shoreline				Shoreline			
Benzene	µg/L	1,701	6.93	55	0.5 U	0.5 U	0.5 U	6.5	45	62	64	50	0.5 U	0.5 U	0.5 U	0.5 U
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	0.5 U	0.5 U	0.5 U	0.2 J	0.56	0.77 J	0.75	0.67	0.5 U	0.5 U	0.5 U	0.5 U
Naphthalene	µg/L	148	20.1	7.86	0.1 U	0.07 J	0.09 J	9.5	13	16	20	23	0.2	0.11	0.07 J	0.17
Pentachlorophenol	µg/L	85.3	-	0.45	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U	10 U	10 U	0.1 U	10 U	10 U	10 U
Xylenes	µg/L	5,160	162	8,919	1 U	1 U	1 U	2.3 J	3.1	5.1 J	4.6	4.6	1 U	1 U	1 U	1 U

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 26A - Groundwater Exceedances for GAA F Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Units	Human Health / Non-Residential		Resource Restoration	CP16-PZM008				CP16-PZM035				CP18R-PZM009			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/19/2023	10/13/2023	5/16/2024	10/4/2024	4/19/2023	10/13/2023	5/16/2024	10/7/2024	4/25/2023	10/19/2023	5/22/2024	10/7/2024
Groundwater Zone:					Shallow				Intermediate				Shallow			
Location:					Shoreline				Shoreline							
Benzene	µg/L	1,701	6.93	55	77	98	57	82	170	170	180	110	660	180	140	260
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	3 U	3 U	3 U	3 U	3 U	1.6 J	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	0.56	0.64	0.46 J	0.59	0.83	0.86	0.85	0.67	4.4	2.0	1.7	2.2
Naphthalene	µg/L	148	20.1	7.86	8.6	13	7.6	8.6	70	84	63	21	32	14	10	15
Pentachlorophenol	µg/L	85.3	-	0.45	0.07 J	10 U	10 U	10 U	0.1 U	10 U	10 U	10 U	0.1 U	10 U	0.11	10 U
Xylenes	µg/L	5,160	162	8,919	4.9	5.9	4.2	5.8	7.0	7.2	7.2	5.6	42	18	16	21

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 26A - Groundwater Exceedances for GAA F Contaminants of Concern (Sitewide)
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Units	Human Health / Non-Residential		Resource Restoration	CP19R-PZM008				CP20-PZM011					CP21-PZM004			
		On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/24/2023	10/17/2023	5/20/2024	10/11/2024	4/24/2023	10/19/2023	5/22/2024	10/11/2024	11/4/2024	10/12/2022	10/18/2023	5/20/2024	10/11/2024
Groundwater Zone:					Shallow				Shallow					Shallow			
Location:																	
Benzene	µg/L	1,701	6.93	55	1,400	**3,000**	**2,300**	**2,500**	1.5	18	0.75	1.4	35	5.3	11	11	9.4
Benzo[a]pyrene	µg/L	6.21	-	0.0331	0.02 J	0.1 U	0.1 U	0.03 J	0.02 J	0.02 J	0.06 J	0.1 U	0.07 J	0.02 J	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	57.0	-	0.76	18	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	1 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	6.50	-	0.0347	0.05 U	0.05 U	0.05 U	0.03 J	0.05 U	0.05 U	0.01 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Ethylbenzene	µg/L	5,975	15.2	88.3	16	27	17	24	0.5 U	0.17 J	0.5 U	0.5 U	0.5 U	0.5 U	0.28 J	0.22 J	0.23 J
Naphthalene	µg/L	148	20.1	7.86	56	**400**	**200**	**340**	5.0	0.77	0.24	20	8.4	17	21	26	0.24
Pentachlorophenol	µg/L	85.3	-	0.45	0.05 J	10 U	10 U	10 U	0.21	10 U	0.19	10 U	10 U	0.46	10 U	10 U	10 U
Xylenes	µg/L	5,160	162	8,919	230	280	180	240	0.43 J	0.83 J	1 U	1 U	1.2 J	1 U	1.9 J	1.4 J	1.3 J

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Table 26B - Groundwater Exceedances for GAA F Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CP12-PZM012				CP12-PZM052				CP14-PZM009			
				4/17/2023	10/23/2023	5/22/2024	10/3/2024	4/17/2023	10/23/2023	5/22/2024	10/4/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024
Groundwater Zone:				Shallow				Intermediate				Shallow			
Location:				Shoreline				Shoreline				Shoreline			
Benzene	µg/L	6,171	9,750	2.4	17	12	0.5 U	0.5 U	0.5 U	0.5 U	6.5	45	62	64	50
Benzo[a]pyrene	µg/L	0.0157	2.42	**0.03 J**	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Ethylbenzene	µg/L	254,100	548	0.5 U	0.3 J	0.26 J	0.5 U	0.5 U	0.5 U	0.5 U	0.2 J	0.56	0.77 J	0.75	0.67
Naphthalene	µg/L	127	169	3	8.9	2.6	0.1 U	0.1 U	0.07 J	0.09 J	9.5	13	16	20	23
Pentachlorophenol	µg/L	363	593	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U	0.1 U	10 U	10 U	10 U
Xylenes	µg/L	1,134,880	5,025	0.48 J	3.7	2.9	1 U	1 U	1 U	1 U	2.3 J	3.1	5.1 J	4.6	4.6

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 26B - Groundwater Exceedances for GAA F Contaminants of Concern (Shoreline)
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Units	Human Health (Off-Site Recreational User)	Ecological Receptors	CP14-PZM062				CP16-PZM008				CP16-PZM035			
				4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/19/2023	10/13/2023	5/16/2024	10/4/2024	4/19/2023	10/13/2023	5/16/2024	10/7/2024
Groundwater Zone:				Intermediate				Shallow				Intermediate			
Location:				Shoreline				Shoreline				Shoreline			
Benzene	µg/L	6,171	9,750	0.5 U	0.5 U	0.5 U	0.5 U	77	98	57	82	170	170	180	110
Benzo[a]pyrene	µg/L	0.0157	2.42	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	44.8	450	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	1.6 J	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.0157	1.21	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Ethylbenzene	µg/L	254,100	548	0.5 U	0.5 U	0.5 U	0.5 U	0.56	0.64	0.46 J	0.59	0.83	0.86	0.85	0.67
Naphthalene	µg/L	127	169	0.2	0.11	0.07 J	0.17	8.6	13	7.6	8.6	70	84	63	21
Pentachlorophenol	µg/L	363	593	0.1 U	10 U	10 U	10 U	0.07 J	10 U	10 U	10 U	0.1 U	10 U	10 U	10 U
Xylenes	µg/L	1,134,880	5,025	1 U	1 U	1 U	1 U	4.9	5.9	4.2	5.8	7	7.2	7.2	5.6

Preliminary Risk Based Screening Level (RBSL) Exceedances:
Off-Site Recreation User: **Bold**
Ecological: Blue

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

Notes:
(a) Shoreline wells are compared against sitewide Preliminary RBSLs in the Sitewide Exceedance Tables.

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	B18-007-PZ	B18-061-PZ	B18-070-PZ	B18-070R-MWS	B18-071-PZ	B18-072-PZ	B18-074-PZ	B18-075-PZ	B18-076-PZ	CO02-PZM041	CO04-PZM048	CO05A-PZM	CO159-PZM	CO16-PZM006	CO178-MWI
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	12/13/2016	12/13/2016	12/14/2016	12/27/2024	12/15/2016	12/14/2016	12/14/2016	12/14/2016	12/13/2016	2/13/2025	2/13/2025	2/13/2025	2/13/2025	2/14/2025	2/11/2025
				GAA:	GAA C	GAA C	GAA D	GAA D	GAA D	GAA D	GAA D	GAA D	GAA D	GAA B	GAA D	GAA D	GAA B	GAA B	GAA B
				Groundwater Zone:	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Intermediate	Intermediate	Shallow	Shallow	Shallow	Intermediate
				Shoreline:	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Arsenic	µg/L	6,680	--	36	5.00 U	5.00 U	5.00 U	3.36	7.20	5.00 U	5.00 U	5.00 U	5.00 U	1.11	0.57	9.5	0.27 J	8.85	30.2
Iron	µg/L	33,398,693	--	4,453,159	36.7 J	12.6 J	36,000	4,560	70.0 U	56.5 J	57.3 J	15,900	75.1	31.4 J	50.0 U	717	66.3	58.5	500 U
Manganese	µg/L	22,902	--	3,054	5.00 U	4.60 J	1,510	200	1.40 J	5.00 U	238	1,630	128	4.20	1.00 U	25.6	56.7	1.00 U	4.43 J
Vandium	µg/L	2,345	--	313	1.20 J	3.30 J	1.60 B	17.4	23.2	41.4	0.76 B	2.30 B	19.2	1.74 J	8.79	1.60 J	5.00 U	532	50.0 U

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CO178-MWS	CO180-MWI	CO180-MWS	CO189-MWS	CO18-PZM006	CO193-MWI	CO193-MWS	CO197-MWS	CO203-MWS	CO206R-MWS	CO209-MWI	CO209-MWS	CO210-MWI	CO210-MWS	CO211-MWI
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	2/11/2025	2/11/2025	2/11/2025	2/13/2025	2/14/2025	2/10/2025	2/10/2025	2/10/2025	2/10/2025	2/11/2025	2/10/2025	2/10/2025	2/10/2025	2/10/2025	3/11/2020
				GAA:	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA E	GAA E	GAA B	GAA B	GAA B	GAA B	GAA B
				Groundwater Zone:	Shallow	Intermediate	Shallow	Shallow	Shallow	Intermediate	Shallow	Shallow	Shallow	Shallow	Intermediate	Shallow	Intermediate	Shallow	Intermediate
				Shoreline:	Yes	Yes	Yes	No	No	No	No	No	Yes	No	yes	yes	yes	yes	No
Arsenic	µg/L	6,680	--	36	3.95 J	5.00 U	5.00 U	1.77	2.62	63.0	1.61	1.45	1.50	1.99	0.84	0.70	0.50 J	0.92	3.90 J
Iron	µg/L	33,398,693	--	4,453,159	500 U	500 U	500 U	65.6	143,000	80.2	73.9	142	361	145	50.0 U	81.3	80.3	57.2	70.0 U
Manganese	µg/L	22,902	--	3,054	10.0 U	10.0 U	10.0 U	13.7	6,392	225	1.00 U	8.00 U	10.0 U	0.65 J	1.00 U	0.91 J	107	2.38	62.4
Vandium	µg/L	2,345	--	313	50.0 U	23.6 J	91.0	12.8	13.9 J	5.00 U	15.2	16.8	1,430	702	6.60	68.3	1.71 J	6.38	0.77 J

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CO211-MWS	CO24-PZM007	CO26-PZM007	CO26-PZM032	CO28-PZM010	CO28-PZM048	CO30-PZM015	CO30-PZM060	CO32-PZM004	CO32-PZM041	CO34-PZM048	CO35-PZM056	CO36-PZM008	CO36-PZM043	CO37-PZM003
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	3/11/2020	2/13/2025	2/10/2025	2/10/2025	2/11/2025	2/11/2025	2/10/2025	2/10/2025	3/19/2020	3/16/2020	2/13/2025	3/12/2020	2/13/2025	2/13/2025	2/14/2025
				GAA:	GAA B	GAA E	GAA E	GAA E	GAA B	GAA B	GAA B	GAA B	GAA B	GAA B	GAA E	GAA E	GAA B	GAA B	GAA B
				Groundwater Zone:	Shallow	Shallow	Shallow	Intermediate	Shallow	Intermediate	Shallow	Intermediate	Shallow	Intermediate	Intermediate	Intermediate	Shallow	Intermediate	Shallow
				Shoreline:	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
Arsenic	µg/L	6,680	--	36	3.20 J	1.07	1.10	2.31	2.69 J	538	1.30	78.7	5.70	5.00 U	0.63	5.00 U	0.80	6.38	1.02
Iron	µg/L	33,398,693	--	4,453,159	162	385	157	4,660	500 U	500 U	57.9	50,100	728	70.0 U	50.0 U	70.0 U	50.0 U	500 U	50.0 U
Manganese	µg/L	22,902	--	3,054	2,050	38.7	1.00 U	4,433	10.0 U	10.0 U	0.84 J	3,414	147	1.50 J	16.6	5.00 U	0.48 J	10.0 U	0.81 J
Vandium	µg/L	2,345	--	313	7.30	498	193	5.00 U	64.4	50.0 U	13.5	5.00 U	195	3.70 J	6.84	2.10 J	247	25.9 J	5.00 U

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CO38-PZM006	CO38-PZM043	CO39-PZM007	CO39-PZM042	CO58-PZM001	CO59-PZP002	COA-MW-001	COA-MWI-004	COA-MWS-004	CP02-PZM007			
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	2/11/2025	2/11/2025	2/14/2025	2/14/2025	2/11/2025	2/11/2025	2/14/2025	2/14/2025	2/14/2025	4/19/2023	10/17/2023	5/16/2024	10/9/2024
				GAA:	GAA B	GAA B	GAA B	GAA B	GAA E	GAA E	GAA C	GAA B	GAA B	GAA F			
				Groundwater Zone:	Shallow	Intermediate	Shallow	Intermediate	Shallow	Shallow	Shallow	Intermediate	Shallow	Shallow			
				Shoreline:	No	No	No	No	Yes	No	No	No	No	No			
Arsenic	µg/L	6,680	--	36	13.7	5.00 U	1.85	5.07	1.10	0.96	0.85	2.42	0.86	27.6	27.2	25.8	29.6
Iron	µg/L	33,398,693	--	4,453,159	500 U	500 U	50.0 U	50.0 U	131	44.7 J	147	50.0 U	50.0 U	76.0	210	325	304 J
Manganese	µg/L	22,902	--	3,054	39.4	60.3	1.00 U	1.00 U	1.00 U	0.90 J	115	1.00 U	1.00 U	799	1,282	1,421	1,614
Vandium	µg/L	2,345	--	313	50.0 U	50.0 U	5.00 U	5.00 U	425	625	1.82 J	32.6	5.00 U	29.4	38.4	30.7 J	22.0 J

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CP02-PZM026				CP05-PZM008				CP05-PZM019				CP05-PZM028			
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/19/2023	10/17/2023	5/16/2024	10/9/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024
				GAA:	GAA F				GAA A				GAA A				GAA A			
				Groundwater Zone:	Intermediate				Shallow				Intermediate				Intermediate			
				Shoreline:	No				Yes				Yes				Yes			
Arsenic	µg/L	6,680	--	36	1.87	1.34	0.39 J	2.10 J	0.81	1.53	0.92	0.99	0.94	1.61	2.29 J	1.10	1.19	1.62	1.12	1.11
Iron	µg/L	33,398,693	--	4,453,159	11,800	5,580	302	14,200	80.8	72.5	77.7	50.6	56.7	123	500 U	378	78.3	114	50.0	211
Manganese	µg/L	22,902	--	3,054	4,115	4,804	4,393	5,326	1.82	1.79	1.91	0.73 J	5.57	12.1	6.74 J	57.7	6.04	5.12	2.90	9.50
Vandium	µg/L	2,345	--	313	5.00 U	5.00 U	50.0 U	50.0 U	1.84 J	2.45 J	2.59 J	3.44 J	5.00 U	5.00 U	50.0 U	3.06 J	4.50 J	3.10 J	6.04	6.01

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CP07-PZM006				CP08R-PZM008				CP08R-PZM034				CP09-PZM010			
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/24/2023	10/23/2023	5/20/2024	10/11/2024	4/25/2023	10/18/2023	5/22/2024	10/9/2024	4/25/2023	10/18/2023	5/22/2024	10/9/2024	4/17/2023	10/11/2023	5/13/2024	10/2/2024
				GAA:	GAA F				GAA F				GAA F				GAA A			
				Groundwater Zone:	Shallow				Shallow				Intermediate				Shallow			
				Shoreline:	No				No				No				Yes			
Arsenic	µg/L	6,680	--	36	5.96	6.73	6.17	6.29	0.79	0.78	0.62	5.00 U	12.2	12.6	7.51	13.2	5.00 U	0.85	0.25 J	0.52
Iron	µg/L	33,398,693	--	4,453,159	33.2 J	27.3 J	19.3 J	500 U	314	33.7 J	208	500 U	46,400	54,300	31,700	51,400	500 U	50.0 U	50.0 U	19.8 J
Manganese	µg/L	22,902	--	3,054	2.38	3.78	1.57	5.47 J	64.7	6.04	2.60	10.7	596	411	394	738	10.0 U	1.00 U	1.00 U	0.61 J
Vandium	µg/L	2,345	--	313	29.5	12.0	37.8	50.0 U	30.3	50.3	18.2	15.9 J	50.0 U	5.00 U	5.00 U	50.0 U	50.0 U	7.09	10.9	8.80

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CP09-PZM047				CP10-PZM008	CP11-PZM010				CP12-PZM012				CP12-PZM052			
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/17/2023	10/19/2023	5/13/2024	10/2/2024	10/28/2021	4/18/2023	10/13/2023	5/20/2024	10/3/2024	4/17/2023	10/23/2023	5/22/2024	10/3/2024	4/17/2023	10/23/2023	5/22/2024	10/4/2024
				GAA:	GAA A				GAA A	GAA A				GAA F				GAA F			
				Groundwater Zone:	Intermediate				Shallow	Shallow				Shallow				Intermediate			
				Shoreline:	Yes				No	Yes				Yes				Yes			
Arsenic	µg/L	6,680	--	36	5.00 U	5.00 U	10.0 U	5.00 U	2.60	1.74	2.25	1.83	1.46	5.00 U	0.51	0.26 J	14.4	10.2	8.31	14.0	0.19 J
Iron	µg/L	33,398,693	--	4,453,159	17,600	18,300	687 J	20,600	370	118	88.4	154	59.8	500 U	108	43.1 J	1,050	500 U	51.6	220 J	66.9
Manganese	µg/L	22,902	--	3,054	1,082	911	466	1,054	6.10	1.56	1.15	18.1	0.55 J	10.0 U	7.27	3.64	576	271	301	413	3.27
Vandium	µg/L	2,345	--	313	50.0 U	50.0 U	100 U	50.0 U	0.32 J	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	1.90 J	5.00 U	50.0 U	50.0 U	1.70 J	50.0 U	5.00 U

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CP14-PZM009				CP14-PZM062				CP15-PZM020				CP15-PZM042			
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/18/2023	10/12/2023	5/14/2024	10/3/2024	4/18/2023	10/12/2023	5/14/2024	10/3/2024
				GAA:	GAA F				GAA F				GAA A				GAA A			
				Groundwater Zone:	Shallow				Intermediate				Shallow				Intermediate			
				Shoreline:	Yes				Yes				Yes				Yes			
Arsenic	µg/L	6,680	--	36	1.25	1.71	1.47	2.68 J	6.02	7.39	4.12 J	14.2	1.98	2.64	1.83	2.15	0.82	1.17	1.39	1.90
Iron	µg/L	33,398,693	--	4,453,159	99.4	92.8	152	500 U	4,480	5,630	2,000	9,830	69.3	48.1 J	29.5 J	85.3	548	50.0 U	33.0 J	79.0
Manganese	µg/L	22,902	--	3,054	9.28	14.5	10.6	10.0 U	642	619	821	910	0.73 J	0.83 J	0.62 J	4.28	59.8	1.11	1.66	3.91
Vandium	µg/L	2,345	--	313	5.00 U	5.00 U	50.0 U	50.0 U	5.00 U	5.00 U	50.0 U	50.0 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

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Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CP16-PZM008				CP16-PZM035				CP17-MWI	CP17-PZM013	CP18R-PZM009			
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/19/2023	10/13/2023	5/16/2024	10/4/2024	4/19/2023	10/13/2023	5/16/2024	10/7/2024	3/13/2020	3/16/2020	4/25/2023	10/19/2023	5/22/2024	10/7/2024
				GAA:	GAA F				GAA F				GAA E	GAA E	GAA F			
				Groundwater Zone:	Shallow				Intermediate				Intermediate	Shallow	Shallow			
				Shoreline:	Yes				Yes				Yes	Yes	No			
Arsenic	µg/L	6,680	--	36	0.92	1.70	1.14	0.87	0.88	1.77	1.29	2.17 J	2.80 J	4.60 J	1.05	1.17	0.99	2.89 J
Iron	µg/L	33,398,693	--	4,453,159	38.7 J	34.3 J	88.9	148	37.1 J	34.2 J	99.1	328 J	70.0 U	70.0 U	96.0	104	148	256 J
Manganese	µg/L	22,902	--	3,054	3.19	2.94	2.60	5.19	1.15	1.04	1.43	8.13 J	4.30 J	2.60 J	3.26	6.48	17.5	26.6
Vandium	µg/L	2,345	--	313	5.00 U	5.00 U	50.0 U	5.00 U	5.00 U	5.00 U	50.0 U	50.0 U	3.60 J	5.10	22.9	19.8	16.3	19.0 J

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
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Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CP19R-PZM008				CP20-PZM011				CP21-PZM004				CP22-MWI	CP22-MWS	CP23-MWI	CP23-MWS
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	4/24/2023	10/17/2023	5/20/2024	10/11/2024	4/24/2023	10/19/2023	5/22/2024	10/11/2024	10/12/2022	10/18/2023	5/20/2024	10/11/2024	2/28/2020	2/28/2020	3/13/2020	3/13/2020
				GAA:	GAA F				GAA F				GAA F				GAA B	GAA B	GAA B	GAA B
				Groundwater Zone:	Shallow				Shallow				Shallow				Intermediate	Shallow	Intermediate	Shallow
				Shoreline:	No				No				No				Yes	Yes	Yes	Yes
Arsenic	µg/L	6,680	--	36	1.40	1.61	1.28	1.81 J	0.71	0.82	1.43	5.00 U	5.06	5.03	5.10	4.90 J	2.80 J	3.50 J	3.80 J	3.70 J
Iron	µg/L	33,398,693	--	4,453,159	75.2	108	28.5 J	500 U	74.4	118	2,640	500 U	331	347	430	221 J	205,000	103	11,600	70.0 U
Manganese	µg/L	22,902	--	3,054	8.71	13.2	2.18	14.9	8.29	12.8	268	7.81 J	307	232	184	166	3,470	1.40 J	1,070	3.50 J
Vandium	µg/L	2,345	--	313	6.34	8.42	6.57	50.0 U	174	250	105	201	10.1	8.64	42.3	50.0 U	5.00 U	59.7	1.10 J	1.00 J

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

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COC: Contaminant of Concern

Table 27A - Groundwater Exceedances for Metals (Sitewide)
CPA Groundwater CMS

		Human Health / Non-Residential		Resource Restoration	CP24-MWI	CP24-MWS	CP25-MWI	CP25-MWS	CP26-MWI	CP26-MWS	SW-030-MWS	SW-085-MWS	SW13-PZM003	SW13-PZM025	SW13-PZM111	SW14-PZM004	SW18-PZM008	SW18-PZM053
Paramter	**Units**	On-Site Utility Worker	On-Site Industrial Worker	Industrial Non-Potable Water User	2/28/2020	2/28/2020	3/16/2020	3/16/2020	3/11/2020	3/11/2020	2/1/2016	2/17/2025	3/28/2016	2/19/2016	12/9/2015	3/31/2016	3/19/2020	3/12/2020
				GAA:	GAA A	GAA A	GAA A	GAA A	GAA E	GAA E	GAA D	GAA C	GAA C	GAA C	GAA C	GAA D	GAA E	GAA E
				Groundwater Zone:	Intermediate	Shallow	Intermediate	Shallow	Intermediate	Shallow	Shallow	Shallow	Shallow	Intermediate	Deep	Shallow	Shallow	Intermediate
				Shoreline:	Yes	Yes	No	No	Yes	Yes	No	Yes	No	No	No	No	No	No
Arsenic	µg/L	6,680	--	36	2.30 J	3.30 J	7.20	3.40 J	5.00 U	2.70 J	4.50 B	1.68	5.00 U	7.80	5.00 U	4.70 J	2.80 B	3.10 J
Iron	µg/L	33,398,693	--	4,453,159	235	61.3 J	1,250	70.0 U	70.0 U	70.0 U	29.9 J	63.9	70.0 U	36,800	21,000	15.6 B	70.0 U	169
Manganese	µg/L	22,902	--	3,054	319	2.20 J	736	58.7	2.50 J	2.60 J	0.92 J	363	5.00 U	1,060	1,180 J	5.00 U	3.30 J	6.00
Vandium	µg/L	2,345	--	313	1.30 J	1.30 J	1.90 J	6.20	5.50	2.00 J	39.6	2.75 J	0.85 B	5.00 U	1.30 B	125	222	68.6

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Utility Worker: **Bold**
Industrial Worker: Underline
Resource Restoration: Yellow

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27B - Groundwater Exceedances for Metals (Shoreline)
CPA Groundwater CMS

		Human Health / Non-Residential	Ecological	CO178-MWI	CO178-MWS	CO180-MWI	CO180-MWS	CO203-MWS	CO209-MWI	CO209-MWS	CO210-MWI	CO210-MWS	CO26-PZM007	CO26-PZM032	CO28-PZM010	CO28-PZM048
Paramter	**Units**	Offsite Recreational User		2/11/2025	2/11/2025	2/11/2025	2/11/2025	2/10/2025	2/10/2025	2/10/2025	2/10/2025	2/10/2025	2/10/2025	2/10/2025	2/11/2025	2/11/2025
			GAA:	GAA B	GAA B	GAA B	GAA B	GAA E	GAA B	GAA B	GAA B	GAA B	GAA E	GAA E	GAA B	GAA B
			Groundwater Zone:	Intermediate	Shallow	Intermediate	Shallow	Shallow	Intermediate	Shallow	Intermediate	Shallow	Shallow	Intermediate	Shallow	Intermediate
			Shoreline:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	µg/L	16.94	2,700	**30.2**	3.95 J	5.00 U	5.00 U	1.50	0.84	0.70	0.50 J	0.92	1.10	2.31	2.69 J	**538**
Iron	µg/L	560,063	22,500	500 U	500 U	500 U	500 U	361	50.0 U	81.3	80.3	57.2	157	4,660	500 U	500 U
Manganese	µg/L	4,801	7,500	4.43 J	10.0 U	10.0 U	10.0 U	10.0 U	1.00 U	0.91 J	107	2.38	1.00 U	4,433	10.0 U	10.0 U
Vandium	µg/L	--	3,750	50.0 U	50.0 U	23.6 J	91.0	1,430	6.60	68.3	1.71 J	6.38	193	5.00 U	64.4	50.0 U

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Offsite Recreation User: **Bold**
Ecological:

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27B - Groundwater Exceedances for Metals (Shoreline)
CPA Groundwater CMS

		Human Health / Non-Residential	Ecological	CO30-PZM015	CO30-PZM060	CO35-PZM056	CO36-PZM008	CO36-PZM043	CO37-PZM003	CO58-PZM001	CP05-PZM008				CP05-PZM019			
Paramter	**Units**	Offsite Recreational User		2/10/2025	2/10/2025	3/12/2020	2/13/2025	2/13/2025	2/14/2025	2/11/2025	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024
GAA:				GAA B	GAA B	GAA E	GAA B	GAA B	GAA B	GAA E	GAA A				GAA A			
Groundwater Zone:				Shallow	Intermediate	Intermediate	Shallow	Intermediate	Shallow	Shallow	Shallow				Intermediate			
Shoreline:				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	µg/L	16.94	2,700	1.30	**78.7**	5.00 U	0.80	6.38	1.02	1.10	0.81	1.53	0.92	0.99	0.94	1.61	2.29 J	1.10
Iron	µg/L	560,063	22,500	57.9	50,100	70.0 U	50.0 U	500 U	50.0 U	131	80.8	72.5	77.7	50.6	56.7	123	500 U	378
Manganese	µg/L	4,801	7,500	0.84 J	3,414	5.00 U	0.48 J	10.0 U	0.81 J	1.00 U	1.82	1.79	1.91	0.73 J	5.57	12.1	6.74 J	57.7
Vandium	µg/L	--	3,750	13.5	5.00 U	2.10 J	247	25.9 J	5.00 U	425	1.84 J	2.45 J	2.59 J	3.44 J	5.00 U	5.00 U	50.0 U	3.06 J

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Offsite Recreation User: **Bold**
Ecological:

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27B - Groundwater Exceedances for Metals (Shoreline)
CPA Groundwater CMS

		Human Health / Non-Residential	Ecological	CP05-PZM028				CP09-PZM010				CP09-PZM047				CP11-PZM010				
Paramter	**Units**	Offsite Recreational User		4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/17/2023	10/11/2023	5/13/2024	10/2/2024	4/17/2023	10/19/2023	5/13/2024	10/2/2024	4/18/2023	10/13/2023	5/20/2024	10/3/2024	4/17/202
			GAA:	GAA A				GAA A				GAA A				GAA A				
			Groundwater Zone:	Intermediate				Shallow				Intermediate				Shallow				
			Shoreline:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	µg/L	16.94	2,700	1.19	1.62	1.12	1.11	5.00 U	0.85	0.25 J	0.52	5.00 U	5.00 U	10.0 U	5.00 U	1.74	2.25	1.83	1.46	5.00
Iron	µg/L	560,063	22,500	78.3	114	50.0	211	500 U	50.0 U	50.0 U	19.8 J	17,600	18,300	687 J	20,600	118	88.4	154	59.8	500
Manganese	µg/L	4,801	7,500	6.04	5.12	2.90	9.50	10.0 U	1.00 U	1.00 U	0.61 J	1,082	911	466	1,054	1.56	1.15	18.1	0.55 J	10.0
Vandium	µg/L	--	3,750	4.50 J	3.10 J	6.04	6.01	50.0 U	7.09	10.9	8.80	50.0 U	50.0 U	100 U	50.0 U	5.00 U	5.00 U	5.00 U	5.00 U	50.0

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Offsite Recreation User: **Bold**
Ecological:

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27B - Groundwater Exceedances for Metals (Shoreline)
CPA Groundwater CMS

		Human Health / Non-Residential	Ecological	CP12-PZM012				CP12-PZM052				CP14-PZM009				CP14-PZM062				
Paramter	**Units**	Offsite Recreational User		23	10/23/2023	5/22/2024	10/3/2024	4/17/2023	10/23/2023	5/22/2024	10/4/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/18/2023
GAA:				GAA F				GAA F				GAA F				GAA F				
Groundwater Zone:				Shallow				Intermediate				Shallow				Intermediate				
Shoreline:					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	µg/L	16.94	2,700	U	0.51	0.26 J	14.4	10.2	8.31	14.0	0.19 J	1.25	1.71	1.47	2.68 J	6.02	7.39	4.12 J	14.2	1.98
Iron	µg/L	560,063	22,500	U	108	43.1 J	1,050	500 U	51.6	220 J	66.9	99.4	92.8	152	500 U	4,480	5,630	2,000	9,830	69.3
Manganese	µg/L	4,801	7,500	U	7.27	3.64	576	271	301	413	3.27	9.28	14.5	10.6	10.0 U	642	619	821	910	0.73 J
Vandium	µg/L	--	3,750	U	1.90 J	5.00 U	50.0 U	50.0 U	1.70 J	50.0 U	5.00 U	5.00 U	5.00 U	50.0 U	50.0 U	5.00 U	5.00 U	50.0 U	50.0 U	5.00 U

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Offsite Recreation User: **Bold**
Ecological:

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27B - Groundwater Exceedances for Metals (Shoreline)
CPA Groundwater CMS

		Human Health / Non-Residential	Ecological	CP15-PZM020			CP15-PZM042				CP16-PZM008				CP16-PZM035				CP17-MWI
Paramter	**Units**	Offsite Recreational User		10/12/2023	5/14/2024	10/3/2024	4/18/2023	10/12/2023	5/14/2024	10/3/2024	4/19/2023	10/13/2023	5/16/2024	10/4/2024	4/19/2023	10/13/2023	5/16/2024	10/7/2024	3/13/2020
			GAA:	GAA A			GAA A				GAA F				GAA F				GAA E
			Groundwater Zone:	Shallow			Intermediate				Shallow				Intermediate				Intermediate
			Shoreline:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	µg/L	16.94	2,700	2.64	1.83	2.15	0.82	1.17	1.39	1.90	0.92	1.70	1.14	0.87	0.88	1.77	1.29	2.17 J	2.80 J
Iron	µg/L	560,063	22,500	48.1 J	29.5 J	85.3	548	50.0 U	33.0 J	79.0	38.7 J	34.3 J	88.9	148	37.1 J	34.2 J	99.1	328 J	70.0 U
Manganese	µg/L	4,801	7,500	0.83 J	0.62 J	4.28	59.8	1.11	1.66	3.91	3.19	2.94	2.60	5.19	1.15	1.04	1.43	8.13 J	4.30 J
Vandium	µg/L	--	3,750	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	5.00 U	50.0 U	5.00 U	5.00 U	5.00 U	50.0 U	50.0 U	3.60 J

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Offsite Recreation User: **Bold**
Ecological:

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 27B - Groundwater Exceedances for Metals (Shoreline)
CPA Groundwater CMS

Paramter	Units	Human Health / Non-Residential Offsite Recreational User	Ecological	CP17-PZM013	CP22-MWI	CP22-MWS	CP23-MWI	CP23-MWS	CP24-MWI	CP24-MWS	CP26-MWI	CP26-MWS	SW-085-MWS
				3/16/2020	2/28/2020	2/28/2020	3/13/2020	3/13/2020	2/28/2020	2/28/2020	3/11/2020	3/11/2020	2/17/2025
GAA:				GAA E	GAA B	GAA B	GAA B	GAA B	GAA A	GAA A	GAA E	GAA E	GAA C
Groundwater Zone:				Shallow	Intermediate	Shallow	Intermediate	Shallow	Intermediate	Shallow	Intermediate	Shallow	Shallow
Shoreline:				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	µg/L	16.94	2,700	4.60 J	2.80 J	3.50 J	3.80 J	3.70 J	2.30 J	3.30 J	5.00 U	2.70 J	1.68
Iron	µg/L	560,063	22,500	70.0 U	205,000	103	11,600	70.0 U	235	61.3 J	70.0 U	70.0 U	63.9
Manganese	µg/L	4,801	7,500	2.60 J	3,470	1.40 J	1,070	3.50 J	319	2.20 J	2.50 J	2.60 J	363
Vandium	µg/L	--	3,750	5.10	5.00 U	59.7	1.10 J	1.00 J	1.30 J	1.30 J	5.50	2.00 J	2.75 J

Preliminary Risk Based Screening Level (RBSL) Exceedance:
Offsite Recreation User: **Bold**
Ecological:

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 28A - Final Remedial Goals Groundwater Exceedances (GAA A, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP05-PZM008				CP05-PZM019				CP05-PZM028			
			4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024
Groundwater Zone:			Shallow				Intermediate				Intermediate			
Location:			Shoreline				Shoreline				Shoreline			
Arsenic	µg/L	40	0.8075	1.527	0.9232	0.9852	0.9361	1.614	2.289 J	1.099	1.194	1.621	1.124	1.106
1,1 -Biphenyl	µg/L	100	0.58 J	2 U	2 U	0.3 J	1.2 J	1.1 J	1.1 J	0.61 J	0.93 J	0.66 J	0.89 J	0.54 J
2-Methylnaphthalene	µg/L	400	1.8	0.9	1.1	1.1	4.7	3.3	3.6	1.7	3.4	2.3	2.9	2.2
Benz[a]anthracene	µg/L	1.00	0.07	0.05 U	0.03 J	0.04 J	0.05	0.05 U	0.04 J	0.04 J	0.09	0.02 J	0.03 J	0.05
Benzo[a]pyrene	µg/L	0.16	0.04 J	0.1 U	0.1 U	0.1 U	0.03 J	0.03 J	0.1 U	0.1 U	0.07 J	0.02 J	0.1 U	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.02 J	0.05 U	0.02 J	0.05 U	0.02 J	0.04 J	0.02 J	0.05 U	0.03 J	0.02 J	0.02 J	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.00	3 U	3 U	3 U	3 U	3 U	3 U	1.7 J	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.16	0.02 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.02 J	0.05 U	0.05 U	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.04 J	0.1 U	0.1 U	0.1 U	0.03 J	0.02 J	0.1 U	0.1 U	0.06 J	0.1 U	0.1 U	0.1 U
Naphthalene	µg/L	115	16	9.0	8.0	8.6	81	50	58	28	46	36	37	34
Benzene	µg/L	100	10	5.2	4.9	5.6	45	39	44	1.6	27	29	31	34
Ethylbenzene	µg/L	100	0.32 J	0.32 J	0.29 J	0.37 J	0.71	0.89	0.85	0.5 U	0.66	0.71	0.79	0.74
Toluene	µg/L	10,000	2.1	1.5	1.4	1.7	10	9.3	9.6	0.47 J	5.1	5.8	5.8	6.4
Xylenes	µg/L	1,000	2.2 J	2.3 J	1.8 J	2.6	5.9	7.1	6.5	0.35 J	4.6	5.3	5.6	5.6

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 28A - Final Remedial Goals Groundwater Exceedances (GAA A, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP09-PZM010				CP09-PZM047				CP10-PZM008	CP11-PZM010			
			4/17/2023	10/11/2023	5/13/2024	10/2/2024	4/17/2023	10/19/2023	5/13/2024	10/2/2024	10/28/2021	4/18/2023	10/13/2023	5/20/2024	10/3/2024
Groundwater Zone:			Shallow				Intermediate				Shallow	Shallow			
Location:			Shoreline				Shoreline					Shoreline			
Arsenic	µg/L	40	5 U	0.8457	0.2533 J	0.5154	5 U	5 U	10 U	5 U	2.6	1.735	2.251	1.826	1.457
1,1 -Biphenyl	µg/L	100	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	NA	2.5	2.3	2.2	2 U
2-Methylnaphthalene	µg/L	400	0.1 U	0.04 J	0.1 U	0.1 U	0.1 U	0.03 J	0.05 J	0.1 U	96.2 U	2.9	2.7	2.4	1.3
Benz[a]anthracene	µg/L	1.00	0.05 U	0.02 J	0.05 U	0.05 U	0.13	0.05 J	0.02 J	0.05 U	0.96 U	0.08	0.18	0.08	0.05 J
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	0.1 U	0.1 U	0.1 U	0.96 U	0.1 U	0.03 J	0.02 J	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.05 U	0.02 J	0.05 U	0.05 U	0.05 U	0.02 J	0.02 J	0.05 U	0.96 U	0.05 U	0.06	0.04 J	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.00	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	2.4 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.96 U	0.05 U	0.05 U	0.05 U	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.96 U	0.1 U	0.1 U	0.1 U	0.1 U
Naphthalene	µg/L	115	0.1 U	0.28	0.1 U	0.19	0.1 U	0.08 J	0.13	0.15	391	32	30	38	13
Benzene	µg/L	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	8.7	12	7.8	9.6	5.5
Ethylbenzene	µg/L	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.92 J	0.7	0.54	0.54	0.51
Toluene	µg/L	10,000	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	4.6	3	2.3	2.6	1.8
Xylenes	µg/L	1,000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	4.6	5.2	4.5	4.1	3.9

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 28A - Final Remedial Goals Groundwater Exceedances (GAA A, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP15-PZM020				CP15-PZM042				CP24-MWI	CP24-MWS	CP25-MWI	CP25-MWS
			4/18/2023	10/12/2023	5/14/2024	10/3/2024	4/18/2023	10/12/2023	5/14/2024	10/3/2024	2/28/2020	2/28/2020	3/16/2020	3/16/2020
Groundwater Zone:			Shallow				Intermediate				Intermediate	Shallow	Intermediate	Shallow
Location:			Shoreline				Shoreline				Shoreline	Shoreline		
Arsenic	µg/L	40	1.984	2.638	1.83	2.151	0.8154	1.172	1.386	1.896	2.3 J	3.3 J	7.2	3.4 J
1,1 -Biphenyl	µg/L	100	1.6 J	1.7 J	2.3	2 U	2 U	2 U	2 U	2 U	0.82 J	0.4 J	1.2	2.2
2-Methylnaphthalene	µg/L	400	4.7	7	5.8	3.4	0.15	0.27	0.39	0.49	2.5	1.3	8.1	0.14
Benz[a]anthracene	µg/L	1.00	0.07	0.06	0.07	0.05 U	0.05 U	0.03 J	0.05 U	0.05 U	0.075 J	0.072 J	0.24	0.1
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.099 U	0.02 J	0.093 J	0.078 J
Benzo[b]fluoranthene	µg/L	1.00	0.05 U	0.03 J	0.02 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.099 U	0.035 J	0.15	0.14 J
bis(2-Ethylhexyl)phthalate	µg/L	1.00	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	0.99 U	0.98 U	0.98 U	0.45 J
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.099 U	0.098 U	0.098 U	0.098 UJ
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.099 U	0.098 U	0.098 U	0.036 J
Naphthalene	µg/L	115	48	70	52	32	1.5	5.2	3.4	8.7	41.6	48.3	564	0.39
Benzene	µg/L	100	6.8	6.6	6.2	5.3	0.43 J	1.8	1.1	4.2	1.2	3.4	3.3	2.8
Ethylbenzene	µg/L	100	0.89	0.85	0.78	0.8	0.5 U	0.22 J	0.23 J	0.45 J	0.51 J	0.73 J	0.42 J	1 U
Toluene	µg/L	10,000	3.1	2.8	2.6	2.6	0.75 U	0.66 J	0.56 J	1.4	0.87 J	2.4	1.9	0.95 J
Xylenes	µg/L	1,000	5.2	5.2	4.3	4.6	1 U	1.4 J	1.1 J	2.6	1.4 J	2.1 J	6.3	1.4 J

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 28B - Final Remedial Goals Groundwater Exceedances (GAA A, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CP05-PZM008				CP05-PZM019				CP05-PZM028			
			4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024	4/13/2023	10/11/2023	5/14/2024	10/2/2024
Groundwater Zone:			Shallow				Intermediate				Intermediate			
Location:			Shoreline				Shoreline				Shoreline			
Iron	µg/L	22,500	80.8	72.5	77.7	50.6	56.7	123	500 U	378	78.3	114	50	211
Benzo[a]pyrene	µg/L	0.16	0.04 J	0.1 U	0.1 U	0.1 U	0.03 J	0.03 J	0.1 U	0.1 U	0.07 J	0.02 J	0.1 U	0.1 U
Dibenz[a,h]anthracene	µg/L	0.16	0.02 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.02 J	0.05 U	0.05 U	0.05 U
Pyrene	µg/L	13	0.27	0.09 J	0.14	0.13	0.18	0.12	0.13	0.07 J	0.42	0.13	0.19	0.13
Toluene	µg/L	735	2.1	1.5	1.4	1.7	10	9.3	9.6	0.47 J	5.1	5.8	5.8	6.4

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 28B - Final Remedial Goals Groundwater Exceedances (GAA A, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CP09-PZM010				CP09-PZM047				CP11-PZM010			
			4/17/2023	10/11/2023	5/13/2024	10/2/2024	4/17/2023	10/19/2023	5/13/2024	10/2/2024	4/18/2023	10/13/2023	5/20/2024	10/3/2024
Groundwater Zone:			Shallow				Intermediate				Shallow			
Location:			Shoreline				Shoreline				Shoreline			
Iron	µg/L	22,500	500 U	50 U	50 U	19.8 J	17600	18300	687 J	20600	118	88.4	154	59.8
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U	0.03 J	0.02 J	0.1 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Pyrene	µg/L	13	0.1 U	0.08 J	0.04 J	0.04 J	1.4	0.29	0.04 J	0.09 J	1.3	2	0.58	0.74
Toluene	µg/L	735	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	3	2.3	2.6	1.8

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 28B - Final Remedial Goals Groundwater Exceedances (GAA A, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CP15-PZM020				CP15-PZM042				CP24-MWI	CP24-MWS
			4/18/2023	10/12/2023	5/14/2024	10/3/2024	4/18/2023	10/12/2023	5/14/2024	10/3/2024	2/28/2020	2/28/2020
Groundwater Zone:			Shallow				Intermediate				Intermediate	Shallow
Location:			Shoreline				Shoreline				Shoreline	Shoreline
Iron	µg/L	22,500	69.3	48.1 J	29.5 J	85.3	548	50 U	33 J	79	235	61.3 J
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.099 U	0.02 J
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.099 U	0.098 U
Pyrene	µg/L	13	0.86	0.82	0.63	0.34	0.15	0.09 J	0.07 J	0.06 J	0.85	0.89
Toluene	µg/L	735	3.1	2.8	2.6	2.6	0.75 U	0.66 J	0.56 J	1.4	0.87 J	2.4

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 28C - GAA A Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Final RG (µg/L)	Statistics	
Sitewide Final RGs			
Arsenic	40	Max:	7.2
		Min:	0.2533
		DF:	86%
		EF:	0.0%
1,1 -Biphenyl	100	Max:	2.5
		Min:	0.3
		DF:	56%
		EF:	0.0%
2-Methylnaphthalene	400	Max:	8.1
		Min:	0.03
		DF:	84%
		EF:	0.0%
Benz[a]anthracene	1.0	Max:	0.24
		Min:	0.02
		DF:	70%
		EF:	0.0%
Benzo[a]pyrene	0.16	Max:	0.093
		Min:	0.02
		DF:	30%
		EF:	0.0%
Benzo[b]fluoranthene	1.0	Max:	0.15
		Min:	0.02
		DF:	49%
		EF:	0.0%
bis(2-Ethylhexyl)phthalate	1.0	Max:	1.7
		Min:	0.45
		DF:	5.4%
		EF:	2.7%
Dibenz[a,h]anthracene	0.16	Max:	0.02
		Min:	0.02
		DF:	5.4%
		EF:	0.0%
Indeno[1,2,3-c,d]pyrene	1.0	Max:	0.06
		Min:	0.02
		DF:	14%
		EF:	0.0%
Naphthalene	115	Max:	564
		Min:	0.08
		DF:	92%
		EF:	5.4%
Benzene	100	Max:	45
		Min:	0.43
		DF:	78%
		EF:	0.0%

Table 28C - GAA A Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Final RG (µg/L)	Statistics	
Ethylbenzene	100	Max:	0.92
		Min:	0.22
		DF:	70%
		EF:	0.0%
Toluene	10000	Max:	10
		Min:	0.47
		DF:	76%
		EF:	0.0%
Xylenes	1000	Max:	7.1
		Min:	0.35
		DF:	76%
		EF:	0.0%
Shoreline Final RGs			
Iron	22,500	Max:	20,600
		Min:	19.8
		DF:	85%
		EF:	0%
Benzo[a]pyrene	0.16	Max:	0.07
		Min:	0.02
		DF:	26%
		EF:	0%
Dibenz[a,h]anthracene	0.16	Max:	0.02
		Min:	0.02
		DF:	6%
		EF:	0%
Pyrene	13	Max:	2.0
		Min:	0.04
		DF:	97%
		EF:	0%
Toluene	735	Max:	10.0
		Min:	0.47
		DF:	74%
		EF:	0%

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
RG: Remedial Goal
DF: Detection Frequency
EF: Exceedance Frequency

No Final RG Exceedance
Final RG Exceedance

Notes:
(a) Maximum and minimum values presented in µg/L.
(b) EF and DF presented in percentage.

Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO02-PZM006		CO02-PZM041			CO03-PZM005		CO07-PZM008		CO07-PZM050	CO08A-PZM		CO08B-PZM	CO08C-PZM	CO08D-PZM
			6/10/2015	12/17/2020	6/10/2015	3/9/2020	10/31/2024	6/10/2015	3/9/2020	6/10/2015	3/10/2020	3/10/2020	5/20/2021	9/17/2024	5/19/2021	5/19/2021	5/19/2021
Groundwater Zone:			Shallow	Shallow	Intermediate			Shallow		Shallow		Intermediate	Shallow		Shallow	Intermediate	Intermediate
Location:																	
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	2.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	3.4	NA	0.32 J	NA	0.32	0.25 J	NA	6.5	NA	NA	122 J	NA	82.8 J	1.3 J	0.17 J
Benz[a]anthracene	µg/L	1.00	0.2 J	NA	0.11 U	NA	0.05 U	0.11 U	NA	0.11 U	NA	NA	0.51	NA	4.5 J	0.014 J	0.021 J
Benzo[a]pyrene	µg/L	0.16	0.062 U	NA	0.063 U	NA	0.1 U	0.063 U	NA	0.063 U	NA	NA	0.30	NA	2.4	0.015 J	0.013 J
Benzo[b]fluoranthene	µg/L	1.00	0.26 J	NA	0.16 U	NA	0.05 U	0.21 J	NA	0.17 U	NA	NA	0.33	NA	2.1	0.021 J	0.015 J
bis(2-Ethylhexyl)phthalate	µg/L	1.00	0.24 J	NA	0.13 U	NA	3 U	0.31 J	NA	0.29 J	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	0.11 U	NA	0.05 U	0.11 U	NA	0.11 U	NA	NA	0.046 J	NA	0.37	0.067 U	0.067 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.13 U	NA	0.13 U	NA	0.1 U	0.13 U	NA	0.13 U	NA	NA	0.17	NA	1.4	0.012 J	0.095 U
Naphthalene	µg/L	115	201	173	114	NA	25	24.5	NA	140 B	319	10.0 U	5,190	3,100	1,490	15.9	1.4 J
Benzene	µg/L	100	168,000	134,000	36.4	12.0	7.9	0.25 U	5.0 U	27,000	30,000	5.0 U	452	510	5,240	1.0 U	9.0
Ethylbenzene	µg/L	100	374	248	3.7 J	6.6	0.36 J	0.3 U	5.0 U	96.5 J	90.9	5.0 U	342	240	211	1.0 U	1.0 U
Toluene	µg/L	10,000	156	99.1	1.0	5.0 U	0.34 J	0.26 U	5.0 U	1,020	763	5.0 U	2,590	1,800	2,470	1.0 U	1.5
Xylenes	µg/L	1,000	753	252	9.9	10.2 J	9.8	0.66 U	15.0 U	132 U	349	15.0 U	8,040	4,100	1,480	2.4 J	3.0 U

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO08-PZM005	CO08-PZM036	CO09-PZM007	CO100-PZM		CO101-PZM	CO102-PZM	CO103-PZM	CO104-PZM	CO121-PZM		
			6/10/2015	6/11/2015	6/10/2015	10/7/2019	9/17/2024	12/17/2020	12/17/2020	12/17/2020	12/17/2020	6/10/2015	10/8/2019	9/19/2024
Groundwater Zone:			Shallow	Intermediate	Shallow	Shallow		Shallow	Shallow	Shallow	Shallow	Shallow		
Location:								Shoreline			Shoreline	Shoreline		
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	8.7	58.4	32.1	NA	NA	NA	NA	NA	NA	25.5	NA	NA
Benz[a]anthracene	µg/L	1.00	0.11 U	0.11 U	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA
Benzo[a]pyrene	µg/L	0.16	0.063 U	0.063 U	0.063 U	NA	NA	NA	NA	NA	NA	0.063 U	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	0.17 U	0.16 U	0.16 U	NA	NA	NA	NA	NA	NA	0.17 U	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	0.32 J	0.3 J	0.1 U	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	0.11 U	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.13 U	0.13 U	0.13 U	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA
Naphthalene	µg/L	115	257	2,170	810	1,270	0.44 J	179	874	88.4	2.0 U	324	2,010	1,800
Benzene	µg/L	100	15,000	35,300	358	7,080	0.86	5,480	13,500	1,100	4.3	1,970	1,230	1,600
Ethylbenzene	µg/L	100	198	1,070	21.9 J	603	0.30 J	4.9	18.1	2.3	1.0 U	61.7	52.4	56.0
Toluene	µg/L	10,000	6,150	17,700	279	54.2	0.27 J	385	964	59.6	1.0 U	1,650	1,100	1,400
Xylenes	µg/L	1,000	2,760	8,770	401	268	0.35 J	64.8	194	30.5	3.0 U	642	597	660

Final Remedial Goal (RG) Exceedance
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NA: Not Analyzed

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO152-PZM			CO159-PZM		CO15-PZM005	CO167-PZM		CO16-PZM006		CO177-MWI	CO177-MWS	CO178-MWI		CO178-MWS	
			4/10/2020	9/19/2024	10/31/2024	4/10/2020	9/19/2024	6/9/2015	4/10/2020	9/19/2024	6/9/2015	10/8/2019	9/27/2019	9/27/2019	10/14/2019	2/11/2025	10/11/2019	2/11/2025
Groundwater Zone:			Shallow			Shallow		Shallow	Shallow		Shallow		Shallow	Shallow	Intermediate		Shallow	
Location:													Shoreline	Shoreline	Shoreline		Shoreline	
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	30.2	NA	3.95 J
1,1 -Biphenyl	µg/L	100	NA	NA	1.0 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0 U	NA	4.0
2-Methylnaphthalene	µg/L	400	NA	NA	0.1 U	NA	NA	0.59 J	NA	NA	9.3	NA	NA	NA	NA	0.05 J	NA	16
Benz[a]anthracene	µg/L	1.00	NA	NA	0.1	NA	NA	0.29 J	NA	NA	0.11 U	NA	NA	NA	NA	0.05 U	NA	0.04 J
Benzo[a]pyrene	µg/L	0.16	NA	NA	0.05 J	NA	NA	0.24 J	NA	NA	0.063 U	NA	NA	NA	NA	0.1 U	NA	0.05 J
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	0.05 J	NA	NA	0.4 J	NA	NA	0.17 U	NA	NA	NA	NA	0.05 U	NA	0.10
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	NA	3.00 U	NA	NA	0.3 J	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	0.05 U	NA	NA	0.11 U	NA	NA	0.11 U	NA	NA	NA	NA	0.05 U	NA	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	NA	0.1 U	NA	NA	0.13 U	NA	NA	0.13 U	NA	NA	NA	NA	0.1 U	NA	0.05 J
Naphthalene	µg/L	115	37.3	69.0	29.0	54.6	19.0	47.9	82.6	120	244	503	125	161	1,270	0.3	1,500	510
Benzene	µg/L	100	1,520	440	300	64.7	57.0	169,000	5.6	120	119,000	78,000	4,900	5,950	40,800	NA	14,200	NA
Ethylbenzene	µg/L	100	9.8	1.3 J	5.0 U	8.4	5.1	121	2.3 J	2.4	387	250	19.4	31.5	268	NA	242	NA
Toluene	µg/L	10,000	2.7 J	4.2	7.5 U	5.0 U	3.0	10,300	5.6	9.2	9,660	5,270	19.5	147	5,820	NA	7,920	NA
Xylenes	µg/L	1,000	15.0 U	1.6 J	10.0 U	8.4 J	4.1 J	740	13.8 J	14.0	3,020	1,940	125	220	1,870	NA	1,950	NA

Final Remedial Goal (RG) Exceedance

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO179-MWI	CO179-MWS	CO180-MWI		CO180-MWS		CO181-MWI	CO181-MWS	CO182-MWI		CO183-MWI	CO184-MWI	
			10/2/2019	6/13/2023	5/23/2023	2/11/2025	5/23/2023	2/11/2025	5/24/2023	5/24/2023	8/9/2023	12/10/2024	9/27/2019	10/8/2019	11/1/2024
Groundwater Zone:			Intermediate	Shallow	Intermediate		Shallow		Intermediate	Shallow	Intermediate		Intermediate	Intermediate	
Location:			Shoreline	Shoreline	Shoreline		Shoreline		Shoreline	Shoreline					
Arsenic	µg/L	40	NA	NA	NA	5.0 U	NA	5.0 U	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	1.4 J	NA	1.9 J	NA	NA	NA	NA	NA	NA	18.0
2-Methylnaphthalene	µg/L	400	NA	NA	NA	18	NA	24	NA	NA	NA	NA	NA	NA	250
Benz[a]anthracene	µg/L	1.00	NA	NA	NA	0.05	NA	0.05 U	NA	NA	NA	NA	NA	NA	2.0 U
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	0.03 J	NA	0.1 U	NA	NA	NA	NA	NA	NA	2.0 U
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	NA	0.04 J	NA	0.05 U	NA	NA	NA	NA	NA	NA	2.0 U
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	NA	NA	NA	NA	3.0 U	NA	NA	NA	NA	NA	NA	3.0 U
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	0.03 J	NA	0.05 U	NA	NA	NA	NA	NA	NA	2.0 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	NA	NA	0.03 J	NA	0.1 U	NA	NA	NA	NA	NA	NA	2.0 U
Naphthalene	µg/L	115	6,280	1,200	880	610	1,200	700	1,800	1,700	220 J	73.0 J	757	64,100	9,200
Benzene	µg/L	100	28,500	4,700	18,000	NA	17,000	NA	23,000	21,000	250,000	22,000	146,000	209,000	210,000
Ethylbenzene	µg/L	100	373	230	78.0 J	NA	86.0	NA	120	130	1,100	100	743	554	670
Toluene	µg/L	10,000	13,000	2,800	3,900	NA	4,700	NA	5,500	6,300	17,000	2,500	51,200	51,200	52,000
Xylenes	µg/L	1,000	2,990	2,300	1,200	NA	1,500	NA	1,800	2,000	9,500	1,300	16,700	12,000	10,000

Final Remedial Goal (RG) Exceedance

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO185-MWI		CO185-MWS	CO186-MWS		CO187-MWS		CO188-MWI		CO189-MWS		CO18-PZM006			
			2/5/2020	11/1/2024	10/8/2019	6/13/2023	12/10/2024	10/7/2019	9/18/2024	10/8/2019	10/31/2024	10/8/2019	9/17/2024	6/9/2015	12/28/2020	9/18/2024	11/4/2024
Groundwater Zone:			Intermediate		Shallow	Shallow		Shallow		Intermediate		Shallow		Shallow			
Location:																	
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	11.0	NA	NA	NA	NA	NA	NA	7.4	NA	NA	NA	NA	NA	1.3 J
2-Methylnaphthalene	µg/L	400	NA	130	NA	NA	NA	NA	NA	NA	15.0	NA	NA	1.1	NA	NA	2.9
Benz[a]anthracene	µg/L	1.00	NA	2.0 U	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	0.96 J	NA	NA	0.57
Benzo[a]pyrene	µg/L	0.16	NA	2.0 U	NA	NA	NA	NA	NA	NA	1.0 U	NA	NA	0.7 J	NA	NA	0.34
Benzo[b]fluoranthene	µg/L	1.00	NA	2.0 U	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	1.7	NA	NA	0.64
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	3.0 U	NA	NA	NA	NA	NA	NA	3.0 U	NA	NA	2.8	NA	NA	3.00 U
Dibenz[a,h]anthracene	µg/L	0.16	NA	2.0 U	NA	NA	NA	NA	NA	NA	0.5 U	NA	NA	0.11 U	NA	NA	0.07 J
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	2.0 U	NA	NA	NA	NA	NA	NA	1.0 U	NA	NA	0.26 J	NA	NA	0.24 U
Naphthalene	µg/L	115	27,800	8,900	581	100 U	1,000 U	172	130 J	1,120	770	625	720 J	20.2	427	71.0 J	98.0
Benzene	µg/L	100	75,300	78,000	2,610	9,500	140,000	353,000	710,000	320,000	270,000	311,000	290,000	13,200	510,000	330,000	260,000
Ethylbenzene	µg/L	100	241	220	7.0	22.0 J	240 J	42.3	250.0 U	991	1,100	223	1,000 U	4.7 J	93.8	42.0 J	1,000 U
Toluene	µg/L	10,000	15,700	18,000	257	460	37,000	8,380	6,800	38,000	37,000	20,600	3,900	237	18,100	520.0	550 J
Xylenes	µg/L	1,000	3,890	3,900	101	150 J	4,200	527	240 J	13,600	14,000	3,100	2,000 U	380	2,410	780.0	2,000 U

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO190-MWS						CO191-MWS		CO192-MWS	CO193-MWI			CO193-MWS
			8/15/2023	11/28/2023	3/12/2024	6/20/2024	8/14/2024	12/17/2024	5/30/2023	6/7/2024	10/7/2019	2/6/2020	11/1/2024	2/10/2025	10/1/2019
Groundwater Zone:			Shallow						Shallow		Shallow	Intermediate			Shallow
Location:															
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	63.0	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6 J	NA	NA
2-Methylnaphthalene	µg/L	400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.07 J	NA	NA
Benz[a]anthracene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03 J	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.04 J	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.00 U	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U	NA	NA
Naphthalene	µg/L	115	400 U	330 J	2,500 U	4,000 U	320 J	2,000 U	290 J	190 J	301	47,600	1.00	NA	1,170
Benzene	µg/L	100	35,000	160,000	270,000	550,000	96,000	290,000	67,000	34,000	72,900	34,800	12,000	NA	33,700
Ethylbenzene	µg/L	100	200 U	500 U	1,200 U	2,000 U	500 U	1,000 U	220 J	110	221	61.4	32.0 J	NA	50.9
Toluene	µg/L	10,000	1,600	10,000	16,000	35,000	5,300	14,000	6,700	2,700	2,470	49.6	75.0 U	NA	3,320
Xylenes	µg/L	1,000	400 U	1,000 U	2,500 U	4,000 U	1,000 U	2,000 U	2,200	900	475	150	100.0 U	NA	599

Final Remedial Goal (RG) Exceedance

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO194-MWS					CO195-MWS						CO196-MWS				CO197-MWS
			5/30/2023	11/8/2023	6/6/2024	11/4/2024	12/12/2024	8/11/2023	11/8/2023	3/8/2024	6/6/2024	8/12/2024	11/20/2024	5/31/2023	11/8/2023	6/6/2024	12/13/2024	10/1/2019
Groundwater Zone:			Shallow					Shallow						Shallow				Shallow
Location:																		
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	12.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	NA	NA	NA	22.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	NA	NA	NA	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	0.10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	NA	NA	3.00 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	NA	NA	0.10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	1,900	470	760	1,400	1,400	1,600	2,000	1,200	1,300	1,700	1,300	600	320	550	330	3,250
Benzene	µg/L	100	600	98	320	560	370	45,000	30,000	17,000	22,000	30,000	24,000	6,000	2,500	3,900	3,200	5,680
Ethylbenzene	µg/L	100	6.3 J	0.79 J	2.4 J	3.9	3.0 J	73.0 J	55.0 J	34.0 J	43.0 J	58.0 J	43.0 J	14.0 J	6.1 J	11.0 J	7.6 J	10.8
Toluene	µg/L	10,000	130	19.0	65.0	100	75.0	3,100	2,700	1,400	1,900	2,400	1,900	490	200	290	220	420
Xylenes	µg/L	1,000	78.0	9.6	34.0	57.0	39.0	830 J	700 J	400 J	550 J	720 J	520 J	160 J	74	110	82 J	116

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO198-MWS				CO199-MWS	CO19-PZM004		CO200-MWS	CO201-MWS				CO202-MWS	CO209-MWI	
			5/19/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019	6/10/2015	9/17/2024	9/30/2019	5/31/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019	6/2/2023	12/18/2024
Groundwater Zone:			Shallow				Shallow	Shallow		Shallow	Shallow				Shallow	Intermediate	
Location:			Shoreline				Shoreline			Shoreline	Shoreline				Shoreline	Shoreline	
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.2
2-Methylnaphthalene	µg/L	400	NA	NA	NA	NA	NA	0.19 U	NA	NA	NA	NA	NA	NA	NA	NA	130
Benz[a]anthracene	µg/L	1.00	NA	NA	NA	NA	NA	0.12 U	NA	NA	NA	NA	NA	NA	NA	NA	2.0 U
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	NA	NA	0.064 U	NA	NA	NA	NA	NA	NA	NA	NA	2.0 U
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	NA	NA	NA	0.17 U	NA	NA	NA	NA	NA	NA	NA	NA	2.0 U
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	NA	NA	NA	NA	0.23 J	NA	NA	NA	NA	NA	NA	NA	NA	3.0 U
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	2.0 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	2.0 U
Naphthalene	µg/L	115	1,300	1,900	1,700	1,600	12,200	0.19 U	12.0	1,130	180	44.0	11.0	74	886	13,000	18,000
Benzene	µg/L	100	190	310	280	230	34,200	409	12.0	34,100	1,100	330	42.0	600	1,780	2,300	2,000
Ethylbenzene	µg/L	100	1.7 J	10.0 U	2.6 J	1.8 J	71.7	7.90	0.92	44.1	3.9 J	0.94 J	0.21 J	1.1 J	3.3	71.0	75.0
Toluene	µg/L	10,000	42.0	79.0	72.0	55	2,650	2.40 J	4.5	2,840	79.0	6.9	2.0	27	134	340	5.1 J
Xylenes	µg/L	1,000	22.0 J	34.0 J	34.0	26 J	1,150	8.00 U	13.0	575	56.0	11.0 J	3.1	14 J	42.1	140 J	55.0

Final Remedial Goal (RG) Exceedance

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO209-MWS		CO210-MWI		CO210-MWS		CO211-MWI	CO211-MWS	CO212-MWI	CO212-MWS		CO213-RIW	CO214-RIW	CO215-RIW
			6/2/2023	12/18/2024	2/5/2020	12/20/2024	2/5/2020	12/18/2024	3/11/2020	3/11/2020	2/6/2020	2/6/2020	11/5/2024	9/18/2024	9/18/2024	9/18/2024
Groundwater Zone:			Shallow		Intermediate		Shallow		Intermediate	Shallow	Intermediate	Shallow		Shallow	Shallow	Shallow
Location:			Shoreline		Shoreline		Shoreline									
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	3.9 J	3.2 J	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	18.0	NA	2.0 U	NA	8.2	1.0 U	0.98 U	NA	NA	110	NA	NA	NA
2-Methylnaphthalene	µg/L	400	NA	85.0	NA	0.79	NA	32.0	0.18	0.17	NA	NA	81.0	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	NA	2.0 U	NA	0.05 U	NA	2.0 U	0.044 J	2.0	NA	NA	0.17	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	2.0 U	NA	0.1 U	NA	2.0 U	0.02 J	2.0	NA	NA	0.10 U	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	NA	2.0 U	NA	0.05 U	NA	2.0 U	0.035 J	2.5	NA	NA	0.04 J	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	3.0 U	NA	3.00 U	NA	3.0 U	0.980 U	1.0 U	3.0 U	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	2.0 U	NA	0.05 U	NA	2.0 U	0.10 U	0.37	NA	NA	0.05 U	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	2.0 U	NA	0.1 U	NA	2.0 U	0.098 U	1.1	NA	NA	0.1 U	NA	NA	NA
Naphthalene	µg/L	115	2,400	3,300	291	46	1,140	1,800	0.70	4.9	16.3	19,000	3,800	250 U	1,000 U	1.0 U
Benzene	µg/L	100	180	13	277	100	97	230	42.1	369	3.4	10,600	4,400	29,000	630,000	7.3
Ethylbenzene	µg/L	100	5.7 J	2.2 J	5.0 U	0.3 J	2.5 J	3.5 J	1.00 U	0.94 J	1.0 U	727	580	120 U	330 J	0.5 U
Toluene	µg/L	10,000	170	7.0 J	11.4	1.0	20.9	44.0	1.00 U	1.0 U	0.61 J	7,930	5,300	140 J	57,000	0.98
Xylenes	µg/L	1,000	82.0 J	38.0	6.9 J	1.9 J	18.5	30.0	3.00 U	3.0 U	3.0 U	7,790	8,100	250 U	7,500	0.81 J

Final Remedial Goal (RG) Exceedance

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NA: Not Analyzed

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COC: Contaminant of Concern

Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO27-PZM012					CO27-PZM046					CO28-PZM010		CO28-PZM048		
			8/9/2023	11/13/2023	3/4/2024	8/13/2024	12/17/2024	8/9/2023	11/14/2023	3/4/2024	8/13/2024	12/17/2024	6/9/2015	5/24/2023	6/9/2015	5/24/2023	2/11/2025
Groundwater Zone:			Shallow					Intermediate					Shallow		Intermediate		
Location:			Shoreline					Shoreline					Shoreline		Shoreline		
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	537.6
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.30	NA	30.1	NA	NA
Benz[a]anthracene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.10 U	NA	0.11 U	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.06 U	NA	0.063 U	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.17 U	NA	0.17 U	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13 U	NA	0.24 J	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA	0.11 U	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.13 U	NA	0.13 U	NA	NA
Naphthalene	µg/L	115	470	1,100	760	570	450	910	1,000	750	700	840	627	1.0 U	1,250 B	1,600	NA
Benzene	µg/L	100	5,500	13,000	10,000	10,000	7,900	19,000	50,000	52,000	14,000	11,000	20,900	0.19 J	291,000	93,000	NA
Ethylbenzene	µg/L	100	64.0	170	110	120	84	180	260	280	140	140	36.6	0.5 U	525	260 J	NA
Toluene	µg/L	10,000	1,100	4,900	3,500	2,700	2,600	4,200	5,000	6,600	4,600	4,000	1,080	0.8 U	34,300	1,900	NA
Xylenes	µg/L	1,000	480	1,400	940	920	700	1,400	1,600	1,800	1,200	1,200	436	1.0 U	6,610	4,800	NA

Final Remedial Goal (RG) Exceedance
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NA: Not Analyzed

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO29-PZM010			CO29-PZM051		CO30-PZM015							CO30-PZM060		
			6/9/2015	12/19/2019	12/18/2024	6/9/2015	12/19/2019	8/11/2023	11/8/2023	3/8/2024	6/6/2024	8/12/2024	11/20/2024	2/10/2025	5/19/2023	6/6/2024	2/10/2025
Groundwater Zone:			Shallow			Intermediate		Shallow							Intermediate		
Location:			Shoreline			Shoreline		Shoreline							Shoreline		
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.30	NA	NA	78.7
1,1 -Biphenyl	µg/L	100	NA	NA	13.0	NA	NA	NA	NA	NA	NA	NA	NA	11.0	NA	NA	2.0 U
2-Methylnaphthalene	µg/L	400	12.1	NA	22.0	0.18 U	NA	NA	NA	NA	NA	NA	NA	54	NA	NA	0.1 U
Benz[a]anthracene	µg/L	1.00	0.11 U	NA	2.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.08	NA	NA	0.05 U
Benzo[a]pyrene	µg/L	0.16	0.064 U	NA	2.0 U	0.062 U	NA	NA	NA	NA	NA	NA	NA	0.04 J	NA	NA	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.17 U	NA	2.0 U	0.16 U	NA	NA	NA	NA	NA	NA	NA	0.05	NA	NA	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.00	0.27 J	NA	3.0 U	0.12 U	NA	NA	NA	NA	NA	NA	NA	3.0 U	NA	NA	3.0 U
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	2.0 U	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.05 U	NA	NA	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.13 U	NA	2.0 U	0.13 U	NA	NA	NA	NA	NA	NA	NA	0.1 U	NA	NA	0.1 U
Naphthalene	µg/L	115	193	573	700	2.0	14.2	2,300	2,000	2,100	1,800	1,400	1,800	3,300	1.0 U	5.3	0.2
Benzene	µg/L	100	15.1 J	13.8	26.0	0.29 J	1.8	56,000	40,000	34,000	32,000	23,000	38,000	NA	7.5	99.0	NA
Ethylbenzene	µg/L	100	7.5 U	1.9	2.0	0.30 U	1.0 U	110 J	72.0 J	76.0 J	75.0 J	45.0 J	76.0 J	NA	0.5 U	0.3 J	NA
Toluene	µg/L	10,000	6.5 U	5.2	7.4	0.26 U	0.4 J	4,000	3,000	2,700	2,600	1,900	3,200	NA	0.8 U	6.7	NA
Xylenes	µg/L	1,000	16.5 U	14.7	15.0	0.66 U	3.0 U	1,300 J	920	910	950	510 J	990	NA	1.0 U	3.3 J	NA

Final Remedial Goal (RG) Exceedance
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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO32-PZM004		CO32-PZM041		CO36-PZM008	CO36-PZM043	CO37-PZM003			CO37-PZM038			CO38-PZM006	CO38-PZM043	CO39-PZM007	CO39-PZM042
			6/11/2015	3/29/2020	6/9/2015	3/16/2020	8/10/2023	8/10/2023	8/8/2023	11/20/2023	3/12/2024	8/8/2023	11/20/2023	3/11/2024	8/8/2023	8/8/2023	8/8/2023	8/8/2023
Groundwater Zone:			Shallow		Intermediate		Shallow	Intermediate	Shallow			Intermediate			Shallow	Intermediate	Shallow	Intermediate
Location:							Shoreline	Shoreline	Shoreline			Shoreline						
Arsenic	µg/L	40	NA	5.7	NA	5.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	0.9 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	0.18 U	NA	0.20 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	0.11 U	NA	0.12 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	0.063 U	NA	0.069 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	0.16 U	NA	0.18 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	0.13 U	NA	0.23 J	0.990 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	0.12 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.13 U	NA	0.14 U	0.099 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	0.19 U	NA	0.32 J	0.690	530	550	9.1	200	75	1,500	1,100	1,300	590	1.0 U	240	870
Benzene	µg/L	100	0.35 J	12.9	0.25 U	1.0 U	15,000	16,000	24.0	4,200	66	12,000	12,000	17,000	2,800	0.71	380	4,200
Ethylbenzene	µg/L	100	0.30 U	1.0 U	0.30 U	1.0 U	60.0	46.0 J	2.9	25.0	5.3	210	180	230	29.0	0.5 U	2.2	49.0
Toluene	µg/L	10,000	0.26 U	0.6 J	0.26 U	1.0 U	3,200	2,100	42.0	1,200	52.0	6,300	6,000	7,800	470	0.75 U	43.0	1,400
Xylenes	µg/L	1,000	0.66 U	3.0 U	0.66 U	3.0 U	970	660	30.0	340	77.0	1,800	1,500	2,000	200	0.70 J	12.0	390

Final Remedial Goal (RG) Exceedance

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO40-PZM008	CO41-PZM001						CO41-PZM036						
			8/9/2023	6/9/2015	8/2/2023	11/14/2023	3/4/2024	6/7/2024	8/13/2024	12/16/2024	6/9/2015	8/2/2023	11/14/2023	3/4/2024	6/7/2024	8/13/2024	12/17/2024
Groundwater Zone:			Shallow	Shallow							Shallow						
Location:																	
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	NA	8.3	NA	NA	NA	NA	NA	NA	4.2	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	NA	0.11 U	NA	NA	NA	NA	NA	NA	0.1 U	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	0.063 U	NA	NA	NA	NA	NA	NA	0.06 U	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	NA	0.16 U	NA	NA	NA	NA	NA	NA	0.19 J	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	NA	0.13 U	NA	NA	NA	NA	NA	NA	0.54 J	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	0.11 U	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	NA	0.13 U	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	150	326	11	49.0 J	0.3 J	3.1 J	10.0 J	330	181	770 J	390 J	260 J	580 J	2,000 U	2,500 U
Benzene	µg/L	100	740	76,200	690	11,000	56	550	2,000	35,000	616,000	290,000	180,000	290,000	290,000	320,000	280,000
Ethylbenzene	µg/L	100	5.6	990	14.0	130	1.7	3.0	27.0	760	1,260	990 J	520	970	740 J	1,100	830 J
Toluene	µg/L	10,000	110	42,600	180	3,200	7.5	29.0	590	18,000	138,000	94,000	57,000	100,000	84,000	100,000	90,000
Xylenes	µg/L	1,000	44	16,300	110	1,300	3.6 J	13.0 J	240	8,600	30,000	18,000	10,000	19,000	13,000	21,000	17,000

Final Remedial Goal (RG) Exceedance

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO42-PZM004				CO43-PZM048	CO44-PZM048	CO45-PZM047	CO46-PZM047	CO47-PZM046	CO48-PZM044	CO79-PZM	CO88-PZM		
			6/9/2015	5/25/2023	11/20/2023	3/4/2024	6/30/2022	6/30/2022	6/30/2022	6/30/2022	6/30/2022	6/30/2022	6/9/2015	6/9/2015	10/8/2019	9/17/2024
Groundwater Zone:			Shallow				Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Shallow	Shallow		
Location:							Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline				
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	6.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 J	6.2	NA	NA
Benz[a]anthracene	µg/L	1.00	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.5 J	0.11 U	NA	NA
Benzo[a]pyrene	µg/L	0.16	0.063 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.6 J	0.062 U	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	0.16 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6	0.16 U	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U	0.12 U	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0 U	0.11 U	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.2 J	0.13 U	NA	NA
Naphthalene	µg/L	115	94.8	65	170	1.0 U	39.0 J	7.2	1.0	820	990	1,200	9.3	172	719	1,400
Benzene	µg/L	100	650	140	580	0.78	4,200	300	85	24,000	22,000	20,000	1,380	166,000	207,000	86,000
Ethylbenzene	µg/L	100	103	19	56	0.5 U	8.0 J	1.0 J	0.2 J	280	290	340	7.5 U	535	378	310 J
Toluene	µg/L	10,000	1,310	160	190	0.7 J	30.0 U	2.3	0.2 J	6,500	6,600	10,000	43.3	10,600	1,300	330 J
Xylenes	µg/L	1,000	908	140	290	1.0 U	25.0 J	4.3 J	1.0 U	1,900	2,200	2,500	33.0 J	4,060	2,600	1,700 J

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO93-PZM							COA-MW-003	COA-MWI-004	COA-MWI-006	COA-MWI-007	COA-MWI-009	COA-MWI-011	COA-MWS-004
			6/9/2015	8/15/2023	11/27/2023	3/12/2024	6/18/2024	8/13/2024	12/10/2024	6/5/2024	6/5/2024	11/12/2024	11/11/2024	11/11/2024	11/11/2024	6/5/2024
Groundwater Zone:			Shallow							Shallow	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Shallow
Location:													Shoreline		Shoreline	
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	27.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	1.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	1.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	3.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.00	1.0 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.31 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	1,740	1,900 J	2,100	1,700	1,900	1,700	1,700	270	2,900	100 J	1,900	900	830	3,700
Benzene	µg/L	100	302,000	170,000	180,000	140,000	200,000	170,000	130,000	1,200	16,000	18,000	1,300	940	680	16,000
Ethylbenzene	µg/L	100	2,970	1,500	1,400	1,000	1,400	1,200	1,200	7.5	400	63.0 J	39.0	1.3 J	1.4 J	460
Toluene	µg/L	10,000	51,800	58,000	57,000	50,000	65,000	59,000	40,000	38.0	8,800	1,200	950	140	110	9,200
Xylenes	µg/L	1,000	37,000	16,000	17,000	12,000	17,000	15,000	13,000	45.0	4,700	740	450	25.0	22.0	5,500

Final Remedial Goal (RG) Exceedance

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Table 29A - Final Remedial Goals Groundwater Exceedances (GAA B, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP22-MWI	CP22-MWS		CP23-MWI	CP23-MWS		TS06-PPM008
			2/28/2020	2/28/2020	12/19/2024	3/13/2020	3/13/2020	12/19/2024	6/11/2015
Groundwater Zone:			Intermediate	Shallow		Intermediate	Shallow		Shallow
Location:			Shoreline	Shoreline		Shoreline	Shoreline		Shoreline
Arsenic	µg/L	40	2.8 J	3.5 J	NA	3.8 J	3.7 J	NA	NA
1,1 -Biphenyl	µg/L	100	1.0 U	1.7	2.4	1.0 U	5.50	12.0	NA
2-Methylnaphthalene	µg/L	400	0.15	9.4	16.0	0.11	10.7	36.0	0.13 U
Benz[a]anthracene	µg/L	1.00	0.098 U	0.24	0.34 J	0.099 U	0.098 U	2.0 U	0.21 U
Benzo[a]pyrene	µg/L	0.16	0.013 J	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.20 U
Benzo[b]fluoranthene	µg/L	1.00	0.098 U	0.032 J	2.0 U	0.099 U	0.098 U	2.0 U	0.20 U
bis(2-Ethylhexyl)phthalate	µg/L	1.00	0.980 U	0.980 U	3.0 U	0.990 U	0.980 U	3.0 U	0.16 U
Dibenz[a,h]anthracene	µg/L	0.16	0.098 U	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.17 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.098 U	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.14 U
Naphthalene	µg/L	115	1.4	424	440	0.85	898	880	3.4 J
Benzene	µg/L	100	1.0 U	78.8	55.0	1.0 U	55.3	51.0	7.30 J
Ethylbenzene	µg/L	100	1.0 U	1.0	0.77 J	1.0 U	4.0 J	4.2	10.00 U
Toluene	µg/L	10,000	1.0 U	6.3	6.5	1.0 U	33.5	35.0	2.9 J
Xylenes	µg/L	1,000	3.0 U	16.2	11.0	3.0 U	58.0	62.0	20.0 U

Final Remedial Goal (RG) Exceedance
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29B - Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO101-PZM	CO104-PZM	CO121-PZM			CO177-MWI	CO177-MWS	CO178-MWI		CO178-MWS		CO179-MWI	CO179-MWS	CO180-MWI	
			12/17/2020	12/17/2020	6/10/2015	10/8/2019	9/19/2024	9/27/2019	9/27/2019	10/14/2019	2/11/2025	10/11/2019	2/11/2025	10/2/2019	6/13/2023	5/23/2023	2/11/2025
Groundwater Zone:			Shallow	Shallow	Shallow			Shallow	Shallow	Intermediate		Shallow		Intermediate	Shallow	Intermediate	
Location:			Shoreline	Shoreline	Shoreline			Shoreline	Shoreline	Shoreline		Shoreline		Shoreline	Shoreline	Shoreline	
Iron	µg/L	22,500	NA	NA	NA	NA	NA	NA	NA	NA	500 U	NA	500 U	NA	NA	NA	500 U
Benzo[a]pyrene	µg/L	0.16	NA	NA	0.063 U	NA	NA	NA	NA	NA	0.1 U	NA	0.05 J	NA	NA	NA	0.03 J
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	0.11 U	NA	NA	NA	NA	NA	0.05 U	NA	0.05 U	NA	NA	NA	0.03 J
Pyrene	µg/L	13	NA	NA	0.052 U	NA	NA	NA	NA	NA	0.07 J	NA	0.25	NA	NA	NA	NA
Toluene	µg/L	735	385	1.0 U	1,650	1,100	1,400	19.5	147	5,820	NA	7,920	NA	13,000	2,800	3,900	NA

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29B - Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO180-MWS		CO181-MWI	CO181-MWS	CO198-MWS				CO199-MWS	CO200-MWS	CO201-MWS				CO202-MWS
			5/23/2023	2/11/2025	5/24/2023	5/24/2023	5/19/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019	9/30/2019	5/31/2023	11/8/2023	6/6/2024	12/13/2024	9/30/2019
Groundwater Zone:			Shallow		Intermediate	Shallow	Shallow				Shallow	Shallow	Shallow				Shallow
Location:			Shoreline		Shoreline	Shoreline	Shoreline				Shoreline	Shoreline	Shoreline				Shoreline
Iron	µg/L	22,500	NA	500 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	0.05 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	µg/L	13	NA	0.31	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	735	4,700	NA	5,500	6,300	42.0	79.0	72.0	55	2,650	2,840	79.0	6.9	2.0	27	134

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29B - Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO209-MWI			CO209-MWS			CO210-MWI			CO210-MWS			CO27-PZM012				
			6/2/2023	12/18/2024	2/10/2025	6/2/2023	12/18/2024	2/10/2025	2/5/2020	12/20/2024	2/10/2025	2/5/2020	12/18/2024	2/10/2025	8/9/2023	11/13/2023	3/4/2024	8/13/2024	12/17/2024
Groundwater Zone:			Intermediate			Shallow			Intermediate			Shallow			Shallow				
Location:			Shoreline			Shoreline			Shoreline			Shoreline			Shoreline				
Iron	µg/L	22,500	NA	NA	50.0 U	NA	NA	81.3	NA	NA	80.3	NA	NA	57.2	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	2.0 U	NA	NA	2.0 U	NA	NA	0.1 U	NA	NA	2.0 U	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	2.0 U	NA	NA	2.0 U	NA	NA	0.05 U	NA	NA	2.0 U	NA	NA	NA	NA	NA	NA
Pyrene	µg/L	13	NA	2.0 U	NA	NA	1.4 J	NA	NA	0.1 U	NA	NA	2.0 U	NA	NA	NA	NA	NA	NA
Toluene	µg/L	735	340	5.1 J	NA	170	7.0 J	NA	11.4	1.0	NA	20.9	44.0	NA	1,100	4,900	3,500	2,700	2,600

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29B - Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO27-PZM046					CO28-PZM010			CO28-PZM048			CO29-PZM010				CO29-PZM051	
			8/9/2023	11/14/2023	3/4/2024	8/13/2024	12/17/2024	6/9/2015 & 6/10/2015	5/24/2023	2/11/2025	6/9/2015	5/24/2023	2/11/2025	6/9/2015	6/10/2015	12/19/2019	12/18/2024	6/9/2015	12/19/2019
Groundwater Zone:			Intermediate					Shallow			Intermediate			Shallow				Intermediate	
Location:			Shoreline					Shoreline			Shoreline			Shoreline				Shoreline	
Iron	µg/L	22,500	NA	NA	NA	NA	NA	NA	NA	500 U	NA	NA	500 U	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	NA	NA	0.06 U	NA	NA	0.063 U	NA	NA	NA	0.064 U	NA	2.0 U	0.062 U	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	NA	NA	0.11 U	NA	NA	0.11 U	NA	NA	NA	0.11 U	NA	2.0 U	0.11 U	NA
Pyrene	µg/L	13	NA	NA	NA	NA	NA	0.051 U	NA	NA	0.052 U	NA	NA	NA	0.23 J	NA	2.0 U	0.051 U	NA
Toluene	µg/L	735	4,200	5,000	6,600	4,600	4,000	1,080	0.75 U	NA	34,300	1,900	NA	NA	6.5 U	5.2	7.4	0.26 U	0.39 J

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29B - Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO30-PZM015							CO30-PZM060			CO36-PZM008		CO36-PZM043	
			8/11/2023	11/8/2023	3/8/2024	6/6/2024	8/12/2024	11/20/2024	2/10/2025	5/19/2023	6/6/2024	2/10/2025	8/10/2023	2/13/2025	8/10/2023	2/13/2025
Groundwater Zone:			Shallow							Intermediate			Shallow		Intermediate	
Location:			Shoreline							Shoreline			Shoreline		Shoreline	
Iron	µg/L	22,500	NA	NA	NA	NA	NA	NA	57.9	NA	NA	50,100	NA	50.0 U	NA	500 U
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	NA	NA	NA	0.04 J	NA	NA	0.1 U	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	NA	NA	NA	0.05 U	NA	NA	0.05 U	NA	NA	NA	NA
Pyrene	µg/L	13	NA	NA	NA	NA	NA	NA	0.81	NA	NA	0.1 U	NA	NA	NA	NA
Toluene	µg/L	735	4,000	3,000	2,700	2,600	1,900	3,200	NA	0.75 U	6.7	NA	3,200	NA	2,100	NA

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29B - Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO37-PZM003				CO37-PZM038			CO43-PZM048	CO44-PZM048	CO45-PZM047	CO46-PZM047	CO47-PZM046	CO48-PZM044	COA-MWI-007	COA-MWI-011	CP22-MWI
			8/8/2023	11/20/2023	3/12/2024	2/14/2025	8/8/2023	11/20/2023	3/11/2024	6/30/2022	6/30/2022	6/30/2022	6/30/2022	6/30/2022	6/30/2022	11/11/2024	11/11/2024	2/28/2020
Groundwater Zone:			Shallow				Intermediate			Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
Location:			Shoreline				Shoreline			Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline
Iron	µg/L	22,500	NA	NA	NA	50.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	205,000
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.013 J
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.098 U
Pyrene	µg/L	13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.055 J
Toluene	µg/L	735	42.0	1,200	52.0	NA	6,300	6,000	7,800	30.0 U	2.3	0.24 J	6,500	6,600	10,000	950	110	1.0 U

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29B - Final Remedial Goals Groundwater Exceedances (GAA B, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CP22-MWS		CP23-MWI	CP23-MWS		TS06-PPM008
			2/28/2020	12/19/2024	3/13/2020	3/13/2020	12/19/2024	6/11/2015
Groundwater Zone:			Shallow		Intermediate	Shallow		Shallow
Location:			Shoreline		Shoreline	Shoreline		Shoreline
Iron	µg/L	22,500	103	NA	11,600	70.0 U	NA	NA
Benzo[a]pyrene	µg/L	0.16	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.20 U
Dibenz[a,h]anthracene	µg/L	0.16	0.098 U	2.0 U	0.099 U	0.098 U	2.0 U	0.17 U
Pyrene	µg/L	13	2.4	2.20	0.099 U	1.7	4.4	0.14 U
Toluene	µg/L	735	6.3	6.5	1.0 U	33.5	35.0	2.9 J

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 29C - GAA B Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Final RG (µg/L)	Statistics	
Sitewide Final RGs			
Arsenic	40	Max:	537.6
		Min:	1.298
		DF:	5.8%
		EF:	1.3%
1,1 -Biphenyl	100	Max:	110
		Min:	0.59
		DF:	8.8%
		EF:	0.44%
2-Methylnaphthalene	400	Max:	250
		Min:	0.05
		DF:	22%
		EF:	0.0%
Benz[a]anthracene	1.0	Max:	4.5
		Min:	0.014
		DF:	9%
		EF:	1.3%
Benzo[a]pyrene	0.16	Max:	2.4
		Min:	0.013
		DF:	7.6%
		EF:	3.6%
Benzo[b]fluoranthene	1.0	Max:	3.2
		Min:	0.015
		DF:	9.3%
		EF:	2.2%
bis(2-Ethylhexyl)phthalate	1.0	Max:	2.8
		Min:	0.23
		DF:	5.8%
		EF:	0.44%
Dibenz[a,h]anthracene	0.16	Max:	0.37
		Min:	0.03
		DF:	2.2%
		EF:	0.9%
Indeno[1,2,3-c,d]pyrene	1.0	Max:	1.4
		Min:	0.012
		DF:	4.0%
		EF:	0.9%
Naphthalene	115	Max:	64,100
		Min:	0.2
		DF:	89%
		EF:	67%
Benzene	100	Max:	710,000
		Min:	0.19
		DF:	93%
		EF:	76%

Table 29C - GAA B Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area A COCs	Final RG (µg/L)	Statistics	
Ethylbenzene	100	Max:	2,970
		Min:	0.21
		DF:	80%
		EF:	32%
Toluene	10000	Max:	138,000
		Min:	0.24
		DF:	87%
		EF:	16%
Xylenes	1000	Max:	37,000
		Min:	0.35
		DF:	80%
		EF:	31%
Shoreline Final RGs			
Iron	22,500	Max:	205,000
		Min:	57.2
		DF:	8.0%
		EF:	2.0%
Benzo[a]pyrene	0.16	Max:	0.05
		Min:	0.013
		DF:	4.0%
		EF:	0.0%
Dibenz[a,h]anthracene	0.16	Max:	0.03
		Min:	0.03
		DF:	1.0%
		EF:	0.0%
Pyrene	13	Max:	4.4
		Min:	0.055
		DF:	12.0%
		EF:	0.0%
Toluene	735	Max:	34,300
		Min:	0.24
		DF:	76%
		EF:	42%

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
RG: Remedial Goal
DF: Detection Frequency
EF: Exceedance Frequency

No Final RG Exceedance
Final RG Exceedance

Notes:
(a) Maximum and minimum values presented in µg/L.
(b) EF and DF presented in percentage.

Table 30A - Final Remedial Goals Groundwater Exceedances (GAA C, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	B18-007-PZ	B18-044-PZ	B18-046-PZ	B18-061-PZ	B18-077-PZ	B18-078-PZ	B18-079-PZ	B18-080-PZ	B18-081-PZ	B18-082-PZ
			12/13/2016	11/30/2018	11/29/2018	12/13/2016	11/29/2018	11/30/2018	11/29/2018	11/28/2018	11/28/2018	11/29/2018
Groundwater Zone:			Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow
Location:												
Arsenic	µg/L	40	5.0 U	NA	NA	5.0 U	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	1.4	30.3	3.4	1 U	0.98 U	3.1	7.3	7.1	10.6	44.4 J
2-Methylnaphthalene	µg/L	400	11.5	582	66.3	0.028 J	0.098 U	16.5	138	85.9	206	508
Benz[a]anthracene	µg/L	1.00	0.043 J	41.8	0.098 U	0.1 U	0.098 U	0.095 J	0.11	1.6	1.6	0.28
Benzo[a]pyrene	µg/L	0.16	0.01 J	24.2	0.098 U	0.1 U	0.098 U	0.029 J	0.014 J	1.2	1.2	0.16
Benzo[b]fluoranthene	µg/L	1.00	0.1 U	15.1	0.098 U	0.1 U	0.098 U	0.058 J	0.099 U	1.8	1.7	0.48
Bis(2-Ethylhexyl)phthalate	µg/L	1.00	1 U	9.8 U	0.98 U	1 U	0.3 J	0.98 U	0.99 U	0.25 J	0.98 U	49 U
Dibenz[a,h]anthracene	µg/L	0.16	0.1 U	2.9 J	0.098 U	0.1 U	0.098 U	0.098 U	0.099 U	0.25	0.20	0.098 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.1 U	3.7 J	0.098 U	0.1 U	0.098 U	0.098 U	0.099 U	0.52	0.5	0.075 J
Naphthalene	µg/L	115	411	159	314	0.48	0.043 J	127	1,310	587	2,520	15,300
Benzene	µg/L	100	67.2	6.6	6.4	1 U	1 U	2.9	22	41.4	55.9	2,440
Ethylbenzene	µg/L	100	1.8	4.6	1.2	1 U	1 U	0.64 J	1.6	2.0	5.8	149
Toluene	µg/L	10,000	30.1	3.6	9.2	1 U	1 U	3.9	21.1	28.3	52.1	1,520
Xylenes	µg/L	1,000	29.3	16.8	23.6	3 U	3 U	10.1	33.8	41	102	2,010

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 30A - Final Remedial Goals Groundwater Exceedances (GAA C, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	B18-083-PZ	BA-81-7945	BA-81-7946	COA-MW-001	COA-MW-002	SW-085-MWS	SW-086-MWS	SW13-PZM003	SW13-PZM025	SW13-PZM111
			11/28/2018	11/30/2018	11/29/2018	6/5/2024	6/5/2024	11/28/2018	11/28/2018	3/28/2016	2/19/2016	12/9/2015
Groundwater Zone:			Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Intermediate	Deep
Location:								Shoreline	Shoreline			
Arsenic	µg/L	40	NA	NA	NA	0.85	NA	1.68	NA	5.0 U	7.80	5.0 U
1,1 -Biphenyl	µg/L	100	1 U	0.98 U	12.1 J	NA	NA	0.99 U	0.83 J	1.2	1 U	1 U
2-Methylnaphthalene	µg/L	400	0.15	0.098 U	228	NA	NA	92.4	281	12.2	0.1 U	0.1
Benz[a]anthracene	µg/L	1.00	0.1 U	0.098 U	0.28	NA	NA	6.0	0.59	0.33	0.1 U	0.1 U
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.015 U	0.098	NA	NA	5.2	0.32	0.04 J	0.1 U	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.1 U	0.098 U	0.17	NA	NA	7.5	0.54	0.11	0.1 U	0.1 U
Bis(2-Ethylhexyl)phthalate	µg/L	1.00	0.2 J	0.98 U	48.8 U	NA	NA	0.39 J	0.98 U	1 U	1 UJ	1.1
Dibenz[a,h]anthracene	µg/L	0.16	0.1 U	0.098 U	0.098 U	NA	NA	0.52	0.028 J	0.1 U	0.1 U	0.1 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.00	0.1 U	0.098 U	0.098 U	NA	NA	1.2	0.13	0.1 U	0.1 U	0.1 U
Naphthalene	µg/L	115	0.63	0.067 J	3,860	13,000	230	90.4	625	169	0.1 U	0.14
Benzene	µg/L	100	1 U	1 U	91.5	3,500	66	8.2	25.3	20.4	1 U	1 U
Ethylbenzene	µg/L	100	1 U	1 U	7.9	210	1.1	2.2	3.5	2.0	1 U	1 U
Toluene	µg/L	10,000	1 U	1 U	69.8	2,600	14.0	1.5	2.1	35.6	1 U	1 U
Xylenes	µg/L	1,000	3 U	3 U	97.2	2,100	15.0	6.6	10.1	47.7	3 U	3 U

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 30B - Final Remedial Goals Groundwater Exceedances (GAA C, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	SW-085-MWS	SW-086-MWS
			11/28/2018	11/28/2018
		Groundwater Zone:	Shallow	Shallow
		Location:	Shoreline	Shoreline
Iron	µg/L	22,500	63.9	NA
Benzo[a]pyrene	µg/L	0.16	5.2	0.32
Dibenz[a,h]anthracene	µg/L	0.16	0.52	0.028 J
Pyrene	µg/L	13	18.2	3.6
Toluene	µg/L	735	1.5	2.1

Final Remedial Goal (RG) Exceedance (Shoreline)

J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 30C - GAA C Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area C COCs	Final RG (µg/L)	Statistics	
Sitewide Final RGs			
Arsenic	40	Max:	7.8
		Min:	0.8526
		DF:	15%
		EF:	0.0%
1,1 -Biphenyl	100	Max:	44.4
		Min:	0.83
		DF:	55%
		EF:	0%
2-Methylnaphthalene	400	Max:	582
		Min:	0.028
		DF:	75%
		EF:	10%
Benz[a]anthracene	1.0	Max:	41.8
		Min:	0.043
		DF:	55%
		EF:	20%
Benzo[a]pyrene	0.16	Max:	24.2
		Min:	0.01
		DF:	55%
		EF:	25%
Benzo[b]fluoranthene	1.0	Max:	15.1
		Min:	0.058
		DF:	45%
		EF:	20%
bis(2-Ethylhexyl)phthalate	1.0	Max:	1.1
		Min:	0.2
		DF:	25%
		EF:	5.0%
Dibenz[a,h]anthracene	0.16	Max:	2.9
		Min:	0.028
		DF:	25%
		EF:	20%
Indeno[1,2,3-c,d]pyrene	1.0	Max:	3.7
		Min:	0.075
		DF:	30%
		EF:	10%
Naphthalene	115	Max:	15300
		Min:	0.043
		DF:	95%
		EF:	65%
Benzene	100	Max:	3500
		Min:	2.9
		DF:	70%
		EF:	10%

Table 30C - GAA C Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area C COCs	Final RG (µg/L)	Statistics	
Ethylbenzene	100	Max:	210
		Min:	0.64
		DF:	70%
		EF:	10%
Toluene	10000	Max:	2600
		Min:	1.5
		DF:	70%
		EF:	0.0%
Xylenes	1000	Max:	2100
		Min:	6.6
		DF:	70%
		EF:	10%
Shoreline Final RGs			
Iron	22,500	Max:	63.9
		Min:	63.9
		DF:	100%
		EF:	0%
Benzo[a]pyrene	0.16	Max:	5.2
		Min:	0.32
		DF:	100%
		EF:	100%
Dibenz[a,h]anthracene	0.16	Max:	0.52
		Min:	0.028
		DF:	100%
		EF:	50%
Pyrene	13	Max:	18.2
		Min:	3.6
		DF:	100%
		EF:	50%
Toluene	735	Max:	2.1
		Min:	1.5
		DF:	100%
		EF:	0%

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
RG: Remedial Goal
DF: Detection Frequency
EF: Exceedance Frequency

No Final RG Exceedance
Final RG Exceedance

Notes:
(a) Maximum and minimum values presented in µg/L.
(b) EF and DF presented in percentage.

Table 31A - Final Remedial Goals Groundwater Exceedances (GAA D, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	B18-070-PZ	B18-070R-MWS	B18-071-PZ	B18-072-PZ	B18-074-PZ	B18-075-PZ	B18-076-PZ	CO04-PZM048			CO05A-PZM		
			12/14/2016	12/27/2024	12/14/2016	12/14/2016	12/14/2016	12/14/2016	12/13/2016	6/10/2015	3/10/2020	2/13/2025	5/19/2021	11/5/2024	2/13/2025
Groundwater Zone:			Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Intermediate			Shallow		
Location:															
Arsenic	µg/L	40	5 U	3.36	7.20	5 U	5 U	5 U	5 U	NA	NA	0.566	NA	NA	9.51
1,1 -Biphenyl	µg/L	100	1.00 U	NA	1.00 U	1.00 U	0.49 J	1.00 U	1.00 U	NA	NA	NA	NA	28.0	NA
2-Methylnaphthalene	µg/L	400	0.30 J	NA	0.10 UJ	0.10 U	3.50	0.21	0.10 U	0.18 U	NA	NA	506 J	350	NA
Benz[a]anthracene	µg/L	1.00	0.063 B	NA	0.026 B	0.10 U	0.067 B	0.07 J	0.034 B	0.48 J	NA	NA	94.8 U	5.00 U	NA
Benzo[a]pyrene	µg/L	0.16	0.013 J	NA	0.014 J	0.10 U	0.049 J	0.024 J	0.0093 J	0.063 U	NA	NA	2.50	10.0 U	NA
Benzo[b]fluoranthene	µg/L	1.00	0.018 J	NA	0.10 U	0.10 U	0.031 J	0.028 J	0.10 U	0.26 J	NA	NA	2.10	5.0 U	NA
Bis(2-Ethylhexyl)phthalate	µg/L	1.0	1.00 U	NA	0.59 J	1.00 U	1.00 J	1.00 U	0.22 J	0.22 J	NA	NA	NA	3.0 U	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.10 UJ	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.11 U	NA	NA	0.33	5.0 U	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.10 UJ	NA	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.13 U	NA	NA	1.20	10.0 U	NA
Naphthalene	µg/L	115	0.13	NA	0.019 B	0.064 B	3.00	1.60	0.049 B	0.19 U	8.80 J	NA	16,600	8,700	NA
Benzene	µg/L	100	0.55 J	NA	1.00 U	1.00 U	2.80	1.00 U	1.00 U	NA	4.30 J	NA	1,330	1,200	NA
Ethylbenzene	µg/L	100	1.00 U	NA	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	NA	5.00 U	NA	71.8	53.0	NA
Toluene	µg/L	10,000	1.0 U	NA	0.48 J	1.0 U	1.0 U	1.0 U	1.0 U		5.00 U	NA	597	420.0	NA
Xylenes	µg/L	1,000	3.00 U	NA	3.00 U	3.00 U	3.00 U	3.00 U	3.00 U	NA	15.00 U	NA	1,080	600	NA

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 31A - Final Remedial Goals Groundwater Exceedances (GAA D, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO05B-PZM	CO05C-PZM	CO05-PZM006	CO10-PZM006	CO20-PZM004		CO212A-PZM	CO216-MWS	SW-030-MWS	SW14-PZM004
			5/20/2021	5/19/2021	6/10 & 6/18/2015	6/11 & 6/18/2015	6/10/2015	6/18/2015	5/20/2021	4/10/2020	2/1/2016	3/31/2016
Groundwater Zone:			Shallow	Shallow	Shallow	Shallow	Shallow		Shallow	Shallow	Shallow	Shallow
Location:						Shoreline						
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	4.5 B	4.7 J
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	1.00 U	2.20
2-Methylnaphthalene	µg/L	400	236 J	9.40 UJ	63.8	1.00 U	NA	12.10	0.055 J	NA	0.10 U	12.80 J
Benz[a]anthracene	µg/L	1.00	11.0 J	0.58	0.57 J	1.00 U	NA	0.53 J	0.094 U	NA	0.10 U	0.33
Benzo[a]pyrene	µg/L	0.16	5.80 J	0.47	0.27 J	1.00 U	NA	1.00 U	0.094 U	NA	0.10 U	0.035 J
Benzo[b]fluoranthene	µg/L	1.00	5.90 J	0.43	0.54 J	1.00 U	NA	0.19 J	0.094 U	NA	0.10 U	0.089 J
Bis(2-Ethylhexyl)phthalate	µg/L	1.0	NA	NA	0.29 J	1.00 U	NA	1.00 U	NA	NA	1.00 U	1.00 U
Dibenz[a,h]anthracene	µg/L	0.16	0.68 J	0.067	1.00 U	1.00 U	NA	1.00 U	0.066 U	NA	0.10 U	0.10 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	2.60	0.28	1.00 U	1.00 U	NA	1.00 U	0.094 U	NA	0.10 U	0.10 U
Naphthalene	µg/L	115	12,500	7.40 J	2,810	1.90	NA	231 B	1.20	2,850	0.027 B	49.5
Benzene	µg/L	100	2,550	3.80	1,850	0.32 J	70.9	NA	1.00 U	53.4	1.00 U	1.00 U
Ethylbenzene	µg/L	100	163	1.00	109	1.00 U	25.0 U	NA	1.00 U	2.40 J	1.00 U	1.00 U
Toluene	µg/L	10,000	176	0.47 J	464	0.26 U	6.50 U	NA	1.00 U	4.60 J	1.00 U	1.00 U
Xylenes	µg/L	1,000	296	3.00 U	483	2.00 U	50.00 U	NA	3.00 U	10.30 J	3.00 U	3.00 U

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 31B - Final Remedial Goals Groundwater Exceedances (GAA D, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO10-PZM006	
			6/11 & 6/18/2015	
		Groundwater Zone:	Shallow	
		Location:	Shoreline	
Iron	µg/L	22,500	NA	
Benzo[a]pyrene	µg/L	0.16	1.00	U
Dibenz[a,h]anthracene	µg/L	0.16	1.00	U
Pyrene	µg/L	13	0.052	U
Toluene	µg/L	735	0.26	U

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 31C - GAA D Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area D COCs	Final RG (µg/L)	Statistics	
Sitewide Final RGs			
Arsenic	40	Max:	9.511
		Min:	0.5655
		DF:	26%
		EF:	0.0%
1,1 -Biphenyl	100	Max:	28
		Min:	0.49
		DF:	13%
		EF:	0.0%
2-Methylnaphthalene	400	Max:	506
		Min:	0.055
		DF:	43%
		EF:	4.3%
Benz[a]anthracene	1.0	Max:	11
		Min:	0.026
		DF:	48%
		EF:	4.3%
Benzo[a]pyrene	0.16	Max:	5.8
		Min:	0.0093
		DF:	43%
		EF:	17%
Benzo[b]fluoranthene	1.0	Max:	5.9
		Min:	0.018
		DF:	43%
		EF:	8.7%
bis(2-Ethylhexyl)phthalate	1.0	Max:	1.0
		Min:	0.22
		DF:	22%
		EF:	4.3%
Dibenz[a,h]anthracene	0.16	Max:	0.68
		Min:	0.067
		DF:	13%
		EF:	8.7%
Indeno[1,2,3-c,d]pyrene	1.0	Max:	2.6
		Min:	0.28
		DF:	13%
		EF:	8.7%
Naphthalene	115	Max:	16600
		Min:	0.019
		DF:	78%
		EF:	26%

Table 31C - GAA D Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area D COCs	Final RG (µg/L)	Statistics	
Benzene	100	Max:	2550
		Min:	0.32
		DF:	48%
		EF:	17%
Ethylbenzene	100	Max:	163
		Min:	1.0
		DF:	26%
		EF:	8.7%
Toluene	10000	Max:	597
		Min:	0.47
		DF:	30%
		EF:	0.0%
Xylenes	1000	Max:	1080
		Min:	10.3
		DF:	22%
		EF:	4.3%

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
RG: Remedial Goal
DF: Detection Frequency
EF: Exceedance Frequency

No Final RG Exceedance
Final RG Exceedance

Notes:
(a) Maximum and minimum values presented in µg/L.
(b) EF and DF presented in percentage.
(c) There is only one shoreline monitoring well (and no exceedances); no statistics were calculated for shoreline receptors.

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO203-MWS		CO204-MWS	CO205-MWS	CO206R-MWS					CO207-MWS	CO208-MWS	CO23-PZM008						
			7/25/2023	2/10/2025	5/18/2023	7/25/2023	2/15/2024	6/7/2024	8/20/2024	11/4/2024	2/11/2025	7/26/2023	10/10/2019	6/10/2015	8/15/2023	11/15/2023	3/5/2024	6/7/2024	8/20/2024	11/19/2024
Groundwater Zone:			Shallow		Shallow	Shallow	Shallow					Shallow	Shallow	Shallow						
Location:			Shoreline			Shoreline						Shoreline	Shoreline							
Arsenic	µg/L	40	NA	1.50	NA	NA	NA	NA	NA	NA	1.99	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	11	NA	NA	NA	NA	NA	7.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	NA	91	NA	NA	NA	NA	NA	66	NA	NA	NA	27.5	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	NA	0.16	NA	NA	NA	NA	NA	0.35	NA	NA	NA	0.32	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	NA	0.04 J	NA	NA	NA	NA	NA	0.14	NA	NA	NA	0.063 U	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	NA	0.07	NA	NA	NA	NA	NA	0.17	NA	NA	NA	0.3 J	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.0	NA	3 U	NA	NA	NA	NA	NA	3 U	NA	NA	NA	1.5	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	0.05 U	NA	NA	NA	NA	NA	0.05 U	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	NA	0.1 U	NA	NA	NA	NA	NA	0.11	NA	NA	NA	0.13 U	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	4,600	2,900	6,900	2,400	2,900	2,300	1,800	1,800	NA	1,600	1,390	886	2,900	2,600	3,200	3,800	3,200	3,200
Benzene	µg/L	100	380	NA	760	380	140	230	260	440	NA	200	202	NA	320	320	410	840	390	380
Ethylbenzene	µg/L	100	9.8 J	NA	17 J	10	7.9	8.5 J	10	14	NA	9.7	9.9	NA	20	16	24	24	21	21
Toluene	µg/L	10,000	99	NA	460	110	51	87	110	260	NA	93	77	NA	70	150	220	540	190	210
Xylenes	µg/L	1,000	210	NA	440	230	200	190	210	330	NA	180	153	NA	320	270	390	420	360	350

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO24-PZM007								CO25-PZM008					
			6/10/2015	8/15/2023	11/15/2023	3/11/2024	6/7/2024	8/20/2024	11/19/2024	2/13/2025	5/18/2023	11/28/2023	3/5/2024	6/7/2024	8/20/2024	11/19/2024
Groundwater Zone:			Shallow													
Location:																
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	1.07	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	86.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	2.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	3.8	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.0	0.68	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.58 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	1,220	2,000	2,000	1,600	1,200	1,400	1,800	NA	15,000	14,000	17,000	14,000	13,000	15,000
Benzene	µg/L	100	NA	3.9 J	7.7	3.5 J	1,700	3.2 J	3.8 J	NA	1,400	1,000	950	830	1,100	980
Ethylbenzene	µg/L	100	NA	4.2 J	7	2.5 J	14	3.2 J	2.9 J	NA	32 J	25 J	28 J	24 J	36 J	32 J
Toluene	µg/L	10,000	NA	15 U	6 J	2.0	940	8 U	2.0	NA	1,100	940	870	730	1,000	940
Xylenes	µg/L	1,000	NA	20 U	14	10 U	250	3.4 J	10 U	NA	830	640	680	640	920	810

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO26-PZM007								CO26-PZM032			CO34-PZM048		CO35-PZM013	
			6/10/2015	8/14/2023	11/15/2023	3/5/2024	6/7/2024	8/14/2024	11/20/2024	2/10/2025	6/10/2015	8/3/2022	2/10/2025	6/10/2015	2/13/2025	6/11/2015	7/26/2023
Groundwater Zone:			Shallow								Intermediate			Intermediate		Shallow	
Location:			Shoreline								Shoreline					Shoreline	
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	1.10	NA	NA	2.31	NA	0.63	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	80.1	NA	NA	NA	NA	NA	NA	NA	0.18 U	NA	NA	0.18 U	NA	9.0	NA
Benz[a]anthracene	µg/L	1.00	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	0.11 U	NA	0.11 U	NA
Benzo[a]pyrene	µg/L	0.16	0.062 U	NA	NA	NA	NA	NA	NA	NA	0.062 U	NA	NA	1 U	NA	0.063 U	NA
Benzo[b]fluoranthene	µg/L	1.00	0.17 U	NA	NA	NA	NA	NA	NA	NA	0.16 U	NA	NA	0.17 U	NA	0.17 U	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.0	0.13 U	NA	NA	NA	NA	NA	NA	NA	1/0/1900	NA	NA	0.29	NA	0.27	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	NA	NA	NA	NA	NA	NA	0.11 U	NA	NA	0.11 U	NA	0.11 U	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.13 U	NA	NA	NA	NA	NA	NA	NA	0.13 U	NA	NA	0.13 U	NA	0.13 U	NA
Naphthalene	µg/L	115	400	400	660	400	2,600	800	1,200	NA	0.93	1.0 U	NA	0.56 J	NA	210	420
Benzene	µg/L	100	NA	120	240	39	210	160	210	NA	NA	0.5 U	NA	1 U	NA	109	110
Ethylbenzene	µg/L	100	NA	1.8	4.4	1.6 J	7.9 J	3.7 J	5.7	NA	NA	0.5 U	NA	1 U	NA	2.8 J	2.8
Toluene	µg/L	10,000	NA	41	100	23	130	79	110	NA	NA	0.75 U	NA	0.26 U	NA	23.5	21
Xylenes	µg/L	1,000	NA	38	93	36	190	79	120	NA	NA	1 U	NA	2 U	NA	38.4	38

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO35-PZM056		CO55-PZM000						CO56-PZP001					
			6/11/2015	3/12/2020	8/10/2023	11/16/2023	3/8/2024	6/7/2024	8/15/2024	11/20/2024	8/10/2023	11/15/2023	3/5/2024	6/7/2024	8/14/2024	11/20/2024
Groundwater Zone:			Intermediate		Shallow						Shallow					
Location:			Shoreline													
Arsenic	µg/L	40	NA	5.00 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	0.97 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	0.29 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	0.063 U	0.014 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	0.16 U	0.097 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.0	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	0.097 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.13 U	0.097 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	6.6 B	29.2	12	130	1 U	24	1.2	130	1,900	1,900	1,700	1,200	1,200	1,600
Benzene	µg/L	100	21.2	37.6	2.8	48	0.5 U	6.6	1.4	65	160	230	100	94	94	120
Ethylbenzene	µg/L	100	6.3	3.6	0.17 J	1.1	0.5 U	0.3 J	0.5 U	1.6	8	7.5 J	6.8	5.4	4.8 J	5.4
Toluene	µg/L	10,000	16	10.1	1.6	16	0.75 U	2	0.58 J	26	73	76	22	9	28	21
Xylenes	µg/L	1,000	70.1	36.9	1.9 J	16	1 U	2.9 J	0.42 J	21	170	170	150	110	110	110

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO57-PZP002							CO58-PZM001						
			6/10/2015	8/14/2023	11/16/2023	3/8/2024	6/7/2024	8/19/2024	11/19/2024	8/14/2023	11/14/2023	3/5/2024	6/7/2024	8/15/2024	11/20/2024	2/11/2025
Groundwater Zone:			Shallow							Shallow						
Location:										Shoreline						
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.10
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.8
2-Methylnaphthalene	µg/L	400	0.3 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	36
Benz[a]anthracene	µg/L	1.00	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 J
Benzo[a]pyrene	µg/L	0.16	0.063 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.17 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.0	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4 JB
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U
Naphthalene	µg/L	115	4.9	1 U	1 U	1 U	220	0.62 J	0.64 J	850	380	220	230	170	1,700	1,100
Benzene	µg/L	100	NA	0.16 J	0.32 J	0.5 U	270	0.26 J	1.8	110	70	36	33	29	150	NA
Ethylbenzene	µg/L	100	NA	0.5 U	0.5 U	0.5 U	6.3	0.5 U	0.5 U	5.4	2.8	3.0	1.5	1.2	8.0	NA
Toluene	µg/L	10,000	NA	0.75 U	0.25 J	0.34 J	310	0.44 J	1.5	36	21	4.1	2.6	3.4	59	NA
Xylenes	µg/L	1,000	NA	1 U	1 U	1 U	130	1 U	0.42 J	84	44	27	21	23	140	NA

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO59-PZP002								CO60-PZP001	CO61-PZM007	CO62-PZM007	CO63-PZM007		CO64-PZM006		CO65-PZM005	
			6/10/2015	8/10/2023	11/16/2023	3/11/2024	6/7/2024	8/19/2024	11/19/2024	2/11/2025	5/12/2022	6/22/2023	6/22/2023	6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023	10/17/2023
Groundwater Zone:			Shallow								Shallow	Shallow	Shallow	Shallow		Shallow		Shallow	
Location:											Shoreline								
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	0.96	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	µg/L	400	23.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz[a]anthracene	µg/L	1.00	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[a]pyrene	µg/L	0.16	0.063 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo[b]fluoranthene	µg/L	1.00	0.16 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	µg/L	1.0	0.24 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	µg/L	115	642	5.7	24	1 U	130	0.9 J	77	NA	360	12,000	2,100	3,200	4,600	2,900	6,600	2,900	7,800
Benzene	µg/L	100	NA	2.5	5.9	0.5 U	300	0.19 J	14	NA	57.2	380	200	260	350	260	350	250	360
Ethylbenzene	µg/L	100	NA	1.3	0.46 J	0.5 U	5.1	0.5 U	1.0	NA	2.2	28 J	10	13	17	12	17 J	12	17 J
Toluene	µg/L	10,000	NA	2.8	1.2	0.75 U	280	0.75 U	2.8	NA	10	440	90	160	290	160	300	150	320
Xylenes	µg/L	1,000	NA	7.4	5.4	1 U	110	1 U	15	NA	40.1	730	170	260	400	250	380	240	410

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
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B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CO66-PZM005		CO67-PZM006		CO68-PZM005		CO69-PZM005	CO70-PZM005	CO71-PZM006	CO72-PZM005	CP17-MWI	CP17-PZM013	CP26-MWI	CP26-MWS
			6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023	10/17/2024	6/22/2023	6/22/2023	6/22/2023	6/22/2023	3/13/2020	3/16/2020	3/11/2020	3/11/2020
Groundwater Zone:			Shallow		Shallow		Shallow		Shallow	Shallow	Shallow	Shallow	Intermediate	Shallow	Intermediate	Shallow
Location:													Shoreline	Shoreline	Shoreline	Shoreline
Arsenic	µg/L	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.80 J	4.60 J	5.00 U	2.70 J
1,1 -Biphenyl	µg/L	100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.98 U	8.10	0.97 U	NA
2-Methylnaphthalene	µg/L	400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.061 J	4.9	NA	1
Benz[a]anthracene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.098 U	0.099 U	0.057	0.069 J
Benzo[a]pyrene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.098 U	0.099 U	0.074 J	0.11
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.098 U	0.099 U	0.087 J	0.13
bis(2-Ethylhexyl)phthalate	µg/L	1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.98 U	0.99 U	0.97 U	0.98 U
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.098 U	0.099 U	0.097 U	0.098 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.098 U	0.099 U	0.045 J	0.061 J
Naphthalene	µg/L	115	3,400	8,500	3,400	4,700	810	2,300	1,500	1	1 U	2,900	0.15	193	2.1	70.5
Benzene	µg/L	100	250	370	250	220	120	170	220	0.76	0.5 U	300	1 U	22.5	0.83 J	59.9
Ethylbenzene	µg/L	100	12	21	10 J	11 J	4.7	8.8	8.1	0.5 U	0.5 U	10 J	1 U	1.8	1 U	0.72 J
Toluene	µg/L	10,000	150	330	140	170	58	110	88	0.75 U	0.75 U	130	1 U	8.7	1 U	11
Xylenes	µg/L	1,000	260	580	250	260	110	200	170	1 U	1 U	230	3 U	21.3	3 U	5.5

Final Remedial Goal (RG) Exceedance

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B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32A - Final Remedial Goals Groundwater Exceedances (GAA E, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CT-037-GW-12.5	CT-037-GW-41	SW18-PZM008		SW18-PZM053	
			2/6/2024	2/6/2024	3/19/2020		3/12/2020	
Groundwater Zone:			Shallow	Intermediate	Shallow		Intermediate	
Location:			Shoreline	Shoreline				
Arsenic	µg/L	40	NA	NA	2.80	B	3.10	J
1,1 -Biphenyl	µg/L	100	NA	NA	0.54	J	0.99	U
2-Methylnaphthalene	µg/L	400	NA	NA	4.6	J	0.049	J
Benz[a]anthracene	µg/L	1.00	NA	NA	0.097	U	0.099	U
Benzo[a]pyrene	µg/L	0.16	NA	NA	0.097	U	0.099	U
Benzo[b]fluoranthene	µg/L	1.00	NA	NA	0.097	U	0.099	U
bis(2-Ethylhexyl)phthalate	µg/L	1.0	NA	NA	0.97	U	0.99	U
Dibenz[a,h]anthracene	µg/L	0.16	NA	NA	0.097	U	0.099	U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	NA	NA	0.097	U	0.099	U
Naphthalene	µg/L	115	1,600	2,600	253		1.5	
Benzene	µg/L	100	280	320	24.8		1.3	
Ethylbenzene	µg/L	100	9.3	10	1.1		1	U
Toluene	µg/L	10,000	19	37	1.6		1	U
Xylenes	µg/L	1,000	190	230	10.7		3	U

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
B: Analyte detected above the reporting limit in the associated method blank.
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32B - Final Remedial Goals Groundwater Exceedances (GAA E, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO203-MWS		CO205-MWS	CO207-MWS	CO208-MWS	CO26-PZM007							
			7/25/2023	2/10/2025	7/25/2023	7/26/2023	10/10/2019	6/10/2015	8/14/2023	11/15/2023	3/5/2024	6/7/2024	8/14/2024	11/20/2024	2/10/2025
Groundwater Zone:			Shallow		Shallow	Shallow	Shallow	Shallow							
Location:			Shoreline		Shoreline	Shoreline	Shoreline	Shoreline							
Iron	µg/L	22,500	NA	361	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	157
Benzo[a]pyrene	µg/L	0.16	NA	0.04 J	NA	NA	NA	0.062 U	NA	NA	NA	NA	NA	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	NA	0.05 U	NA	NA	NA	0.11 U	NA	NA	NA	NA	NA	NA	NA
Pyrene	µg/L	13	NA	1.7	NA	NA	NA	1.1	NA	NA	NA	NA	NA	NA	NA
Toluene	µg/L	735	99	NA	110	93	77	NA	41	100	23	130	79	110	NA

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32B - Final Remedial Goals Groundwater Exceedances (GAA E, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CO26-PZM032			CO35-PZM013		CO35-PZM056		CO58-PZM001							CO60-PZP001
			6/10/2015	8/3/2022	2/10/2025	6/11/2015	7/26/2023	6/11/2015	3/12/2020	8/14/2023	11/14/2023	3/5/2024	6/7/2024	8/15/2024	11/20/2024	2/11/2025	5/12/2022
Groundwater Zone:			Intermediate			Shallow		Intermediate		Shallow							Shallow
Location:			Shoreline			Shoreline		Shoreline		Shoreline							Shoreline
Iron	µg/L	22,500	NA	NA	4660	NA	NA	NA	70.00 U	NA	NA	NA	NA	NA	NA	131	NA
Benzo[a]pyrene	µg/L	0.16	0.062 U	NA	NA	0.063 U	NA	0.063 U	0.014 J	NA	NA	NA	NA	NA	NA	0.1 U	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.11 U	NA	NA	0.11 U	NA	0.11 U	0.097 U	NA	NA	NA	NA	NA	NA	0.05 U	NA
Pyrene	µg/L	13	0.051 U	NA	NA	0.66 J	NA	0.051 U	0.035 J	NA	NA	NA	NA	NA	NA	0.68	NA
Toluene	µg/L	735	NA	0.75 U	NA	23.5	21	16	10.1	36	21	4.1	2.6	3.4	59	NA	10.1

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32B - Final Remedial Goals Groundwater Exceedances (GAA E, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CP17-MWI	CP17-PZM013	CP26-MWI	CP26-MWS	CT-037-GW-12.5	CT-037-GW-41
			3/13/2020	3/16/2020	3/11/2020	3/11/2020	2/6/2024	2/6/2024
Groundwater Zone:			Intermediate	Shallow	Intermediate	Shallow	Shallow	Intermediate
Location:			Shoreline	Shoreline	Shoreline	Shoreline	Shoreline	Shoreline
Iron	µg/L	22,500	70 U	70 U	70 U	70 U	NA	NA
Benzo[a]pyrene	µg/L	0.16	0.098 U	0.099 U	0.074 J	0.11	NA	NA
Dibenz[a,h]anthracene	µg/L	0.16	0.098 U	0.099 U	0.097 U	0.098 U	NA	NA
Pyrene	µg/L	13	0.098 U	0.16	0.09 J	0.12	NA	NA
Toluene	µg/L	735	1 U	8.7	1 U	11	19	37

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 32C - GAA E Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area E COCs	Final RG (µg/L)	Statistics	
Sitewide Final RGs			
Arsenic	40	Max:	4.6
		Min:	0.6304
		DF:	12%
		EF:	0.0%
1,1 -Biphenyl	100	Max:	11
		Min:	0.54
		DF:	4.5%
		EF:	0.0%
2-Methylnaphthalene	400	Max:	91
		Min:	0.049
		DF:	14%
		EF:	0.0%
Benz[a]anthracene	1.0	Max:	2.5
		Min:	0.05
		DF:	6%
		EF:	0.9%
Benzo[a]pyrene	0.16	Max:	2.0
		Min:	0.014
		DF:	5.5%
		EF:	0.9%
Benzo[b]fluoranthene	1.0	Max:	3.8
		Min:	0.07
		DF:	5.5%
		EF:	0.9%
bis(2-Ethylhexyl)phthalate	1.0	Max:	2.4
		Min:	0.21
		DF:	6.4%
		EF:	1.8%
Dibenz[a,h]anthracene	0.16	Max:	0
		Min:	0
		DF:	0.0%
		EF:	0.0%
Indeno[1,2,3-c,d]pyrene	1.0	Max:	0.58
		Min:	0.045
		DF:	3.6%
		EF:	0.0%
Naphthalene	115	Max:	17000
		Min:	0.15
		DF:	88%
		EF:	71%
Benzene	100	Max:	1700
		Min:	0.16
		DF:	81%
		EF:	49%

Table 32C - GAA E Contaminants of Concern - Statistics
CPA Groundwater CMS

Ethylbenzene	100	Max:	36
		Min:	0.17
		DF:	73%
		EF:	0.0%
Toluene	10000	Max:	1100
		Min:	0.25
		DF:	75%
		EF:	0.0%
Xylenes	1000	Max:	920
		Min:	0.42
		DF:	72%
		EF:	0.0%
Shoreline Final RGs			
Iron	22,500	Max:	4660
		Min:	131
		DF:	12%
		EF:	0%
Benzo[a]pyrene	0.16	Max:	0.11
		Min:	0.01
		DF:	12%
		EF:	0%
Dibenz[a,h]anthracene	0.16	Max:	0.00
		Min:	0.00
		DF:	0%
		EF:	0%
Pyrene	13	Max:	1.70
		Min:	0.04
		DF:	24%
		EF:	0%
Toluene	735	Max:	130
		Min:	2.60
		DF:	74%
		EF:	0%

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
RG: Remedial Goal
DF: Detection Frequency
EF: Exceedance Frequency

No Final RG Exceedance
Final RG Exceedance

Notes:
(a) Maximum and minimum values presented in µg/L.
(b) EF and DF presented in percentage.

Table 33A - Final Remedial Goals Groundwater Exceedances (GAA F, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP02-PZM007				CP02-PZM026				CP07-PZM006			
			4/19/2023	10/17/2023	5/16/2024	10/9/2024	4/19/2023	10/17/2023	5/16/2024	10/9/2024	4/24/2023	10/23/2023	5/20/2024	10/11/2024
Groundwater Zone:			Shallow				Intermediate				Shallow			
Location:														
Arsenic	µg/L	40	27.58	27.22	25.78	29.59	1.87	1.34	0.39 J	2.10 J	5.96	6.73	6.17	6.29
1,1 -Biphenyl	µg/L	100	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	0.94 J	0.56 J	0.89 J	0.77 J
2-Methylnaphthalene	µg/L	400	0.10 U	0.10 U	0.16	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	3.50	1.90	2.20	3.70
Benz[a]anthracene	µg/L	1.00	0.03 J	0.02 J	0.06	0.03 J	0.09	0.05	0.05 U	0.1	0.03 J	0.05 U	0.05 U	0.06
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.02 J	0.1 U	0.1 U	0.1 U	0.1 U	0.04 J	0.1 U	0.1 U	0.1 U	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.05 U	0.02 J	0.03 J	0.05 U	0.05 U	0.02 J	0.05 U	0.05	0.01 J	0.02 J	0.01 J	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.0	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.06	0.05 U	0.05 U	0.05 U	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.10 U	0.01 J	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.06 J	0.10 U	0.10 U	0.10 U	0.10 U
Naphthalene	µg/L	115	0.07 J	0.1 U	1.7	0.06 J	0.1 U	0.1 U	0.1 U	0.1 U	56	53	62	93
Benzene	µg/L	100	0.28 J	0.5 U	0.26 J	0.16 J	0.5 U	0.5 U	0.5 U	0.5 U	390	400	390	360
Ethylbenzene	µg/L	100	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	3.2	2.7	2.3	3.3
Toluene	µg/L	10,000	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	62	65	53	62
Xylenes	µg/L	1,000	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	36	28	24	34

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 33A - Final Remedial Goals Groundwater Exceedances (GAA F, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP08R-PZM008				CP08R-PZM034				CP12-PZM012			
			4/25/2023	10/18/2023	5/22/2024	10/9/2024	4/25/2023	10/18/2023	5/22/2024	10/9/2024	4/17/2023	10/23/2023	5/22/2024	10/3/2024
Groundwater Zone:			Shallow				Intermediate				Shallow			
Location:											Shoreline			
Arsenic	µg/L	40	0.79	0.78	0.62	5.00 U	12.24	12.56	7.51	13.17	5.00 U	0.51	0.26 J	14.39
1,1 -Biphenyl	µg/L	100	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Methylnaphthalene	µg/L	400	2.30	2.80	1.60	0.92	0.10 U	0.04 J	0.07 J	0.06 J	0.56	0.93	0.45	0.10 U
Benz[a]anthracene	µg/L	1.00	0.07	0.06	0.06	0.05	0.05 U	0.02 J	0.05 U	0.05 U	0.05	0.02 J	0.05 U	0.05 U
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.03 J	0.1 U	0.1 U	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.05 U	0.05 U	0.05 U	0.04 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.02 J	0.05 U	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.0	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10	0.10	0.10 U	0.01 J	0.10 U	0.10 U
Naphthalene	µg/L	115	68	77	56	33	0.4	0.31	0.48	0.41	3.0	8.9	2.6	0.1 U
Benzene	µg/L	100	2,100	1,500	2,700	1,000	1.9	12	3.2	12	2.4	17	12	0.5 U
Ethylbenzene	µg/L	100	27	46	29	16	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.3 J	0.26 J	0.5 U
Toluene	µg/L	10,000	790	510	970	350	1.3	2.5	0.23 J	1.1	0.4 J	2	2.4	0.75 U
Xylenes	µg/L	1,000	580	880	680	320	1.9 J	0.87 J	1.2	0.72 J	0.48 J	3.7	2.9	1 U

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 33A - Final Remedial Goals Groundwater Exceedances (GAA F, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP12-PZM052				CP14-PZM009				CP14-PZM062			
			4/17/2023	10/23/2023	5/22/2024	10/4/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024
Groundwater Zone:			Intermediate				Shallow				Intermediate			
Location:			Shoreline				Shoreline				Shoreline			
Arsenic	µg/L	40	10.16	8.31	13.96	0.19 J	1.25	1.71	1.47	2.68 J	6.02	7.39	4.12 J	14.19
1,1 -Biphenyl	µg/L	100	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	0.37 J	2.0 U	2.0 U	2.0 U	2.0 U
2-Methylnaphthalene	µg/L	400	0.10 U	0.10 U	0.10 U	1.40	0.86	1.10	1.10	1.40	0.10 U	0.10 U	0.10 U	0.10 U
Benz[a]anthracene	µg/L	1.00	0.05 U	0.03 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.05 U	0.02 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.0	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Naphthalene	µg/L	115	0.1 U	0.07 J	0.09 J	9.5	13	16	20	23	0.2	0.11	0.07 J	0.17
Benzene	µg/L	100	0.5 U	0.5 U	0.5 U	6.5	45	62	64	50	0.5 U	0.5 U	0.5 U	0.5 U
Ethylbenzene	µg/L	100	0.5 U	0.5 U	0.5 U	0.2 J	0.56	0.77 J	0.75	0.67	0.5 U	0.5 U	0.5 U	0.5 U
Toluene	µg/L	10,000	0.75 U	0.75 U	0.75 U	0.43 J	3.7	5.8	5.7	4.5	0.75 U	0.75 U	0.75 U	0.75 U
Xylenes	µg/L	1,000	1 U	1 U	1 U	2.3 J	3.1	5.1 J	4.6	4.6	1 U	1 U	1 U	1 U

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 33A - Final Remedial Goals Groundwater Exceedances (GAA F, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP16-PZM008				CP16-PZM035				CP18R-PZM009			
			4/19/2023	10/13/2023	5/16/2024	10/4/2024	4/19/2023	10/13/2023	5/16/2024	10/7/2024	4/25/2023	10/19/2023	5/22/2024	10/7/2024
Groundwater Zone:			Shallow				Intermediate				Shallow			
Location:			Shoreline				Shoreline							
Arsenic	µg/L	40	0.92	1.70	1.14	0.87	0.88	1.77	1.29	2.17 J	1.05	1.17	0.99	2.89 J
1,1 -Biphenyl	µg/L	100	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	0.46 J	0.5 J	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Methylnaphthalene	µg/L	400	0.77	0.89	0.58	0.55	1.60	1.30	1.40	0.59	0.84	0.47	0.43	0.46
Benz[a]anthracene	µg/L	1.00	0.05 J	0.05 J	0.05 U	0.05 U	0.05 U	0.06	0.05 U	0.05 U	0.04 J	0.04 J	0.05 U	0.03 J
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.03 J	0.03 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
bis(2-Ethylhexyl)phthalate	µg/L	1.0	3 U	3 U	3 U	3 U	3 U	1.6 J	3 U	3 U	3 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Naphthalene	µg/L	115	8.6	13	7.6	8.6	70	84	63	21	32	14.0	10	15
Benzene	µg/L	100	77	98	57	82	170	170	180	110	660	180	140	260
Ethylbenzene	µg/L	100	0.56	0.64	0.46 J	0.59	0.83	0.86	0.85	0.67	4.4	2	1.7	2.2
Toluene	µg/L	10,000	8.3	9.4	6.2	8.7	14	12	13	9.1	76	26	20	32
Xylenes	µg/L	1,000	4.9	5.9	4.2	5.8	7.0	7.2	7.2	5.6	42	18	16	21

Final Remedial Goal (RG) Exceedance

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 33A - Final Remedial Goals Groundwater Exceedances (GAA F, Sitewide)
CPA Groundwater CMS

Analyte	Units	Final RGs - Sitewide	CP19R-PZM008				CP20-PZM011					CP21-PZM004			
			4/24/2023	10/17/2023	5/20/2024	10/11/2024	4/24/2023	10/19/2023	5/22/2024	10/11/2024	11/4/2024	10/12/2022	10/18/2023	5/20/2024	10/11/2024
Groundwater Zone:			Shallow				Shallow					Shallow			
Location:															
Arsenic	µg/L	40	1.40	1.61	1.28	1.81 J	0.71	0.82	1.43	5.00 U	NA	5.06	5.03	5.10	4.90 J
1,1 -Biphenyl	µg/L	100	3.1	2.6	2.2	3.2	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
2-Methylnaphthalene	µg/L	400	14.00	31.00	34.00	59.00	0.13	0.05 J	0.03 J	0.38	0.15	0.54 J	0.23	0.40	0.10
Benz[a]anthracene	µg/L	1.00	0.05 J	0.04 J	0.06	0.12	0.04 J	0.08	0.09	0.05 U	0.10	0.10	0.06	0.05 U	0.08
Benzo[a]pyrene	µg/L	0.16	0.02 J	0.1 U	0.1 U	0.03 J	0.02 J	0.02 J	0.06 J	0.1 U	0.07 J	0.02 J	0.1 U	0.1 U	0.1 U
Benzo[b]fluoranthene	µg/L	1.00	0.02 J	0.02 J	0.05 U	0.05	0.03 J	0.03 J	0.12	0.05 U	0.11	0.05 J	0.05 U	0.05 U	0.04 J
bis(2-Ethylhexyl)phthalate	µg/L	1.0	18	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	1 U	3 U	3 U	3 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.03 J	0.05 U	0.05 U	0.01 J	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Indeno[1,2,3-c,d]pyrene	µg/L	1.0	0.10 U	0.10 U	0.10 U	0.04 J	0.02 J	0.10 U	0.06 J	0.10 U	0.08 J	0.10 U	0.10 U	0.10 U	0.03 J
Naphthalene	µg/L	115	56	400	200	340	5	0.77	0.24	20	8.4	17	21	26	0.24
Benzene	µg/L	100	1,400	3,000	2,300	2,500	1.5	18	0.75	1.4	35	5.3	11	11	9.4
Ethylbenzene	µg/L	100	16	27	17	24	0.5 U	0.17 J	0.5 U	0.5 U	0.5 U	0.5 U	0.28 J	0.22 J	0.23 J
Toluene	µg/L	10,000	250	540	360	410	0.2 J	1.1	0.75 U	0.75 U	0.63 J	0.32 J	0.7 J	0.6 J	0.51 J
Xylenes	µg/L	1,000	230	280	180	240	0.43 J	0.83 J	1 U	1 U	1.2 J	1 U	1.9 J	1.4 J	1.3 J

Final Remedial Goal (RG) Exceedance
U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NA: Not Analyzed

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 33B - Final Remedial Goals Groundwater Exceedances (GAA F, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CP12-PZM012				CP12-PZM052				CP14-PZM009			
			4/17/2023	10/23/2023	5/22/2024	10/3/2024	4/17/2023	10/23/2023	5/22/2024	10/4/2024	4/18/2023	10/17/2023	5/16/2024	10/7/2024
Groundwater Zone:			Shallow				Intermediate				Shallow			
Location:			Shoreline				Shoreline				Shoreline			
Iron	µg/L	22500	500 U	108	43.1 J	1,050	500 U	51.6	220 J	66.9	99.4	92.8	152	500 U
Benzo[a]pyrene	µg/L	0.16	0.03 J	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Pyrene	µg/L	13	0.37	0.23	0.10	0.05 J	0.10	0.04 J	0.1 U	0.20	0.26	0.18	0.22	0.35
Toluene	µg/L	735	0.4 J	2	2.4	0.75 U	0.75 U	0.75 U	0.75 U	0.43 J	3.7	5.8	5.7	4.5

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 33B - Final Remedial Goals Groundwater Exceedances (GAA F, Shoreline)
CPA Groundwater CMS

Analyte	Units	Final RGs - Shoreline	CP14-PZM062				CP16-PZM008				CP16-PZM035			
			4/18/2023	10/17/2023	5/16/2024	10/7/2024	4/19/2023	10/13/2023	5/16/2024	10/4/2024	4/19/2023	10/13/2023	5/16/2024	10/7/2024
Groundwater Zone:			Intermediate				Shallow				Intermediate			
Location:			Shoreline				Shoreline				Shoreline			
Iron	µg/L	22500	4,480	5,630	2,000	9,830	38.7 J	34.3 J	88.9	148	37.1 J	34.2 J	99.1	328 J
Benzo[a]pyrene	µg/L	0.16	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Dibenz[a,h]anthracene	µg/L	0.16	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Pyrene	µg/L	13	0.05 J	0.1 U	0.1 U	0.1 U	0.36	0.30	0.22	0.12	0.90	0.75	0.76	0.12
Toluene	µg/L	735	0.75 U	0.75 U	0.75 U	0.75 U	8.3	9.4	6.2	8.7	14	12	13	9.1

Final Remedial Goal (RG) Exceedance (Shoreline)

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit

GAA: Groundwater Assessment Area
COC: Contaminant of Concern

Table 33C - GAA F Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Final RG (µg/L)	Statistics	
Sitewide Final RGs			
Arsenic	40	Max:	29.59
		Min:	0.1881
		DF:	93%
		EF:	0%
1,1 -Biphenyl	100	Max:	3.2
		Min:	0.37
		DF:	18%
		EF:	0%
2-Methylnaphthalene	400	Max:	59
		Min:	0.03
		DF:	74%
		EF:	0%
Benz[a]anthracene	1.0	Max:	0.12
		Min:	0.02
		DF:	56%
		EF:	0%
Benzo[a]pyrene	0.16	Max:	0.07
		Min:	0.02
		DF:	16%
		EF:	0%
Benzo[b]fluoranthene	1.0	Max:	0.12
		Min:	0.01
		DF:	34%
		EF:	0%
bis(2-Ethylhexyl)phthalate	1.0	Max:	18
		Min:	1.6
		DF:	3.3%
		EF:	3.3%
Dibenz[a,h]anthracene	0.16	Max:	0.06
		Min:	0.01
		DF:	4.9%
		EF:	0.0%
Indeno[1,2,3-c,d]pyrene	1.0	Max:	0.1
		Min:	0.01
		DF:	16%
		EF:	0%
Naphthalene	115	Max:	400
		Min:	0.06
		DF:	89%
		EF:	4.9%
Benzene	100	Max:	3000
		Min:	0.16
		DF:	79%
		EF:	33%

Table 33C - GAA F Contaminants of Concern - Statistics
CPA Groundwater CMS

Groundwater Assessment Area F COCs	Final RG (µg/L)	Statistics	
Ethylbenzene	100	Max:	46
		Min:	0.17
		DF:	57%
		EF:	0%
Toluene	10000	Max:	970
		Min:	0.21
		DF:	70%
		EF:	0%
Xylenes	1000	Max:	880
		Min:	0.43
		DF:	69%
		EF:	0%
Shoreline Final RGs			
Iron	22,500	Max:	9830
		Min:	34.20
		DF:	88%
		EF:	0%
Benzo[a]pyrene	0.16	Max:	0.03
		Min:	0.03
		DF:	4.2%
		EF:	0.0%
Dibenz[a,h]anthracene	0.16	Max:	0.00
		Min:	0.00
		DF:	0%
		EF:	0%
Pyrene	13	Max:	0.9
		Min:	0.04
		DF:	83%
		EF:	0%
Toluene	735	Max:	14
		Min:	0.43
		DF:	67%
		EF:	0%

Acronyms:
GAA: Groundwater Assessment Area
COC: Contaminant of Concern
RG: Remedial Goal
DF: Detection Frequency
EF: Exceedance Frequency

No Final RG Exceedance
Final RG Exceedance

Notes:
(a) Maximum and minimum values presented in µg/L.
(b) EF and DF presented in percentage.

Table 34 - Summary of Final Remedial Goals Groundwater Exceedances by GAA
CPA Groundwater CMS

	GAA A	GAA B	GAA C	GAA D	GAA E	GAA F
Sitewide						
Arsenic		X				
1,1 -Biphenyl		X				
2-Methylnaphthalene			X	X		
Benz[a]anthracene		X	X	X	X	
Benzo[a]pyrene		X	X	X	X	
Benzo[b]fluoranthene		X	X	X	X	
bis(2-Ethylhexyl)phthalate	X	X	X	X	X	X
Dibenz[a,h]anthracene		X	X	X		
Indeno[1,2,3-c,d]pyrene		X	X	X		
Naphthalene	X	X	X	X	X	X
Benzene		X	X	X	X	X
Ethylbenzene		X	X	X		
Toluene		X				
Xylenes		X	X	X		
Shoreline						
Iron		X				
Benzo[a]pyrene			X			
Dibenz[a,h]anthracene			X			
Pyrene			X			
Toluene		X				

Table 35A - Soil Screening Levels by COPC / Point of Compliance
CPA Groundwater CMS

Groundwater COC / Soil COPC	CAS	Parameter Group	Units	Soil Screening Levels (SSLs)		10 x SSLs	
				Sitewide	Shoreline	Sitewide	Shoreline
Arsenic	7440-38-2	Metal	mg/kg	1.168	--	11.7	--
Iron	7439-89-6	Metal	mg/kg	--	567	--	567
1,1-Biphenyl	92-52-4	SVOC	mg/kg	1.046	--	10.5	--
2-Methylnaphthalene	91-57-6	SVOC	mg/kg	2.063	--	20.6	--
Benz[a]anthracene	56-55-3	SVOC	mg/kg	0.354	--	3.54	--
Benzo[a]pyrene	50-32-8	SVOC	mg/kg	0.188	0.188	1.88	0.188
Benzo[b]fluoranthene	205-99-2	SVOC	mg/kg	1.199	--	12.0	--
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	mg/kg	0.239	--	2.39	--
Dibenz[a,h]anthracene	53-70-3	SVOC	mg/kg	0.612	0.612	6.12	0.612
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	mg/kg	3.902	--	39.0	--
Naphthalene	91-20-3	SVOC	mg/kg	0.378	--	3.78	--
Pyrene	129-00-0	SVOC	mg/kg	--	1.45	--	1.45
Benzene	71-43-2	VOC	mg/kg	0.051	--	0.51	--
Ethylbenzene	100-41-4	VOC	mg/kg	0.112	--	1.12	--
Toluene	108-88-3	VOC	mg/kg	6.920	0.509	69.2	0.509
Xylenes	1330-20-7	VOC	mg/kg	0.990	--	9.90	--

-- Not identified as a COC in GW, therefore no soil screening level required.

Notes:
(a) All screening levels are in milligrams per kilogram (mg/kg).
(b) 10x SSLs calculated only for sitewide COPCs.

Acronyms:
COC = Contaminant of Concern
COPC = Contaminant of Potential Concern
SSL = Soil Screening Level

Table 35B - Soil COCs by GAA
CPA Groundwater CMS

Groundwater COC / Soil COPC	GAA A	GAA B	GAA C	GAA D	GAA E	GAA F
Sitewide						
Arsenic		X				
1,1 -Biphenyl		--				
2-Methylnaphthalene			X	X		
Benz[a]anthracene		X	X	X	X	
Benzo[a]pyrene		X	X	X	X	
Benzo[b]fluoranthene		X	X	X	X	
bis(2-Ethylhexyl)phthalate	--	--	--	--	--	--
Dibenz[a,h]anthracene		X	X	X		
Indeno[1,2,3-c,d]pyrene		--	X	X		
Naphthalene	--	X	X	X	X	X
Benzene		X	X	X	--	--
Ethylbenzene		X	X	X		
Toluene		X				
Xylenes		X	X	X		
Shoreline						
Iron		X				
Benzo[a]pyrene			X			
Dibenz[a,h]anthracene			X			
Pyrene			X			
Toluene		--				

	No GW exceedances for parameter within GAA. Therefore, parameter is not a GW COC for the GAA and was not evaluated for soil.
--	Parameter evaluated for GAA in soil, no exceedances identified.
X	Parameter identified as a COC in soil for GAA

Acronyms:
COC = Contaminant of Concern
COPC = Contaminant of Potential Concern
GAA = Groundwater Assessment Area
GW = Groundwater

Table 36A - Applicability Evaluation of Technologies for GAA A - Coke Point Landfill
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
No Action	No Action	None	No further action to achieve remedial action objectives.	NA	Applicable to GAA A.	Retained for comparison purposes.	
Institutional Controls	Administrative Restrictions	Restrictions on Site Use	Deed restrictions are used to specify land use for certain areas (e.g., prohibition of residential use).	Impacted soil / slag	Applicable to GAA A.	Retained for use in combination with other process options.	
	Administrative Restrictions	Restrictions on Groundwater Use	Groundwater use restrictions are controls (generally at the local or county level) directed at limiting or prohibiting certain uses of groundwater (e.g., use as potable water).	Impacted groundwater	Applicable to GAA A.	Retained for use in combination with other process options.	
	Administrative Controls	Inspection and Maintenance	Inspections of facilities and performance of preventative or corrective measures to ensure proper operation of engineered controls.	Impacted soil / slag and groundwater	Applicable to GAA A.	Retained for use in combination with other process options.	
	Sampling and Analysis	Monitored Natural Attenuation	Allow naturally-occurring processes (e.g., dispersion, volatilization, biodegradation, adsorption, and chemical reactions) to reduce contaminant levels.	Impacted soil / slag and groundwater	Applicable to GAA A.	Retained for use in combination with other process options. Semi-annual sampling of the Coke Point Landfill wells, as described in the Conceptual Site Model section and summarized in Appendix G, statstically significant downward trends have been calculated for eight wells in GAA A. Including for naphthalene. Upward trends for bis(2-ethylhexyl)phthalate are related to laboratory reporting limits.	
Engineering Controls	Engineering Controls	Fencing/Warning Signs/Access Restrictions	Placing physical restrictions on activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. May also include installation of security fence around impacted areas. Signs, fencing and/or other barriers designed to reduce or eliminate human exposure to COCs.	Impacted soil / slag and groundwater	Applicable to GAA A.	Retained for use in combination with other process options.	
	Engineering Controls	Vapor Mitigation - Sub-slab Vapor Barrier	Vapor barrier below floor slab of new building. Vapor barriers include impermeable barriers designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA A future development.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
	Engineering Controls	Vapor Mitigation - Sub-slab Venting System	Sub-slab venting system (passive/active) below floor slab of new building. Venting systems include sub-slab piping designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA A future development.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
Removal Technologies	Excavation	Excavation	Excavate NAPL impacted or contaminated soil/slag in source areas to eliminate leaching of contaminants to groundwater.	Impacted soil / slag	Not applicable to GAA A as naphthalene and benzene plumes do not exist at a high enough concentration that NAPL can occur. Note that recent activities in support of preparing the site for development include efforts to recover slag and concrete from the landfill.		Eliminated - NAPL is not present in wells within the Coke Point Landfill while removal actions for concrete and other debris are ongoing. The presumptive remedy for landfill closure is capping.

Table 36A - Applicability Evaluation of Technologies for GAA A - Coke Point Landfill
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
Containment Technologies	In Situ Physical	Hydraulic Containment	A series of extraction wells are placed to induce groundwater flow towards the installed extraction wells, and prevent contaminated groundwater from migrating offsite.	Impacted groundwater	Applicable for GAA A. Design and approach would need to take into account depth of waste.	Retained for use in combination with other process options. Semi-annual sampling of the Coke Point Landfill wells, as described in the Conceptual Site Model section and summarized in Appendix G, statstically significant downward trends have been calculated for eight wells in GAA A. Including for naphthalene. Upward trends for bis(2-ethylhexyl)phthalate are related to laboratory reporting limits.	
	Capping	Impermeable and low-permeability cap	In-place isolation of materials below an impermeable or low permeability cap.	Impacted soil / slag	Applicable for GAA A to reduce infiltration and minimize migration of dissolved phase contamination.	Retained for use in combination with other process options. This is the presumptive remedy for landfill closure.	
	Vertical Barrier	Sheet piling / slurry wall	Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration. Slurry wall may be implaced via injection of grout via injection technology. Placement may be limited by slag or subsurface obstructions.	Impacted groundwater	Applicable for GAA A, specific to benzene and naphthalene plumes.	Retained for use in combination with other process options.	
Treatment Technologies	In Situ Physical	Air Sparge/Soil Vapor Extraction	Air sparging involves the installation of injection wells that introduce air below the water table. Soil Vapor Extraction involves the installation of extraction wells above the water table that pull air and vapors through the soil to the ground surface for treatment.	Impacted soil / slag and groundwater	Applicable to GAA A. Effective air sprarging may be difficult to achieve but could be an option for benzene and naphthalene impacts.	Retained, for use in combination with other process options. This process option may be challenging with the significant heterogeneity of the local geology but may be applicable to naphthalene exceedances.	
	In Situ Physical	Product Recovery (Absorbent/ Skimmers)	NAPL is removed from recovery wells using absorbent/skimmers (active or passive) or via enhanced fluid recovery where multiple phases of hydrocarbons (liquid, dissolved, adsorbed and vapor phase) are simultaneously removed.	NAPL in groundwater wells	Not applicable to GAA A. Naphthalene and benzene plumes do not exist at a high enough concentration that NAPL can occur.		Eliminated - NAPL is not present in wells within GAA A
	In Situ Physical	Multi-Phase Extraction	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	Impacted soil / slag and groundwater	Not applicable to GAA A. Naphthalene and benzene plumes do not exist at a high enough concentration that NAPL can occur and no soil source has been observed.		Eliminated - NAPL is not present in wells within GAA A
	In Situ Physical	Soil Flushing	In situ leaching method using extraction wells and liquid treatment to remove contaminants from soil.	Impacted soil	Not applicable to GAA A. NAPL is not present in soil.		Eliminated - NAPL is not present in soil within GAA A
	In Situ Physical	Stabilization / solidification	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Impacted soil	Not applicable to GAA A. NAPL is not present in soil.		Eliminated - NAPL is not present in soil within GAA A

Table 36A - Applicability Evaluation of Technologies for GAA A - Coke Point Landfill
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	Ex Situ Physical	Groundwater Pump and Treat (GWPT)	A series of extraction wells are placed to remove contaminated groundwater. Extracted water is then treated and may be reinjected, transferred to a treatment system, or discharged with the proper permitting.	Impacted groundwater	Applicable to GAA A.	Retained for use in combination with other process options. This process option would target mass removal and reduction of dissolved phase COCs in GAA A. Exceedances of Final RGs are spread out with no single source area.	
	In Situ Chemical	In-situ Chemical Oxidation (ISCO)	ISCO involves the introduction of a chemical oxidant into the subsurface to oxidize contaminants and transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Applicable to GAA A. However, ISCO may drive chemical changes in implaced slag, potentially increasing Mn, Fe, and Co concentration in treatment area.	Retained for use in combination with other process options to treat and reduce naphthalene and benzene at potential source areas identified.	
	In Situ Chemical	In-situ Chemical Reduction (ISCR)	ISCR involves the introduction of a chemical reductant into the subsurface to create reducing conditions (lower oxidation reduction potential and dissolved oxygen) to transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Not applicable to remaining COCs in GAA A, naphthalene and benzene. Most applicable for CVOCs, also PCBs and Chromium VI.		Eliminated - GAA A does not have applicable COCs to support the implementation of ISCR.
	In Situ Biological	Enhanced Anaerobic Bioremediation	Subsurface delivery of electron donors within the target zone to stimulate anaerobic biodegradation of compounds by cometabolic remediation. Different electron acceptor may be injected to promote availability of hydrogen to speed up the process.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA A. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the naphthalene plumes. This process option may be ineffective due to high pH in impacted area.	
	In Situ Biological	Enhanced Aerobic Bioremediation	Injection of oxygen (other than bioventing), substrates, or nutrients to enhance microbial activities.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA A. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the naphthalene plumes. Process option may be ineffective due to high pH in impacted area. Additionally, natural conditions indicate a highly reducing environment.	
	In Situ Biological	Biosparging	Similar to air sparging, air or oxygen is introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA A. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the naphthalene plumes. Process option may be ineffective due to high pH in impacted area. Additionally, natural conditions indicate a highly reducing environment.	
	Ex Situ Physical	Low-temperature thermal treatment / stripping	Excavation of impacted material, low temperature heating and agitation to drive off volatile contaminants coupled with collection and treatment of gases and condensate.	Impacted soil	Not applicable to GAA A. No NAPL impacted soil has been obvserved.		Eliminated - Not applicable to dissolved phase COCs in this GAA. No soil impacted NAPL observed.
	In Situ	Thermal Conductance Heating (TCH)	Installation of thermal wells into the ground, heat treatment volume to desired temperature based on contamination type. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Applicable to GAA A.	Retained for use in combination with other process options to treat and reduce naphthalene at potential source areas identified.	

Table 36A - Applicability Evaluation of Technologies for GAA A - Coke Point Landfill
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ	Electrical Resistance Heating (ERH)	Installation of electrodes into the ground, application of alternating current (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Not applicable to GAA A. Areas of naphthalene and benzene plumes that extend into the footprint of the landfill excavation would cause implementation issues due to subsurface obstructions inhibiting the ability to install electrodes in the spacing required to heat uniformly.		Eliminated - Final RG exceedances are minimal and ERH is typically used to target source zones. Subsurface obstructions would inhibit the ability to install electrodes in the spacing required to heat uniformly.
	In Situ	Permeable Reactive Barriers (PRB)	A permeable wall containing reactive substances is installed across the groundwater flow path. Contaminants are chemically removed as groundwater flows through the wall.	Impacted groundwater	Applicable to GAA A.	Retained for use in combination with other process options to mitigate potential offsite migration.	
Disposal Technologies	Excavation & Disposal	On-Site or Off-Site Disposal/ Landfilling	Contaminated material is removed and transported to on-site landfill or permitted off-site disposal facilities.	Impacted soil / slag	Not applicable to naphthalene and benzene plumes adjacent to Coke Point Landfill portion of GAA A. Excavation in this area could impact the stability of the landfill.		Eliminated - NAPL is not present in wells within the Coke Point Landfill while removal actions for concrete and other debris has already been completed. The presumptive remedy for landfill closure is capping.
	Excavation & Disposal	On-Site Disposal (CAMU)	CAMUs are used to facilitate treatment, storage, and disposal of CAMU-eligible wastes to implement corrective action or cleanup.	Impacted soil / slag	Not applicable to GAA A, there is no available area for a CAMU.		Eliminated - There is no area available in GAA A for a CAMU.
	Disposal	Permitted Discharge	Discharge of treated groundwater via NPDES or other permit.	Treated groundwater	Applicable to GAA A. To be paired with GWPT.	Retained, for use in combination with other process options. Specifically, to be paired with GWPT.	

Notes:
Treatment technologies retained based on applicability will likely require the completion of treatability studies, bench scale testing, or pilot installations to establish feasibility in this GAA.

Table 36B - Corrective Measures Alternatives for GAA A - Coke Point Landfill
Coke Point CMS

General Response Action	Process Option	Alternative 1 No Action	Alternative 2 Reclamation, Capping, MNA, and ECs/ICs (a)	Alternative 3 Bioremediation, Reclamation, Capping, MNA, and ECs/ICs (a)	Alternative 4 ISCO, Reclamation, Capping, MNA, and ECs/ICs (a)
No Action	None	X			
Institutional Controls	Restrictions on Site Use		X	X	X
	Restrictions on Groundwater Use		X	X	X
	Inspection and Maintenance		X	X	X
	Monitored Natural		X	X	X
Engineering Controls	Fencing/Warning Signs/Access Restrictions		X	X	X
	Vapor Mitigation - Sub-slab Vapor Barrier		X	X	X
	Vapor Mitigation - Sub-slab Venting System		X	X	X
Containment Technologies	*Hydraulic Containment*	*Hydraulic containment is not the best suited remedial option. Significant attenuation of COC impacts are observed prior to reaching the property boundary or surface water and current monitoring trends indicate a significant decrease in naphthalene concentration. Bis(2-ethylhexyl)phthalate has been below laboratory reporting limits during the last four sampling events. Thus the potential for offiste migration of COCs is not significant and remedial options schould be focused on potential source areas.*			
	Impermeable or Low-permeability cap		X	X	X
	Sheet piling / slurry wall	*A sheet pile or slurry wall is not the best suited remedial option. The presumptive remedy for landfills is capping. Additionally, significant attenuation of COC impacts are observed before reaching the property boundary or surface water and current monitoring trends indicate a significant decrease in naphthalene concentration. Thus the potential for offiste migration of COCs is not significant and remedial options schould be focused on potential source areas.*			
Treatment Technologies	*Air Sparge/Soil Vapor Extraction*	*The application of air sparge/soil vapor extraction is not the best suited remedial option because naphthalene and bis(2-ethylhexyl)phthalate are the only two COCs with exceedances of Final RGs and do not easily volatilize. Recovery of air via SVE will be difficult due to subsurface heterogenity.*			
	Groundwater Pump and Treat (GWPT)	*The implementation of a GWPT system is not the best suited remedial option. The naphthalene exceedances are no observed in a continuous plume, making significant mass removal via GWPT unlikely. Additionally, current monitoring trends indicate a significant decrease in concentrations.*			
	In-situ Chemical Oxidation (ISCO)				X
	Enhanced Anaerobic Bioremediation			X	
	Enhanced Aerobic Bioremediation	*Aerobic bioremediation is not the best suited remedial option. The aquifer in the area of COC impacts is naturally reducing. Thus, aerobic bioremediation may be ineffective due to the challenges related to flipping redox conditions from reducing to oxidizing.*			
	Biosparging	*The application of biosparging is not practicable due to the heterogeneity of the geology and low concentration of constituents where the COC mass is located. Targeted and uniform injection of air to increase rate of aerobic biodegradation will be difficult.*			
	Thermal Conductance Heating (TCH)	*The implementation of TCH is not the best suited remedial option. The installation of heating wells within the landfill is not practicable and may impact the stability of the landfill. Soil temperatures during TCH operation can reach as high as 900 C, at which soil dessecation occurs, possibly impacting the structural stability of the area.*			
	Permeable Reactive Barriers (PRB)	*Installation of a PRB is not the best suited remedial option. Significant attenuation of COC impacts is observed prior to reaching the property boundary or surface water and current monitoring trends indicate a significant decrease in naphthalene concentration. There are no shoreline exceedances of Final RGs in this GAA. Thus the potential for offiste migration of COCs is not significant and remedial options schould be focused on potential source areas.*			
Disposal Technologies	*Permitted Discharge*	*Typically paired with GWPT. See GWPT section above.*			
Description of Alternative		No Action	- Capping of the area will occur during development and will include significant areas of impermeable cap installation. - Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys potentially completed over multiple seasons. - LUCs will prevent groundwater use, require HASP for utility workers. - MNA: GW sampling for COCs, MNA parameters; sampling will remain consistent with current semi-annual sampling.	Alt 2, plus bioremediation injections in the naphthalene impacted areas adjacent to/within the Coke Point Landfill. Injections may include nutrients, pH buffer, and/or other amendments as necessary.	Alt 2, plus ISCO. Injections could occur via a low volume continuous injecting system to attack the low permeability zones (silts and clays below the water table).

Notes:
(a) MNA sampling frequency is defined in the Coke Point Area Groundwater Sampling and Analysis Plan.

Table 36C - Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA A - Coke Point Landfill
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Reclamation, Capping, MNA, and ECs/Ics	Alternative 3 Bioremediation, Reclamation, Capping, MNA, and ECs/Ics	Alternative 4 ISCO, Reclamation, Capping, MNA, and ECs/ICs
THRESHOLD CRITERIA				
Protection of Human Health and the Environment	No, will not protect HH&E.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys via a sampling plan approved by the Agencies. Long term GW concentrations would decrease due to natural attenuation, monitored per the Coke Point Sampling Plan.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys via a sampling plan approved by the Agencies. Will reduce contaminant mass of naphthalene via bioremediation, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to bioremediation within the apparent source area and natural attenuation at surrounding wells, monitored per the Coke Point Sampling Plan.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys via a sampling plan approved by the Agencies. Will reduce contaminant mass of naphthalene and bis(2-ethylhexyl)phthalate via ISCO, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to ISCO within the apparent source area and natural attenuation at surrounding wells, monitored per the current semi-annual landfill sampling program.
Achievement of Media Objectives (a)	No, will not address relevant cleanup objectives.	Yes - installation of an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and helping meet Final RGs and CAOs. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - installation of an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and helping meet Final RGs and CAOs. Bioremediation can decrease naphthalene concentrations in GW via destruction. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - installation of an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and helping meet Final RGs and CAOs. ISCO can rapidly decrease naphthalene and bis(2-ethylhexyl)phthalate concentrations in GW via destruction. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.
Source Control	No, will not control source or treatment of principal threat.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater. Bioremediation would address naphthalene GW impacts.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater. ISCO would address naphthalene and bis(2-ethylehxyl)phthalate GW impacts.

Notes:
(a) Sitewide CAOs:
1) Control any releases of COPCs to the groundwater to the extent practicable;
2) Control human exposure to the COPCs remaining in the groundwater;
3) Ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors or adjacent surface water and pore water quality;
4) Achieve cleanup levels for groundwater based on its maximum beneficial use, to the extent practicable.

Table 36D - Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA A - Coke Point Landfill
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Reclamation, Capping, MNA, and ECs/Ics	Alternative 3 Bioremediation, Reclamation, Capping, MNA, and ECs/Ics	Alternative 4 ISCO, Reclamation, Capping, MNA, and ECs/ICs
BALANCING CRITERIA				
Long-Term Effectiveness	NA: did not pass Threshold criteria	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness of ECs and ICs. Once controls are installed, the continued maintenance of capped areas will increase the long term effectiveness of reductions in vadose zone soil to GW pathway.	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of naphthalene impacts via bioremediation will increase the rate of destruction, driving concentrations towards Final RGs.	Risks from residual contamination would be low with ICs/LUCs. MNA via oxidation provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of naphthalene and bis(2-ethylhexyl)phthalate impacts via ISCO will increase the rate of destruction, driving concentrations towards Final RGs.
Reduction of Toxicity, Mobility, and Volume	NA: did not pass Threshold criteria	Reduction of toxicity and mobility will be achieved via capping (reduction in mobility and prevention of exposure). Reduction in volume of GW contaminants will be achieved via natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA.	Reduction of toxicity and mobility will be achieved via capping (reduction in mobility and prevention of exposure). Reduction in toxicity and volume will be achieved via degradation of naphthalene with application of bioremediation and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA.	Reduction of toxicity and mobility will be achieved via capping (reduction of mobility and prevention of exposure). Reduction in toxicity and volume will be achieved via destruction of naphthalene and bis(2-ethylhexyl)phthalate with application of ISCO and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA.
Short-Term Effectiveness	NA: did not pass Threshold criteria	Short-term effectiveness via reclamation and capping of the landfill. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap construction.	Short-term effectiveness via reclamation and capping of the landfill. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Bioremediation is considered a long-term remedial option that, once implemented, would help reduce contaminant concentrations over time and support progress toward meeting Final RGs. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap construction.	Short-term effectiveness via reclamation and capping of the landfill. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. ISCO is considered a longer-term treatment option due to the time needed for chemical reactions to degrade contaminants and would help reduce contaminant concentrations over time and support progress toward meeting Final RGs. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap construction.
Cost (a)	NA: did not pass Threshold criteria	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs for Alternative 2 are associated with installation of wells for MNA monitoring purposes. O&M costs include the implementation of the MNA sampling plan. • Capital Costs: $16,000 • Present Worth of Annual O&M Costs: $137,000 • Present Worth of Period Costs: $11,000 • Total Present Worth: $164,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 3 consist of the installation of a bioremediation injection system and monitoring wells. O&M costs include semi-annual bioremediation injections for 2 years and the implementation of the MNA sampling plan. • Capital Costs: $81,000 • Present Worth of Annual O&M Costs: $449,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $541,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 4 consist of the installation an ISCO injection system. O&M costs include semi-annual ISCO injections for 2 years and the implementation of the MNA sampling plan. • Capital Costs: $81,000 • Present Worth of Annual O&M Costs: $505,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $597,000
Implementability	NA: did not pass Threshold criteria	This alternative is considered implementable with all Process Options implemented during and after planned development.	The bioremediation portion of this alternative may be challenging to implement. Bioremediation would take place via injections of nutrient amendment to address the naphthalene impacts. Subsurface obstructions and complex geology may make injection well installation difficult. Additionally, preferential pathways could exist within the geology, which may prevent uniform distribution of additives. Introduction of a pH buffer may be required due to the high pH in groundwater. Injecting materials into an impacted saturated zone and adjusting pH may mobilize slag-related constituents by causing biological or chemical changes that influence their mobility.	The ISCO portion of this alternative may be challenging to implement. ISCO would take place via injections on a regular basis to address the naphthalene and bis(2-ethylhexyl)phthalate impacts. Subsurface obstructions and complex geology may make injection well installation difficult. Additionally, preferential pathways could exist within the geology, which may prevent uniform distribution of additives. Low permeable zones may be difficult to address. Due to the naturally high pH observed at many wells within this GAA, an alkaline activated persulfate or peroxide would be utilized as the oxidant that has the best chances of success. Injecting materials into an impacted saturated zone and adjusting pH may mobilize slag-related constituents by causing biological or chemical changes that influence their mobility.

Table 36D - Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA A - Coke Point Landfill
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Reclamation, Capping, MNA, and ECs/Ics	Alternative 3 Bioremediation, Reclamation, Capping, MNA, and ECs/Ics	Alternative 4 ISCO, Reclamation, Capping, MNA, and ECs/ICs
Community Acceptance	NA: did not pass Threshold criteria	This alternative should have community acceptance as it is protective of human health via source containment. Additionally, this will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health via mass reduction by bioremdiation. Additionally, this will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health via mass reduction. Additionally, this will be included in a public comment period to enable meaningful community involvement.
State Acceptance	NA: did not pass Threshold criteria	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.

Notes:
(a) Costs assume 15 years of MNA sampling. Long-term monitoring will be determined during analysis of quarterly MNA sampling results, as discussed in the Sitewide Groundwater Sampling Plan. See Appendix I for costing detail.

Table 37A - Applicability Evaluation of Technologies for GAA B - Parcel B10 West
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
No Action	No Action	None	Do nothing to achieve remedial action objectives.	NA	Applicable to GAA B.	Retained for comparison purposes.	
Institutional Controls	Administrative Restrictions	Restrictions on Site Use	Deed restrictions are used to specify land use for certain areas (e.g., prohibition of residential use.)	Impacted soil / slag	Applicable to GAA B.	Retained for use in combination with other process options.	
	Administrative Restrictions	Restrictions on Groundwater Use	Groundwater use restrictions are controls (generally at the local or county level) directed at limiting or prohibiting certain uses of groundwater (e.g., use as potable water.)	Impacted groundwater	Applicable to GAA B.	Retained for use in combination with other process options.	
	Administrative Controls	Inspection and Maintenance	Inspections of facilities and performance of preventative or corrective measures to ensure proper operation of engineered controls.	Impacted soil / slag and groundwater	Applicable to GAA B.	Retained for use in combination with other process options.	
	Sampling and Analysis	Monitored Natural Attenuation	Allow naturally-occurring processes (e.g., dispersion, volatilization, biodegradation, adsorption, and chemical reactions) to reduce contaminant levels.	Impacted soil / slag and groundwater	Applicable to GAA B.	Retained for use in combination with other process options.	
Engineering Controls	Engineering Controls	Fencing/Warning Signs/Access Restrictions	Placing physical restrictions on activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. May also include installation of security fence around impacted areas. Signs, fencing and/or other barriers designed to reduce or eliminate human exposure to COCs.	Impacted soil / slag and groundwater	Applicable to GAA B.	Retained for use in combination with other process options.	
	Engineering Controls	Vapor Mitigation - Sub-slab Vapor Barrier	Vapor barrier below floor slab of new building. Vapor barriers include impermeable barriers designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA B future development.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
	Engineering Controls	Vapor Mitigation - Sub-slab Venting System	Sub-slab venting system (passive/active) below floor slab of new building. Venting systems include sub-slab piping designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA B future development.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
Removal Technologies	Excavation	Excavation	Excavate NAPL impacted or contaminated soil/slag in source areas to eliminate leaching of contaminants to groundwater.	Impacted soil / slag	Applicable to NAPL in soil within GAA B. Not applicable to naphthalene and benzene dissolved-phase plumes.	Retained for use in combination with other process options. Applicable to area north of Cell 6, near historical tank locations. Vadose zone NAPL locations would need to be further delineated. This may be difficult to successfully implement due to previous infrastructure (e.g., tank and building foundations) currently in place.	
Containment Technologies	In Situ Physical	Hydraulic Containment	A series of extraction wells are placed to induce groundwater flow towards the installed extraction wells, and prevent contaminated groundwater from migrating offsite.	Impacted groundwater	Applicable to shoreline exceedances within GAA B. A hydraulic containment system would require additional investigation, potentially including a tracer test or modeling in relation to the Graving Dock operations and filling of the Coal Pier Channel.	Retained for use in combination with other process options. Hydraulic investigation may require a significant amount of time due to a relatively flat gradient across CPA. Groundwater gauging within GAA B indicates the Graving Dock provides significant hydraulic control within the intermediate groundwater zone where concentrations at the shoreline are highest.	

Table 37A - Applicability Evaluation of Technologies for GAA B - Parcel B10 West
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	Capping	Impermeable and low-permeability cap	In-place isolation of materials below an impermeable or low permeability cap.	Impacted soil / slag	Applicable for GAA B to prevent leaching to groundwater.	Retained for use in combination with other process options.	
	Vertical Barrier	Sheet piling / slurry wall	Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration. Placement may be limited by slag or subsurface obstructions.	Impacted groundwater	Applicable for GAA B to reduce offsite migration of COCs.	Retained for use in combination with other process options. Due to subsurface obstructions (i.e., building and tank foundations), sheet piling / slurry wall may be difficult to implement in slag.	
	In Situ Physical	Reduced permeability containment	Construction of adjacent dredged material containment facility (DMCF), removing and backfilling of adjacent surface water body.	Impacted soil / groundwater	Applicable to GAA B.	Retained for use in combination with other process options.	
Treatment Technologies	In Situ Physical	Air Sparge/Soil Vapor Extraction	Air sparging involves the installation of injection wells that introduce air below the water table. Soil Vapor Extraction involves the installation of extraction wells above the water table that pull air and vapors through the soil to the ground surface for treatment.	Impacted soil / slag and groundwater	Previously Implemented IM in Cells 1, 2, and 3: Applicable to GAA B. Air sparge may be difficult to be effective but could be an option for benzene and naphthalene impacts.	Retained, for use in combination with other process options. This process option is currently operating as an IM in the shallow zone within the Cell 1 and Cell 3 areas. Depending on location, this process option may be challenging with the significant heterogeneity of the local geology but can be applicable to benzene and naphthalene impacts.	
	In Situ Physical	Product Recovery (Absorbent/ Skimmers/Trench)	NAPL is removed from recovery wells or trenches using absorbent/skimmers (active or passive) or via enhanced fluid recovery where multiple phases of hydrocarbons (liquid, dissolved, adsorbed and vapor phase) are simultaneously removed.	NAPL in groundwater	Previously Implemented IM in Cell 6 at CO173: Applicable to GAA B. NAPL has been observed in the area north and south of Cell 6. NAPL has been recovered from within Cell 6 via an MPE system, excavation, and product skimming (Coke Oven 2023 IM Progress Report [ARM, 2024]).	Retained, for use in combination with other process options. This process option is applicable to areas where NAPL is observed in groundwater. Approximately 2,200 gallons of NAPL have been recovered from CO173 via product skimming. Minimal recovery from other wells with measurable NAPL has been observed (Coke Oven 2023 IM Progress Report [ARM, 2024]). The success of this process option as an IM appears to be related to the transmissivity of the NAPL and localized permeability.	
	In Situ Physical	Multi-Phase Extraction	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	Impacted soil / slag and groundwater	Previously Implemented IM in Cell 6: Applicable to GAA B. The Cell 6 MPE system consists of approximately fifty (50) MPE recovery wells. The Cell 6 MPE system has operated since 2010 and has recovered approximately 34,600 gallons of NAPL (Coke Oven 2023 IM Progress Report [ARM, 2024]).	Retained, for use in combination with other process options. This process option has been previously implemented as an IM in Cell 6. Recovery rate from the Cell 6 MPE system has dimishined with only two isolated locations still producing recoverable material. Measureable NAPL exists outside of Cell 6.	

Table 37A - Applicability Evaluation of Technologies for GAA B - Parcel B10 West
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ Physical	Soil Flushing	In situ leaching method using extraction wells and liquid treatment to remove contaminants from soil.	Impacted soil, NAPL in groundwater	Applicable to NAPL in groundwater in Cell 6 area of GAA B. Subsurface obstructions (e.g., tank and building foundations) may make implementation of this technology ineffective.	Retained, for use in combination with other process options. This process option may be difficult to implement due to subsurface obstructions (tank and building foundations) causing preferential pathways and decreased effectiveness.	
	In Situ Physical	Stabilization / solidification	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Impacted soil, NAPL in groundwater	Applicable to NAPL in groundwater in Cell 6 area of GAA B. Subsurface obstructions (e.g., tank and building foundations) may make implementation of this technology ineffective.	Retained, for use in combination with other process options. This process option may be difficult to implement due to subsurface obstructions (tank and building foundations) causing preferential pathways and decreased effectiveness.	
	Ex Situ Physical	Groundwater Pump and Treat (GWPT)	A series of extraction wells are placed to remove contaminated groundwater. Extracted water is then treated and may be reinjected, transferred to a treatment system, or discharged with the proper permitting.	Impacted groundwater	Applicable to dissolved phase COCs in GAA B. Not applicable to NAPL impacts.	Retained for use in combination with other process options. This process option would target removal and reduction of mass of dissolved phase COCs in GAA B.	
	In Situ Chemical	In-situ Chemical Oxidation (ISCO)	ISCO involves the introduction of a chemical oxidant into the subsurface to oxidize contaminants and transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Applicable to dissolved phase COCs in GAA B. However, ISCO may drive chemical changes in implaced slag, potentially increasing Mn, Fe, and Co concentration in groundwater.	Retained for use in combination with other process options to treat and reduce dissolved phase COCs within GAA B. Treatment of areas with high concentrations of dissolved phase and/or NAPL using ISCO may result in a prohibitively high oxidant demand.	
	In Situ Chemical	In-situ Chemical Reduction (ISCR)	ISCR involves the introduction of a chemical reductant into the subsurface to create reducing conditions (lower oxidation reduction potential and dissolved oxygen) to transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Not applicable to remaining COCs in GAA B, naphthalene and benzene. Most applicable for CVOCs, also PCBs and Chromium VI.		Eliminated - GAA B does not have applicable COCs.
	In Situ Biological	Enhanced Anaerobic Bioremediation	Subsurface delivery of electron donors within the target zone to stimulate anaerobic biodegradation of compounds by cometabolic remediation. Different electron acceptor may be injected to promote availability of hydrogen to speed up the process.	Impacted groundwater	Applicable to dissolved phase COCs in GAA B. The historical range of pH in this area ranges from 10-12 s.u. which may inhibit biological activity or drive anaerobic bioremediation into methanogenic conditions.	Retained, for use in combination with other process options for application to dissolved phase COCs. Process option may be ineffective due to high pH in impacted area. Based on geochemical data, the natural aquifer in GAA B tends to support reducing conditions.	
	In Situ Biological	Enhanced Aerobic Bioremediation	Injection of oxygen (other than bioventing), substrates, or nutrients to enhance microbial activities.	Impacted groundwater	Applicable to dissolved phase COCs in GAA B. The historical range of pH in this area ranges from 10-12 s.u. which may not support beneficial microbial populations.	Retained, for use in combination with other process options for application to dissolved phase COCs. Process option may be ineffective due to high pH in impacted area. Based on geochemical data, the natural aquifer in GAA B tends to support reducing conditions. The oxygen demand may be prohibitively high to drive aerobic conditions within the aquifer.	

Table 37A - Applicability Evaluation of Technologies for GAA B - Parcel B10 West
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ Biological	Biosparging	Similar to air sparging, air or oxygen ins introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs	Impacted groundwater	Applicable to dissolved phase COCs in GAA B. The historical range of pH in this area ranges from 10-12 s.u. which may not support beneficial microbial populations.	Retained, for use in combination with other process options for application to dissolved phase COCs. Process option may be ineffective due to high pH in impacted area. Based on geochemical data, the natural aquifer in GAA B tends to support reducing conditions. The oxygen demand may be prohibitively high to drive aerobic conditions within the aquifer.	
	In Situ Physical	Steam Enhanced Extraction (SEE)	Injection of steam in a permeable aquifer to drive LNAPL collection. The system is comprised of steam injection wells, surrounded by multi-phase extraction wells. The injection of steam pushes LNAPL towards MPE wells for recovery and treatment.	NAPL in groundwater	Applicable to NAPL in groundwater in GAA B. Application of SEE may be challenging due to subsurface obstructions (tank and building foundations). Residual heat from steam may help increase rate of natural attentuation.	Retained, for use in combination with other process options for application to LNAPL near Cell 6 area. Recovery of LNAPL would require a series of extraction wells, however not all mobilized LNAPL will be recovered. May drive additional mobilization of NAPL in the subsurface. SEE would not address dissolved phase COCs but may help increase the rate of natural attenuation.	
	In Situ Physical	Thermal Conductance Heating (TCH)	Installation of thermal wells into the ground, heat treatment volume to desired temperature based on contamination type. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Applicable to GAA B. Application of TCH would likely be most beneficial in areas of high dissolved phase concentrations. Applicability to NAPL recovery may be limited due to high temperatures and the potential for in situ ignition at these temperatures. Residual heat in surrounding area may help increase rate of natural attenuation.	Retained for use in combination with other process options for use to treat and reduce dissolved phase source area. This process option could potentially be considered to increase mobility of NAPL in combination with recovery wells and trenches to decrease timeframe of NAPL removal.	
	In Situ Physical	Electrical Resistance Heating (ERH)	Installation of electrodes into the ground, application of alternating current (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Applicable to GAA B. Application of ERH would likely be most beneficial in areas of high dissolved phase concentrations. Applicability to NAPL recovery would depend on a combined heating (causing increased mobility of NAPL) and recovery wells/trenches. Residual heat in surrounding area may help increase rate of natural attenuation.	Retained for use in combination with other process options. Treatment of benzene via ERH is proven. Treatment of naphthalene via ERH is not as effective, but some reduction in mass is likely to occur. This process option could potentially be considered to increase mobility of NAPL in combination with recovery wells and trenches to decrease timeframe of NAPL removal.	
	In Situ Physical/Biological	Permeable Reactive Barriers (PRB)	A permeable wall containing reactive substances is installed across the groundwater flow path. Contaminants are chemically removed as groundwater flows through the wall.	Impacted groundwater	Applicable to GAA B in locations where shoreline exceedances are observed.	Retained for use in combination with other process options for use mitigate potential offsite migration. Application would target low concentration shoreline areas as high concentration areas would require prohibitively high amendment loading and re-application.	

Table 37A - Applicability Evaluation of Technologies for GAA B - Parcel B10 West
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
Disposal Technologies	Excavation & Disposal	On-Site or Off-Site Disposal/ Landfilling	Contaminated material is removed and transported to on-site landfill or permitted off-site disposal facilities.	Impacted soil / slag	Applicable to NAPL in soil within GAA B. Not applicable to naphthalene and benzene dissolved-phase plumes.	Retained for use in combination with other process options. Applicable to area north of Cell 6, near historical tank locations. Vadose zone NAPL locations would need to be further delineated. This may be difficult to successfully implement due to previous infrastructure (e.g., tank and building foundations) currently in place.	
	Excavation & Disposal	On-Site Disposal (CAMU)	CAMUs are used to facilitate treatment, storage, and disposal of CAMU-eligible wastes to implement corrective action or cleanup.	Impacted soil / slag	Not applicable to GAA B, there is no available area for a CAMU.		Eliminated - there is no area available in GAA B for a CAMU.
	Disposal	Permitted Discharge	Discharge of treated groundwater via NPDES or other permit.	Treated groundwater	Applicable to GAA B. To be paired with GWPT.	Retained, for use in combination with other process options. Specifically, to be paired with GWPT.	

Notes:
Treatment technologies retained based on applicability will likely require the completion of treatability studies, bench scale testing, or pilot installations to establish feasibility in this GAA.

Table 37B - Corrective Measures Alternatives for GAA B - Parcel B10 West
Coke Point CMS

General Response Action	Process Option	Alternative 1 No Action	Alternative 2 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 3 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow / Intermediate Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 4 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Pump & Treat, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 5 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Two Intermediate Biosparge Systems Southern Area: Shallow Air Sparge (optimized)
No Action	None	X				
Institutional Controls	Restrictions on Site Use		X	X	X	X
	Restrictions on Groundwater Use		X	X	X	X
	Inspection and		X	X	X	X
	Monitored Natural Attenuation		X	X	X	X
Engineering Controls	Fencing/Warning Signs/Access Restrictions		X	X	X	X
	Vapor Mitigation - Sub-slab Vapor Barrier		X	X	X	X
	Vapor Mitigation - Sub-slab Venting System		X	X	X	X
Removal Technologies	*Excavation*	*Excavation is not the best suited remedial option as the NAPL observed in the subsurface is of varying thickness and varying mobility. The area consists of large foundations, tank rings, concrete obstructions, and concrete debris making excavation extremely difficult. Some areas of NAPL provide significant recovery and other areas provide less recovery (See Section 6.2).*				
Containment Technologies	*Hydraulic Containment*	*Hydraulic containment is not the best suited remedial option. Remedial options should be focused on decreasing contaminant mass in source areas to achieve subsequent concentration reductions in groundwater being captured by the Gracking Dock system and subsequent shoreline areas. Therefore, it is not anticipated that hydraulic containment will be necessary to achieve CAOs within GAA B. Groundwater flow in the southern direction is no longer evident due to the operation of the Graving Dock. An air sparge system was previously installed in the southern area as an IM and is recommended for continued operation and optimization.*				
	Impermeable or Low-permeability cap		X	X	X	X
	Sheet piling / slurry wall	*A sheet pile or slurry wall is not the best suited remedial option. Remedial options should be focused on decreasing contaminant mass in source areas to achieve subsequent concentration reductions in groundwater being captured by the Gracking Dock system and subsequent shoreline areas. Therefore, it is not anticipated that sheet pile/slurry wall will be necessary to achieve CAOs within GAA B.*				
	Reduced permeability containment		X	X	X	X
Treatment Technologies	Air Sparge/Soil Vapor Extraction		X	X	X	X
	Product Recovery (Adsorbent/Skimmers/Trench)		X	X	X	X
	Multi-Phase Extraction	(a)	(a)	(a)	(a)	(a)
	Soil Flushing	*Soil Flushing is not the best suited remedial option for GAA B. As reported in the Coke Oven 2023 IM Progress Report (ARM, 2024), there appears to be areas where the NAPL is recoverable via more conventional methods. Soil flushing may not be necessary to recover mobile NAPL. Addition of surfactants or enzymes may be considered under Product Recovery. Additionally, preferential pathways could exist within the geology, which may prevent uniform distribution of additives. Subsurface obstructions would add to difficulty.*				
	Stabilization / Solidification	*Stabilization / Solidification is not the best suited remedial option for GAA B. As reported in the Coke Oven 2023 IM Progress Report (ARM, 2024), there appears to be areas where the NAPL is recoverable. Stabilization / Solidification is not necessary in this GAA. Additionally, Subsurface obstructions and heterogeneous geology in GAA B would present significant challenges for effective mixing and implementation of stabilization/solidification. Preferential pathways could limit the uniform distribution of additives, potentially causing mobilization of contaminants in unintended directions and reducing the overall effectiveness of the approach.*				
	Groundwater Pump and Treat (GWPT)				X	
	In-situ Chemical Oxidation (ISCO)	*ISCO is not the best suited remedial technology for GAA B. Based on the soil oxidant demand from six (6) soil samples within GAA B, the amendment demand would be prohibitively high. The average soil oxidant demand (SOD) was measured at 5.5 g oxidant per kg of soil (g/kg soil), with a range of 0.6-15 g/kg.*				
	Enhanced Anaerobic Bioremediation	*Anaerobic bioremediation is not the best suited remedial option due to the magnitude of BTEX and naphthalene concentrations, which may inhibit microbial activity and warrant more aggressive remediation methods. Elevated pH conditions may further suppress microbial growth, although the aquifer is naturally reducing and could support anaerobic bioremediation processes under more favorable conditions. In this area, however, bioremediation was not expected to achieve meaningful mass reduction within a reasonable timeframe.*				
	Enhanced Aerobic Bioremediation	*Aerobic bioremediation is not the best suited remedial option due to the magnitude of BTEX and naphthalene concentrations, which may inhibit microbial activity and warrant more aggressive remediation methods. Elevated pH conditions may further suppress microbial growth, although the aquifer is naturally reducing and could support anaerobic bioremediation processes under more favorable conditions. In this area, however, bioremediation was not expected to achieve meaningful mass reduction within a reasonable timeframe.*				
	Biosparging		X	X	X	X
	Steam Enhanced Extraction (SEE)	*Steam Enhanced Extraction is not the best suited remedial option because it will be limited to NAPL recovery only and is highly dependent on the permeability of the area. Due to the subsurface obstructions (building and tank foundations), SEE may not be as effective as a NAPL recovery trench in removing NAPL. Additionally, the application of heat could mobilize NAPL and dissolved contaminants beyond the capture zone, potentially spreading impacts.*				
	Thermal Conductance Heating (TCH)	*TCH is not the best suited remedial option for GAA B. Soil temperatures during TCH operation can reach as high as 900 C, at which NAPL within the subsurface may ignite. This option may be considered to increase NAPL mobility, however, as reported in the Coke Oven 2023 IM Progress Report (ARM, 2024) there are still areas of high NAPL recovery within the NAPL impacted area.*				
	Electrical Resistance Heating (ERH)	*ERH is not the best suited remedial option for GAA B. Naphthalene removal efficiency will be limited with this technology. This option may be considered to increase NAPL mobility, however, as reported in the Coke Oven 2023 IM Progress Report (ARM, 2024) there are still areas of high NAPL recovery within the NAPL impacted area. This process option is not necessary to recover NAPL within source area.*				
	Permeable Reactive Barriers (PRB)	*Installation of a PRB is not the best suited remedial option as significant attenuation of COC impacts are observed before reaching the property boundary or surface water. Application of active remediation in the source area will decrease the mass flux of COCs migrating towards surface water. Therefore, it is anticipated that a PRB will not be necessary to achieve Corrective Action Objectives within GAA B. Groundwater flow in the southern direction is no longer evident due to the operation of the Graving Dock. An air sparge system was previously installed in the southern area as an IM and is recommended for continued operation and optimization.*				
Disposal Technologies	*On-Site or Off-Site Disposal / Landfilling*	*Excavation is not the best suited remedial option as the NAPL observed in the subsurface is of varying thickness and varying mobility. The area consists of large foundations, tank rings, concrete obstructions, and concrete debris making excavation extremely difficult. Some areas of NAPL provide significant recovery and other areas provide less recovery (See Section 6.2).*				
	Permitted Discharge				X	
	Description of Alternative	No Action	- A combination of NAPL recovery trench and recovery pits will be used to effectively remove NAPL at the source. This will be paired with Enhanced Fluid Recovery (EFR) to optimize NAPL removal. - Optimization of the existing air sparge system in the **southern area** of GAA B (Cell 3) to better intercept COCs migrating towards the cove. - An air sparge wall/trench within the shallow zone, in the **northern area** of GAA B will reduce migration of COCs within GAA B to the intermediate zone. -Intermediate biosparging near CO209-MWI will address naphthalene exceedances observed in the area. - Capping of the area will occur during development and will include significant areas of impermeable cap installation. - Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys potentially completed over multiple seasons. - LUCs will prevent groundwater use, require HASP for utility workers. - The existing sheet pile wall provides a barrier through preventing contaminant migration into sediment and pore water of the Coal Pier Channel.	Alt 2, plus air sparge treatment within the intermediate zone only where the semi-confining clay layer is not observed. The semi-confining clay layer is not observed in wells west of CO183-MWS to the Patapsco River and north of CO184-MWS/I to the Coal Pier Channel.	Alt 2, plus operation of the existing Cell 2 GW Pump & Treat system within the intermediate zone. This system would be anticipated to operate for up to five years, concurrent with NAPL removal or until COC recovery has reached asymptotic levels, whichever occurs first. The goal of the GW Pump & Treat system is to improve the remediation timeframe by reducing the distance the plume would travel to be captured and to increase efficiency of capture in high concentration areas.	Alt 2, plus application of biosparging within the intermediate zone northwest of Cell 6 and near Cell 3. Microbial and geochemical sampling indicate the presence of both anaerobic and aerobic mircobial populations. Biosparging can be implemented easily due to the existing air sparge IMs, thus synergy between these systems would provide effective decreases in COC concentration within the intermediate zone.

Notes:
(a) Previously Implemented IM: Cells 1, 2, 3, and 6 are all within the GAA B area. The IMs that have operated in this GAA include air sparge, GWPT, Product Recovery, and MPE. See CMS Section 7.3.2 for detailed discussion of IMs.

Table 37C - Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA B - Parcel B10 West
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 3 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow / Intermediate Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 4 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Pump & Treat, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 5 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Two Intermediate Biosparge Systems Southern Area: Shallow Air Sparge (optimized)
THRESHOLD CRITERIA					
Protection of Human Health and the Environment	No, will not protect HH&E.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs and capping to be completed during development. **Northern Area:** GW concentrations of COCs in the shallow zone would decrease due to removal of NAPL via recovery trench and test pits and removal of dissolved phase via shallow air sparge. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The shallow air sparge would also intercept COCs prior to migration into the intermediate zone, thus decreasing COC concentrations in the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Protection of the environment will be maintained through operation of the Graving Dock system. An intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location. **Southern Area:** GW concentrations of COCs in the shallow zone would decrease due to removal of COCs via shallow air sparge. GW concentrations of COCs in the intermediate zone would decrease due to the reduced migration from shallow to intermediate zones achieved. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs and capping to be completed during development. **Northern Area:** GW concentrations of COCs in the shallow zone would decrease due to removal of NAPL via recovery trench and test pits and removal of dissolved phase via shallow air sparge. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The shallow air sparge would also intercept COCs prior to migration into the intermediate zone, thus decreasing COC concentrations in the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Additional reduction of COCs will occur in the intermediate zone through application of a deeper air sparge system in an open area in the northwest corner of the site where the semi-confining clay layer is not observed. An intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Protection of the environment will be maintained through operation of the Graving Dock system. **Southern Area:** GW concentrations of COCs in the shallow zone would decrease due to removal of COCs via shallow air sparge. GW concentrations of COCs in the intermediate zone would decrease due to the reduced migration from shallow to intermediate zones achieved. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs and capping to be completed during development. **Northern Area:** GW concentrations of COCs in the shallow zone would decrease due to removal of NAPL via recovery trench and test pits and removal of dissolved phase via shallow air sparge. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The shallow air sparge would also intercept COCs prior to migration into the intermediate zone, thus decreasing COC concentrations in the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Additional reduction of COCs will occur in the intermediate zone through continuation of the GWPT IM in Cell 2. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Protection of the environment will be maintained through operation of the Graving Dock system. An intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location. **Southern Area**: GW concentrations of COCs in the shallow zone would decrease due to removal of COCs via shallow air sparge. GW concentrations of COCs in the intermediate zone would decrease due to the reduced migration from shallow to intermediate zones achieved. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs and capping to be completed during development. **Northern Area:** GW concentrations of COCs in the shallow zone would decrease due to removal of NAPL via recovery trench and test pits and removal of dissolved phase via shallow air sparge. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The shallow air sparge would also intercept COCs prior to migration into the intermediate zone, thus decreasing COC concentrations in the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Additional reduction of COCs will occur in the intermediate zone through implementation of bioremediation injections. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Protection of the environment will be maintained through operation of the Graving Dock system. An intermediate biosparge system will be implemented near well CO209-MWI to mitigate naphthalene exceedances observed at that location. **Southern Area:** GW concentrations of COCs in the shallow zone would decrease due to removal of COCs via shallow air sparge. GW concentrations of COCs in the intermediate zone would decrease due to the reduced migration from shallow to intermediate zones achieved. Protection of the environment will be achieved through the shallow air sparge system, located just north of the cove, which will intercept and capture COCs.
Achievement of Media Objectives (a)	No, will not address relevant cleanup objectives.	Yes - removal of NAPL reduces the continuing source migration and expedites meeting CAOs. Site-wide containment of contaminant mass under an impermeable/low-permeability cap reduces potential for NAPL or impacted soil to act as a continuing source to GW and expedites natural attenuation in GW. **Northern Area:** Removal of NAPL via recovery trench/pits reduces continuing source migration and expedites meeting CAOs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Removal of dissolved phase COCs via shallow air sparge in the northern portion of the GAA will decrease COC concentrations downgradient, reduce COC migration towards the western shore of the mouth of the Coal Pier Channel. Operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Shallow air sparge will be located near the source to enhance source control and capture. **Southern Area:** Removal of dissolved phase COCs via shallow air sparge from the southern portion of the GAA will decrease COC concentrations downgradient, reduce migration of COCs towards the cove, and reduce adverse impacts to ecological receptors and surface water.	Yes - removal of NAPL reduces the continuing source migration and expedites meeting CAOs. Site-wide containment of contaminant mass under an impermeable/low-permeability cap reduces potential for NAPL or impacted soil to act as a continuing source to GW and expedites natural attenuation in GW. **Northern Area:** Removal of NAPL via recovery trench/pits reduces continuing source migration and expedites meeting CAOs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Removal of dissolved phase COCs via shallow air sparge in the northern portion of the GAA will decrease COC concentrations downgradient. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Shallow air sparge will be located near the source to enhance source control and capture. Operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area and operation of the intermediate air sparge system will decrease dissolved phase COCs migrating to pore water near the mouth of the Coal Pier Channel. **Southern Area:** Removal of dissolved phase COCs via shallow air sparge from the southern portion of the GAA will decrease COC concentrations downgradient, reduce migration of COCs towards the cove, and reduce adverse impacts to ecological receptors and surface water.	Yes - removal of NAPL reduces the continuing source migration and expedites meeting CAOs. Site-wide containment of contaminant mass under an impermeable/low-permeability cap reduces potential for NAPL or impacted soil to act as a continuing source to GW and expedites natural attenuation in GW. **Northern Area:** Removal of NAPL via recovery trench/pits reduces continuing source migration and expedites meeting CAOs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Removal of dissolved phase COCs via shallow air sparge in the northern portion of the GAA will decrease COC concentrations downgradient. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Shallow air sparge will be located near the source to enhance source control and capture. Operation of the intermediate GWPT system will decrease dissolved phase COCs migrating to the Graving Dock. However, due to the capture zone of the Graving Dock, it is unlikely COCs in the intermediate zone will negatively impact ecological receptors and/or surface water. Operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area. **Southern Area:** Removal of dissolved phase COCs via shallow air sparge from the southern portion of the GAA will decrease COC concentrations downgradient, reduce migration of COCs towards the cove, and reduce adverse impacts to ecological receptors and surface water.	Yes - removal of NAPL reduces the continuing source migration and expedites meeting CAOs. Site-wide containment of contaminant mass under an impermeable/low-permeability cap reduces potential for NAPL or impacted soil to act as a continuing source to GW and expedites natural attenuation in GW. **Northern Area:** Removal of NAPL via recovery trench/pits reduces continuing source migration and expedites meeting CAOs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Removal of dissolved phase COCs via shallow air sparge in the northern portion of the GAA will decrease COC concentrations downgradient. The existing sheet pile wall will provide a barrier through preventing contaminant migration into the sediment and pore water of the Coal Pier Channel. Shallow air sparge will be located near the source to enhance source control and capture. Operation of the intermediate biosparge system (near CO181-MWI) will decrease dissolved phase COCs migrating to pore water near the mouth of the Coal Pier Channel. Operation of the intermediate biosparge system located near CO209-MWI will address Final RG exceedances of naphthalene seen in the area. **Southern Area:** Removal of dissolved phase COCs via shallow air sparge from the southern portion of the GAA will decrease COC concentrations downgradient, reduce migration of COCs towards the cove, and reduce adverse impacts to ecological receptors and surface water.
Source Control	No, will not control source or treatment of principal threat.	Yes – source control is achieved via NAPL source removal, dissolved phase removal and COC migration reduction. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. **Northern area**: Source removal via a NAPL recovery trench will reduce the NAPL to dissolved phase pathway of COCs migrating towards the Graving Dock. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Additional dissolved phase source control via shallow air sparge in the northern area will prevent high concentrations of COCs from migrating from the shallow zone to the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Additional dissolved phase source control via intermediate biosparge will prevent further migration of contaminants. **Southern area:** Optimization of the shallow air sparge in the southern area will prevent high concentrations of COCs from migrating southwest to the cove.	Yes –source control is achieved via NAPL source removal, dissolved phase removal and COC migration reduction. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. **Northern area:** Source removal via a NAPL recovery trench will reduce the NAPL to dissolved phase pathway of COCs migrating towards the Graving Dock. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Additional dissolved phase source control via shallow and intermediate air sparge and will prevent high concentrations of COCs from migrating from the shallow zone to the intermediate zone, as well as reduce both shallow and intermediate zone COC concentrations. Shallow air sparge will be located near the source to enhance source control and capture. Additional dissolved phase source control via intermediate biosparge will prevent further migration of contaminants. **Southern area:** Optimization of the shallow air sparge in the southern area will prevent high concentrations of COCs from migrating southwest to the cove.	Yes – source control is achieved via NAPL source removal, dissolved phase removal and COC migration reduction. **Northern area:** Source removal via a NAPL recovery trench will reduce the NAPL to dissolved phase pathway of COCs migrating towards the Graving Dock. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Additional dissolved phase source control via shallow air sparge in the northern area will prevent high concentrations of COCs from migrating from the shallow zone to the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Intermediate zone pump and treat will capture additional impacted groundwater and reduce off-site migration potential and COC concentrations. Additional dissolved phase source control via intermediate biosparge will prevent further migration of contaminants. **Southern area:** Optimization of the shallow air sparge in the southern area will prevent high concentrations of COCs from migrating southwest to the cove.	Yes –source control is achieved via NAPL source removal, dissolved phase removal and COC migration reduction. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. **Northern area:** Source removal via a NAPL recovery trench will reduce the NAPL to dissolved phase pathway of COCs migrating towards the Graving Dock. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Additional dissolved phase source control via shallow air sparge in the northern area will prevent high concentrations of COCs from migrating from the shallow zone to the intermediate zone. Shallow air sparge will be located near the source to enhance source control and capture. Intermediate zone biosparging at two locations will reduce COC concentrations and off-site migration potential of COCs. **Southern area:** Optimization of the shallow air sparge in the southern area will prevent high concentrations of COCs from migrating southwest to the cove.

Notes:
(a) Sitewide CAOs:
1) Control any releases of COPCs to the groundwater to the extent practicable;
2) Control human exposure to the COPCs remaining in the groundwater;
3) Ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors or adjacent surface water and pore water quality;
4) Achieve cleanup levels for groundwater based on its maximum beneficial use, to the extent practicable.

Table 37D - Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA B - Parcel B10 West
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 3 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow / Intermediate Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 4 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Pump & Treat, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 5 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Two Intermediate Biosparge Systems Southern Area: Shallow Air Sparge (optimized)
BALANCING CRITERIA					
Long-Term Effectiveness	NA: did not pass Threshold criteria	Long term effectiveness is provided through NAPL removal and reduction of source material, as well as removal of dissolved phase COC mass via air sparge. The continuous maintenance of the capped areas ensures a maintained reduction in vadose zone soil to GW pathway. **Northern area:** Removal of NAPL from GW via recovery trench/pits provides long term effectiveness through reduction of material that may impact GW. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Removal of COC mass via shallow air sparge provides long term effectiveness through reduced migration and lower potential for off-site impacts. Removal of dissolved phase contaminant mass via intermediate biosparge provides long term effectiveness through contaminant mass removal and degradation, providing reduced migration and lower potential for shoreline impacts. **Southern area:** Removal of COC mass via shallow air sparge provides long term effectiveness through reduced migration and lower potential for off-site impacts.	Long term effectiveness is provided through NAPL removal and reduction of source material, as well as removal of dissolved phase COC mass via air sparge. The continuous maintenance of the capped areas ensures a maintained reduction in vadose zone soil to GW pathway. **Northern area:** Removal of NAPL via a recovery trench/pits and dissolved phase contaminant mass via shallow and intermediate air sparge and intermediate biosparge provides long term effectiveness through contaminant mass removal and degradation, providing reduced migration and lower potential for shoreline impacts. **Southern area:** Removal of COC mass via shallow air sparge provides long term effectiveness through reduced migration and lower potential for off-site impacts.	Long term effectiveness is provided through NAPL removal and reduction of source material, as well as removal of dissolved phase COC mass via air sparge. The continuous maintenance of the capped areas ensures a maintained reduction in vadose zone soil to GW pathway. **Northern area:** Removal of NAPL from GW via recovery trench/pits provides long term effectiveness through reduction of material that may impact GW. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Removal of COC mass via shallow air sparge provides long term effectiveness through reduced migration and lower potential for off-site impacts. GWPT does not provide additional long term protection for receptors than what the Graving Dock is already providing. Removal of dissolved phase contaminant mass via intermediate biosparge provides long term effectiveness through contaminant mass removal and degradation, providing reduced migration and lower potential for shoreline impacts. **Southern area:** Removal of COC mass via shallow air sparge provides long term effectiveness through reduced migration and lower potential for off-site impacts.	Long term effectiveness is provided through NAPL removal and reduction of source material, as well as removal of dissolved phase COC mass via air sparge. The continuous maintenance of the capped areas ensures a maintained reduction in vadose zone soil to GW pathway. **Northern area:** Removal of NAPL from GW via recovery trench/pits provides long term effectiveness through reduction of material that may impact GW. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. Removal of COC mass via shallow air sparge provides long term effectiveness through reduced migration and lower potential for off-site impacts. The addition of two intermediate zone biosparge systems provide the highest degree of long term effectiveness in reducing COC concentrations and mitigating off-site migration risk. Areas of high pH may negatively impact the efficacy of biosparging and aerobic COC degradation. **Southern area:** Removal of COC mass via shallow air sparge provides long term effectiveness through reduced migration and lower potential for off-site impacts.
Reduction of Toxicity, Mobility, and Volume	NA: did not pass Threshold criteria	Reduction of toxicity, mobility, and volume will be achieved through removal of mobile NAPL, decreased migration via shallow air sparge wall(s)/trench(s), intermediate biosparging, and natural attentuation of downgradient and intermediate COCs. **Northern area:** The NAPL recovery trench will capture mobile NAPL that is contributing to continued high concentrations of dissolved phase COCs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The air sparge system will reduce toxicity and mobility of dissolved phase COCs off site. Natural attenuation will decrease the toxicity of downgradient concentrations. The addition of an intermediate biosparge system will further reduce toxicity of contaminants within the intermediate groundwater zone. **Southern area:** The air sparge systems will reduce mobility of dissolved phase COCs off-site, while natural attentuation will decrease the toxicity of downgradient concentrations.	Reduction of toxicity, mobility, and volume will be achieved through removal of mobile NAPL, decreased migration via shallow air sparge wall(s)/trench(s), intermediate biosparging, and natural attentuation of downgradient and intermediate COCs. **Northern area:** The NAPL recovery trench will capture mobile NAPL that is contributing to continued high concentrations of dissolved phase COCs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The shallow and intermediate air sparge system will reduce mobility of dissolved phase COCs off site. Natural attenuation will decrease the toxicity of downgradient concentrations. The addition of an intermediate biosparge system will further reduce toxicity of contaminants within the intermediate groundwater zone. **Southern area:** The shallow air sparge systems will reduce mobility of dissolved phase COCs off-site, while natural attentuation will decrease the toxicity of downgradient concentrations.	Reduction of toxicity, mobility, and volume will be achieved through removal of mobile NAPL, decreased migration via shallow air sparge wall(s)/trench(s), and intermediate GWPT, intermediate biosparging, and natural attentuation of downgradient and intermediate COCs. **Northern area:** The NAPL recovery trench will capture mobile NAPL that is contributing to continued high concentrations of dissolved phase COCs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The shallow air sparge system will reduce mobility of dissolved phase COCs off site. The addition of intermediate zone GWPT will reduce mobility of dissolved phase COCs. GWPT and natural attenuation will decrease the toxicity of downgradient concentrations. The addition of an intermediate biosparge system will further reduce toxicity of contaminants within the intermediate groundwater zone. **Southern area:** The shallow air sparge systems will reduce mobility of dissolved phase COCs off-site, while natural attentuation will decrease the toxicity of downgradient concentrations.	Reduction of toxicity, mobility, and volume will be achieved through removal of mobile NAPL, decreased migration via shallow air sparge wall(s)/trench(s), intermediate biosparging at two locations, and natural attenuation of downgradient and intermediate COCs. **Northern area:** The NAPL recovery trench will capture mobile NAPL that is contributing to continued high concentrations of dissolved phase COCs. NAPL Recovery Trench and Test Pits will be paired with EFR to optimize NAPL removal. The shallow air sparge system will reduce mobility of dissolved phase COCs off site. The addition of two intermediate zone biosparging systems will reduce mobility of dissolved phase COCs. The addition of intermediate zone biosparging provides the highest degree of toxicity, mobility, and volume reduction of GAA B area COCs. Natural attenuation will decrease the toxicity of downgradient concentrations. **Southern area:** The shallow air sparge systems will reduce mobility of dissolved phase COCs off-site, while natural attenuation will decrease the toxicity of downgradient concentrations.
Short-Term Effectiveness	NA: did not pass Threshold criteria	Short-term effectiveness is achieved by removing NAPL source material, reducing dissolved phase concentrations via shallow air sparge and intermediate biosparge, reducing exposure pathways through installation of a cap, and implementation of LUCs and ICs. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. Effectiveness will be monitored through routine inspections, system performance evaluations, and early groundwater sampling to confirm that engineering controls and active systems are functioning as intended. **Northern Area**: Installation of the NAPL recovery trench and test pits, paired with EFR, will immediately remove mobile NAPL and reduce dissolved phase concentrations in shallow groundwater. Shallow air sparge near source areas will further reduce COC mass and limit vertical migration to the intermediate zone. Intermediate biosparging will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. **Southern Area**: Shallow air sparge will rapidly reduce dissolved phase COCs and limit lateral migration in shallow groundwater.	Short-term effectiveness is achieved by removing NAPL source material, reducing dissolved phase concentrations in both the shallow and intermediate zones with air sparge and biosparge, reducing exposure pathways through installation of a cap, and providing protection of onsite receptors through implementation of LUCs and ICs. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. These combined measures reduce downgradient migration and advance progress toward Final RGs through contaminant destruction and mass removal. Routine inspections and groundwater monitoring will assess early system performance and effectiveness of controls and treatment. **Northern Area**: Installation of the NAPL recovery trench and test pits, paired with EFR, will immediately remove mobile NAPL and reduce dissolved phase concentrations in shallow groundwater. Shallow air sparge near source areas will further reduce COC mass and limit vertical migration to the intermediate zone. Intermediate air sparging (near well CO181-MWI) will operate to actively remove dissolved-phase contaminants migrating toward the pore water at the western shore of the mouth of the Coal Pier Channel. Intermediate biosparging will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. **Southern Area**: Shallow air sparge will rapidly reduce dissolved phase COCs and limit lateral migration in shallow groundwater.	Short-term effectiveness is achieved by addressing source material and reducing exposure pathways through installation of a cap, implementation of LUCs and ICs, and operation of shallow air sparge systems. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. These combined measures may somewhat reduce remediation timeframe, reduce risk of off-site migration, and support attainment of Final RGs by limiting contaminant mobility and mass. Routine inspections and groundwater monitoring will assess early system performance and effectiveness of controls and treatment. **Northern Area**: Installation of the NAPL recovery trench and test pits, paired with EFR, will immediately remove mobile NAPL and reduce dissolved phase concentrations in shallow groundwater. Shallow air sparge near source areas will further reduce COC mass and limit vertical migration to the intermediate zone. Intermediate GWPT will operate in the Northern Area to actively remove dissolved-phase contaminants migrating toward the Graving Dock. Intermediate biosparging will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. **Southern Area**: Shallow air sparge will rapidly reduce dissolved phase COCs and limit lateral migration in shallow groundwater.	Short-term effectiveness is achieved by removing NAPL source material, reducing dissolved phase contaminant mass via shallow air sparge and intermediate biosparge, reducing exposure pathways through installation of a cap, and implementation of LUCs and ICs. The cap will immediately reduce stormwater infiltration and minimize vapor migration and direct contact with impacted media. Routine inspections and monitoring will be conducted to evaluate the performance of engineering and biological treatment components. **Northern Area**: Installation of the NAPL recovery trench and test pits, paired with EFR, will immediately remove mobile NAPL and reduce dissolved phase concentrations in shallow groundwater. Shallow air sparge near source areas will further reduce COC mass and limit vertical migration to the intermediate zone. Intermediate biosparging (near well CO181-MWI) will operate to actively remove dissolved-phase contaminants migrating toward the pore water at the western shore of the mouth of the Coal Pier Channel. Intermediate biosparging will be applied near CO209-MWI to specifically target elevated naphthalene concentrations in the intermediate groundwater. Biosparging in the intermediate zone is expected to support long-term effectiveness but is not anticipated to significantly contribute to short-term performance. **Southern Area**: Shallow air sparge and biosparge systems will reduce lateral and vertical migration of dissolved phase COCs in the shallow zone.
Cost (a)	NA: did not pass Threshold criteria	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 2 include installation of a NAPL recovery trench, the Northern Area shallow air sparge system, installation of the Northern Area intermediate biosparging system, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench and air sparge systems for 5 years and implementation of the MNA sampling plan. • Capital Costs: $736,000 • Present Worth of Annual O&M Costs: $1,787,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $2,534,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 3 include installation of a NAPL recovery trench, installation of the Northern Area shallow and intermediate air sparge systems, installation of the Northern Area intermediate biosparging system, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench and air sparge systems for 5 years and implementation of the MNA sampling plan. • Capital Costs: $955,000 • Present Worth of Annual O&M Costs: $1,787,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $2,753,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 4 include installation of a NAPL recovery trench, installation of the Northern Area shallow air sparge system, installation of the Northern Area intermediate biosparging system, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench, air sparge systems, and existing GWPT system for 5 years and implementation of the MNA sampling plan. • Capital Costs: $1,058,000 • Present Worth of Annual O&M Costs: $2,615,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $3,684,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs associated with Alternative 5 include installation of a NAPL recovery trench, installation of the Northern Area shallow air sparge system, installation of two Northern Area intermediate biosparge systems, and optimization of the Southern Area shallow air sparge system. O&M costs include the operation of the NAPL recovery trench and air sparge / biosparge systems for 5 years and implementation of the MNA sampling plan. • Capital Costs: $927,000 • Present Worth of Annual O&M Costs: $2,361,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $3,299,000
Implementability	NA: did not pass Threshold criteria	This alternative is considered implementable and many Process Options are already being implemented in this GAA (shallow air sparge). Due to subsurface obstructions and hard slag, installation of wells and trenches (NAPL recovery trench/pits) may be challenging but would not prevent implementation.	This alternative is considered implementable and many Process Options are already being implemented in this GAA (shallow air sparge). Due to subsurface obstructions and hard slag, installation of wells and trenches(NAPL recovery trench/pits, intermediate air sparge) may be challenging but would not prevent implementation.	This alternative is considered implementable and many Process Options are already being implemented in this GAA (shallow air sparge). Due to subsurface obstructions and hard slag, installation of wells and trenches (NAPL recovery trench/pits, intermediate GWPT) may be challenging but would not prevent implementation.	This alternative is considered implementable and many Process Options are already being implemented in this GAA (shallow air sparge). Due to subsurface obstructions and hard slag, installation of wells and trenches (NAPL recovery trench/pits, intermediate biosparge) may be challenging but would not prevent implementation.

Table 37D - Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA B - Parcel B10 West
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 3 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow / Intermediate Air Sparge, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 4 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Pump & Treat, Intermediate Biosparge Southern Area: Shallow Air Sparge (optimized)	Alternative 5 GAA wide: Capping, Reduced Permeability Containment, ECs/ICs Northern Area: NAPL Recovery Trench/Pits, Shallow Air Sparge, Two Intermediate Biosparge Systems Southern Area: Shallow Air Sparge (optimized)
Community Acceptance	NA: did not pass Threshold criteria	This alternative should have community acceptance as it is protective of human health via source area removal and prevention of off-site migration. Additionally, this will be included in a community involvement plan that is open to public comment.	This alternative should have community acceptance as it is protective of human health via source area removal and prevention of off-site migration. Additional source removal and off-site migration via the intermediate air sparge and biosparge systems will likely result in more community acceptance than Alt 2. Additionally, this will be included in a community involvement plan that is open to public comment.	This alternative should have community acceptance as it is protective of human health via source area removal and prevention of off-site migration. Additional source removal and off-site migration reduction via the intermediate GWPT system will likely result in more community acceptance than Alt 2. Additionally, this will be included in a community involvement plan that is open to public comment.	This alternative should have community acceptance as it is protective of human health via source area removal and prevention of off-site migration. Additional source removal and off-site migration reduction via intermediate biosparge systems will likely result in highest level of community acceptance. Additionally, this will be included in a community involvement plan that is open to public comment.
State Acceptance	NA: did not pass Threshold criteria	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.

Notes:
(a) Costs assume 15 years of MNA sampling. Long-term monitoring will be determined during analysis of quarterly MNA sampling results, as discussed in the Sitewide Groundwater Sampling Plan. See Appendix I for costing detail.

Table 38A - Applicability Evaluation of Technologies for GAA C
Coke Point Area CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
No Action	No Action	None	Do nothing to achieve remedial action objectives.	NA	Applicable to GAA C.	Retained for comparison purposes.	
Institutional Controls	Administrative Restrictions	Restrictions on Site Use	Deed restrictions are used to specify land use for certain areas (e.g., prohibition of residential use).	Impacted soil / slag	Applicable to GAA C.	Retained for use in combination with other process options.	
	Administrative Restrictions	Restrictions on Groundwater Use	Groundwater use restrictions are controls (generally at the local or county level) directed at limiting or prohibiting certain uses of groundwater (e.g., use as potable water).	Impacted groundwater	Applicable to GAA C.	Retained for use in combination with other process options.	
	Administrative Controls	Inspection and Maintenance	Inspections of facilities and performance of preventative or corrective measures to ensure proper operation of engineered controls.	Impacted soil / slag and groundwater	Applicable to GAA C.	Retained for use in combination with other process options.	
Engineering Controls	Access Restrictions	Fencing/Warning Signs/Access Restrictions	Placing physical restrictions on activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. May also include installation of security fence around impacted areas. Signs, fencing and/or other barriers designed to reduce or eliminate human exposure to COCs.	Impacted soil / slag and groundwater	Applicable to GAA C.	Retained for use in combination with other process options.	
	Vapor Mitigation	Vapor Mitigation - Sub-slab Vapor Barrier	Vapor barrier below floor slab of new building. Vapor barriers include impermeable barriers designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil	Applicable to GAA C.	Retained for use under any potential buildings developed within this area. The need for this EC will be determined based on soil gas testing.	
	Engineering Controls	Vapor Mitigation - Sub-slab Venting System	Sub-slab venting system (passive/active) below floor slab of new building. Venting systems include sub-slab piping designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil	Applicable to GAA C.	Retained for use under any potential buildings developed within this area. The need for this EC will be determined based on soil gas testing.	
Passive Remediation	Sampling and Analysis	Monitored Natural Attenuation	Allow naturally-occurring processes (e.g., dispersion, volatilization, biodegradation, adsorption, and chemical reactions) to reduce contaminant levels.	Impacted soil / slag and groundwater	Applicable to GAA C.	Retained for use in combination with other process options.	
Removal Technologies	Excavation	Excavation	Excavate NAPL impacted soil in source areas to eliminate leaching of contaminants to groundwater.	Impacted soil / slag	Applicable to NAPL impacted soil in GAA C.	Retained for use in combination with other process options. May be challenging to implement due to subsurface obstructions such as tank foundations and walls.	
Containment Technologies	In Situ Physical	Hydraulic Containment	A series of extraction wells are placed to induce groundwater flow towards the installed extraction wells, and prevent contaminated groundwater from migrating offsite.	Impacted groundwater	Applicable for GAA C, along Coal Pier channel.	Retained for use in combination with other process options. The NAPL along the Coal Pier Channel appears to be mostly No. 6 fuel.	
	Engineered Caps	Impermeable and low-permeability cap	In-place isolation of materials below an impermeable or low permeability cap	Impacted soil / slag	Applicable to GAA C, to prevent leaching to groundwater.	Retained for use in combination with other process options.	
	Vertical Barrier	Sheet piling / slurry barrier	Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration. Slurry barrier may be implaced via injection of grout via injection technology. Placement may be limited by slag or subsurface obstructions.	Impacted groundwater	Applicable to GAA C, to prevent leaching to nearby surface water.	Retained for use in combination with other process options.	

Table 38A - Applicability Evaluation of Technologies for GAA C
Coke Point Area CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
Treatment Technologies	In Situ Physical	Air Sparge/Soil Vapor Extraction	Air sparging involves the installation of injection wells that introduce air below the water table. Soil Vapor Extraction involves the installation of extraction wells above the water table that pull air and vapors through the soil to the ground surface for treatment.	Impacted soil / slag and groundwater	Applicable to benzene and ethylbenzene in GAA C. Effectiveness on No. 6 fuel, PAHs, and xylenes is limited.	Retained, for use in combination with other process options. This Process Option may be challenging with the local geology but may be applicable to the benzene and ethylbenzene impacts. Effectiveness on No. 6 fuel, PAHs, and xylenes is limited.	
	In Situ Physical	Product Recovery (Absorbent/ Skimmers)	NAPL is removed from recovery wells using absorbent/skimmers (active or passive) or via fluid recovery from trenches/pits.	NAPL in groundwater wells	Applicable to GAA C. Trace amounts of LNAPL have been observed. The majority of NAPL is DNAPL is below GWE at 10-20 feet below ground surface.	Retained, for use in combination with other process options. This process option is currently being implemented via installation and maintenance of absorbents in Coal Pier channel to address light sheen occassionally observed.	
	In Situ Physical	Multi-Phase Extraction	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	Impacted soil / slag and groundwater	Not applicable to GAA C. Trace amounts of LNAPL have been observed. The majority of NAPL is DNAPL at 10-20 feet below ground surface.		Eliminated: NAPL in area is mostly DNAPL. MPE/DPE systems are typically designed for LNAPL collection. The DNAPL consists mostly of No. 6 fuel with high levels of SVOCs that will not volatilize readily.
	In Situ Physical	Soil Flushing	In situ leaching method using extraction wells and liquid treatment to remove contaminants from soil.	Impacted soil	Not applicable to No. 6 fuel that makes up the NAPL related soil impacts in GAA C.		Eliminated: There is limited field applications of soil flushing successfully removing heavy fuels such as No. 6 fuel. This technology would not be effective on NAPL in GAA C.
	In Situ Physical	Stabilization / solidification	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Impacted soil	Applicable to GAA C, to stabilize NAPL in soil.	Retained for use in combination with other process options. Applicable to stabilize No. 6 fuel in soil and prevent leaching into Coal Pier channel.	
	Ex Situ Physical	Groundwater Pump and Treat (GWPT)	A series of extraction wells are placed to remove contaminated groundwater. Extracted water is then treated and may be reinjected, transferred to a treatment system, or discharged with the proper permitting.	Impacted groundwater	Applicable to GAA C, to remove PAHs, naphthalene, and benzene from groundwater. Would not address DNAPL effectively.	Retained for use in combination with other process options. This process option targets dissolved phase concentrations and would likely be ineffective on DNAPL.	
	In Situ Chemical	In-situ Chemical Oxidation (ISCO)	ISCO involves the introduction of a chemical oxidant into the subsurface to oxidize contaminants and transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Applicable to GAA C, to address dissolved phase PAHs, benzene, and naphthalene in groundwater. Presence of NAPL impacted soil and DNAPL may drive the oxidant demand prohibitively high.	Retained for use in combination with other process options. The presence of DNAPL would likely require a prohibitively high amount of oxidant to successfully achieve media cleanup goals.	
	In Situ Chemical	In-situ Chemical Reduction (ISCR)	ISCR involves the introduction of a chemical reductant into the subsurface to create reducing conditions (lower oxidation reduction potential and dissolved oxygen) to transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Not applicable to COCs in GAA C.		Eliminated - GAA C does not have applicable COCs.

Table 38A - Applicability Evaluation of Technologies for GAA C
Coke Point Area CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
Treatment Technologies	In Situ Biological	Enhanced Anaerobic Bioremediation	Subsurface delivery of electron donors within the target zone to stimulate anaerobic biodegradation of compounds by cometabolic remediation. Different electron acceptor may be injected to promote availability of hydrogen to speed up the process.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA C. The historical range of pH in this area ranges from 10-12 s.u.. However, geochemical monitoring indicates the area sustains naturally reducing conditions that may make bioremediation successful. Would not address DNAPL effectively.	Retained, for use in combination with other process options for application to dissolved phase benzene and naphthalene. Would not be effective on DNAPL.	
	In Situ Biological	Enhanced Aerobic Bioremediation	Injection of oxygen (other than bioventing), substrates, or nutrients to enhance microbial activities and stimulate cometabolic remediation.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA C. The historical range of pH in this area ranges from 10-12 s.u.. However, geochemical monitoring indicates the area sustains naturally reducing conditions that may make bioremediation successful. Would not address DNAPL effectively.	Retained, for use in combination with other process options for application to dissolved phase benzene and naphthalene. Would not be effective on DNAPL.	
	In Situ Biological	Biosparging	Similar to air sparging, air or oxygen is introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs via cometabolic remediation.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA C. The historical range of pH in this area ranges from 10-12 s.u.. However, geochemical monitoring indicates the area sustains naturally reducing conditions that may make bioremediation successful. Would not address DNAPL effectively.	Retained, for use in combination with other process options for application to dissolved phase benzene and naphthalene. Would not be effective on DNAPL.	
	In Situ Physical	Low-temperature thermal recovery	Low temperature heating to decrease viscosity of NAPL and allow for recovery via pumping.	Impacted soil / groundwater	Applicable to GAA C.	Retained, for use in combination with other process options. Application would target DNAPL recovery.	
	In Situ Physical	Thermal Conduction Heating (TCH)	Installation of thermal wells into the ground, heat treatment volume to desired temperature based on contamination type. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Not applicable to GAA C. DNAPL is comprised of No. 6 fuel and would not be conducive to safe operation of TCH.		Eliminated: the COCs identified in GAA C do not readily volatilize and may burn prior to reaching volatilization temperatures.
	In Situ Physical	Electrical Resistance Heating (ERH)	Installation of electrodes into the ground, application of alternating current (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Not applicable to GAA C. DNAPL is comprised of No. 6 fuel and would not be conducive to safe operation of ERH.		Eliminated: the COCs identified in GAA C do not readily volatilize. ERH would not be able to reach high enough temperatures to remove contaminants from the subsurface. Subsurface obstructions would inhibit the ability to install electrodes in the spacing required to heat uniformly.

Table 38A - Applicability Evaluation of Technologies for GAA C
Coke Point Area CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
Treatment Technologies	In Situ Biological / Chemical	Permeable Reactive Barriers (PRB)	A permeable wall containing reactive substances is installed across the groundwater flow path. Contaminants are chemically removed as groundwater flows through the wall.	Impacted groundwater	Applicable to GAA C.	Retained for use in combination with other process options. Applicable along Coal Pier Channel.	
Disposal Technologies	Excavation & Disposal	On-Site or Off-Site Disposal/ Landfilling	Contaminated material is removed and transported to on-site landfill or permitted off-site disposal facilities.	Impacted soil	Application to GAA C. To be paired with excavation.	Retained for use in combination with other process options. May be challenging to implement due to subsurface obstructions such as tank foundations and walls.	
	Excavation & Disposal	On-Site Disposal (CAMU)	CAMUs are used to facilitate treatment, storage, and disposal of CAMU-eligible wastes to implement corrective action or cleanup.	Impacted soil	Not applicable to GAA C. There is no area available onsite for a CAMU.		Eliminated - there is no area available in GAA C for a CAMU.
	Disposal	Permitted Discharge	Discharge of treated groundwater via NPDES or other permit.	Treated groundwater	Applicable to GAA C. To be paired with GWPT.	Retained, for use in combination with other process options. Specifically, to be paired with GWPT.	

Table 38B - Corrective Measures Alternatives for GAA C
Coke Point Area CMS

General Response Action	Process Option	Alternative 1 No Action	Alternative 2 Excavation, Sheet Pile/Slurry Wall Extension, Capping, and ECs/ICs	Alternative 3 Excavation, Capping, and ECs/ICs
No Action	None	X		
Institutional Controls	Restrictions on Site Use		X	X
	Restrictions on Groundwater Use		X	X
	Inspection and Maintenance		X	X
	Monitored Natural Attenuation		X	X
Engineering Controls	Fencing/Warning Signs/Access Restrictions		X	X
	Vapor Mitigation - Sub-slab Vapor Barrier		X	X
	Vapor Mitigation - Sub-slab Venting System		X	X
Removal Technologies	Excavation		X	X
Containment Technologies	*Hydraulic Containment*	*Hydraulic containment was not selected as a process option for GAA C as the source of contaminants in groundwater is likely DNAPL. Hydraulic containment pumping to contain the migration of DNAPL towards the Coal Pier Channel is unlikely to be effective due to the presence of historical tank foundations and other subsurface obstructions in this area. These obstructions are likely to impede capture of the dissolved phase plume.*		
	Impermeable and low-permeability cap		X	X
	Sheet piling / slurry barrier		X	
	Reduced permeability containment		X	X
Treatment Technologies	*Air Sparge/Soil Vapor Extraction*	*Air sparge was not selected as a process option for GAA C due to the limited effectiveness on the types of contaminants present within GAA C, including No.6 fuel, and naphthalene and benzo[a]pyrene which do not readily volatilize. The presence of DNAPL would preclude the use of air sparging. Additionally, contamination located near B18-082-PZ is fully delineated, significantly attenuates laterally, and is not affecting nearby surface water or other receptors.*		
	Product Recovery (Absorbent/ Skimmers)	*Product recovery is not feasible as DNAPL observed in wells (as described in the Parcel B18 No. 10 Tank Area Investigation Report dated January 6, 2020) is extremely viscous and not recoverable.*		
	Stabilization/solidification	*Solidification was not selected as a process option for GAA C because, as mentioned above, No.6 fuel is by its nature viscous, not recoverable, and unlikely to migrate. Stabilization/solidification would require subsurface mixing which would be difficult due to the presence of historic tanks and building foundations.*		
	Groundwater Pump and Treat (GWPT)	*GWPT was not selected as a process option for GAA C because of the presence of DNAPL within GAA C. While it can remove dissolved contaminants, GWPT is not effective at removing DNAPL. Implementation of GWPT in GAA C would operate like a hydraulic containment system, which is unlikely to be effective due to subsurface historical tank infrastructure and subsurface obstructions that will impede capture zones.*		
	In-situ Chemical Oxidation (ISCO)	*ISCO is not the best suited remedial technology due to the high oxidant demand free phased product (DNAPL) will require to achieve media clean up objectives. Depending on the selected oxidant, strong reactions can take place when introducing oxidant to NAPL, increasing the health and safety risks. Additionally, contamination significantlly attenuates laterally, is fully delineated, and is not impacting surface water.*		
	Enhanced Anaerobic Bioremediation	*Application of a bioremediation remedy would likely be ineffective due to the presence of DNAPL in the subsurface. Microbial populations do not typically thrive in areas where NAPL is present. Bioremediation is best applied to dissolved phase, residual plumes. Additionally, contamination significantlly attenuates laterally, is fully delineated, and is not impacting surface water.*		
	Enhanced Aerobic Bioremediation	*Application of a bioremediation remedy would likely be ineffective due to the presence of DNAPL in the subsurface. Microbial populations do not typically thrive in areas where NAPL is present. Bioremediation is best applied to dissolved phase, residual plumes. Additionally, contamination significantlly attenuates laterally, is fully delineated, and is not impacting surface water.*		
	Biosparging	*Application of a biosparging remedy would likely be ineffective due to the presence of DNAPL in the subsurface. Microbial populations do not typically thrive in areas where NAPL is present. Biosparging is best applied to dissolved phase, residual plumes. Additionally, contamination significantlly attenuates laterally, is fully delineated, and is not impacting surface water.*		
	Low-temperature thermal recovery	*Low temperature thermal recovery is not the best suited remedial technology due to the high viscosity of the DNAPL present in the subsurface and significant subsurface obstructions (e.g., tank foundations and walls) that would make drilling difficult. As described in the Parcel B18 No. 10 Tank Area Investigation Report dated January 6, 2020, the No. 6 fuel DNAPL is impractical to remove via bailing. It is unlikely that the viscosity of this DNAPL could be reduced enough to allow for recovery.*		
	Permeable Reactive Barriers (PRB)	*Installation of a PRB is not the best suited remedial option due to the amount of DNAPL existing in the source area. This remedial option may be ineffective due to the presence of DNAPL.*		
Disposal Technologies	On-Site or Off-Site Disposal/Landfilling		X	X
	Permitted Discharge	*Typically paired with GWPT. See GWPT section above.*		

Table 38B - Corrective Measures Alternatives for GAA C
Coke Point Area CMS

General Response Action	Process Option	Alternative 1 No Action	Alternative 2 Excavation, Sheet Pile/Slurry Wall Extension, Capping, and ECs/ICs	Alternative 3 Excavation, Capping, and ECs/ICs
	Description of Alternative	No Action	-Capping of the area will occur during development and will include significant areas of impermeable cap installation (*Container Terminal RADWP,* [ARM, October 2024]). All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete). - Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys potentially completed over multiple seasons. - LUCs will prevent groundwater use, require HASP for utility workers. - MNA: GW sampling for COCs, MNA parameters; sampling will remain consistent with the current groundwater sampling program in the Coke Oven Area. - Extension of the existing sheet pile wall with sheet pile or slurry wall running perpendicular to the flow of groundwater to the Coal Pier Channel to stop contaminant migration. The sheet pile/slurry wall extension would be approximately 250 feet extending the existing cut-off wall that was installed in 1989. - Excavation and disposal of NAPL impacted soils. Excavation would target vadose zone source material in the No. 10 AST area.	Alt 2, without the sheet pile/slurry wall extension. Excavation would target source area identified in the Parcel B18 No. 10 Tank Area Investigation Report dated January 6, 2020. More specifically, excavation would target vadose zone soil largely within the footprints of the former No. 10 and No. 11 ASTs.

Table 38C - Threshold Criteria Evaluation of Corrective Measures Alternatives for GAA C
Coke Point Area CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Excavation, Sheet Pile/Slurry Wall Extension, Capping, and ECs/ICs	Alternative 3 Excavation, Capping, and ECs/ICs
THRESHOLD CRITERIA			
Protection of Human Health and the Environment	No, will not protect HH&E.	Yes, will prevent human exposure to COCs in the vadose zone and groundwater in the short and long term through utilization of LUCs, development of HASP for future utility or construction workers, and physical barriers including installation of an impermeable cap as part of the construction of the container terminal and security measures such as fences and signs to restrict access. GW concentrations of COCs would decrease due to excavation of impacted soil (*Parcel B18 No. 10 Tank Area Investigation Report,* dated January 2020). Extension of the sheet pile wall between Coal Pier Channel and DNAPL source will further reduce risk of migration to surface water. In the long term, groundwater impacts are expected to attenuate naturally and will be monitored to confirm this is the case. Sampling frequency for MNA will be outlined in the Coke Point Area Groundwater Sampling Plan.	Yes, Will prevent human exposure to COCs in the vadose zone and groundwater in the short and long term through the removal of contaminants in soil through excavation, utilization of LUCs, development of HASP for future utility or construction workers, and physical barriers including installation of an impermeable cap as part of the construction of the container terminal and security measures such as fences and signs to restrict access. GW concentrations of COCs would decrease due to excavation of impacted soil (*Parcel B18 No. 10 Tank Area Investigation Report,* dated January 2020). In the long term, groundwater impacts are expected to attenuate naturally and will be monitored to confirm this is the case. Sampling frequency for MNA will be outlined in the Coke Point Area Groundwater Sampling Plan.
Achievement of Media Objectives (a)	No, will not address relevant cleanup objectives.	Yes - Removal of impacted soils reduces potential for impacted soil to act as a continuing source to GW and expedites meeting CAOs and Final RGs. Containment of potentially remaining contaminant mass in the vadose zone under an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of COCs helping meet CAOs and Final RGs in a shorter timeframe. Extension of the sheet pile wall reduces the potential for migration of dissolved contaminants to surface water. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that low permeability barriers are in fact inhibiting contaminant migration. Final RGs are expected to be reached via excavation of NAPL impacted soils, promoting natural contaminant degradation and plume stability through MNA and by preventing stormwater infiltration and migration of DNAPL through capping and extension of the sheet pile wall.	Yes - Removal of impacted soils reduces potential for impacted soil to act as a continuing source to GW and expedites meeting CAOs and Final RGs. Containment of contaminant mass under an impermeable/low-permeability cap reduces potential for NAPL or impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of COCs helping meet CAOs and Final RGs in a shorter timeframe. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that low permeability barriers are in fact inhibiting contaminant migration. Final RGs are expected to be reached via removing vadose zone soils impacted with NAPL, promoting natural contaminant degradation and plume stability through MNA, and capping the source area.
Source Control	No, will not control source or treatment of principal threat.	Yes - Source removal of vadose zone material via excavation controls releases to GW. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils.	Yes - Source removal of vadose zone material via excavation controls releases to GW. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils.

Notes:
(a) Sitewide CAOs:
1) Control any releases of COPCs to the groundwater to the extent practicable;
2) Control human exposure to the COPCs remaining in the groundwater;
3) Ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors or adjacent surface water and pore water quality;
4) Achieve cleanup levels for groundwater based on its maximum beneficial use, to the extent practicable.

Table 38D - Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA C
Coke Point Area CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Excavation, Sheet Pile/Slurry Wall Extension, Capping, and ECs/ICs	Alternative 3 Excavation, Capping, and ECs/ICs
BALANCING CRITERIA			
Long-Term Effectiveness	NA: did not pass Threshold criteria	Removal of NAPL impacted soils provides long term effectiveness through reduction of material that may impact GW. Extension of the sheet pile wall along the leading edge of the groundwater plume will provide a barrier to migration of dissolved COCs in groundwater to surface water. Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness (i.e. contaminant reduction and no migration). Sampling frequency for MNA will be outlined in the Coke Point Area Groundwater Sampling Plan. Once they are installed, the continued maintenance of capped areas will ensure a maintained reduction in vadose zone soil to GW pathway.	Removal of NAPL impacted soils provides long term effectiveness through reduction of material that may impact GW. Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness (i.e. contaminant reduction and no migration). Sampling frequency for MNA will be outlined in the Coke Point Area Groundwater Sampling Plan. Once they are installed, the continued maintenance of capped areas will ensure a maintained reduction in vadose zone soil to GW pathway.
Reduction of Toxicity, Mobility, and Volume	NA: did not pass Threshold criteria	Reduction of toxicity and mobility will be achieved removal of NAPL impacted soils (source control), extension of the sheet pile wall (groundwater containment), and capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in volume of dissolved COCs will be achieved via natural attenuation. Reduction of groundwater contamination will be documented and analyzed via MNA. Sampling frequency for MNA will be outlined in the Coke Point Area Groundwater Sampling Plan.	Reduction of toxicity, mobility, and volume will be achieved through removal of NAPL impacted soil (as identified in *Parcel B18 No. 10 Tank Area Investigation Report,* dated January 2020); Further reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Additional reduction in volume of dissolved COCs will be achieved via natural attenuation. Reduction of groundwater contamination will be documented and analyzed via MNA. Sampling frequency for MNA will be outlined in the Coke Point Area Groundwater Sampling Plan.
Short-Term Effectiveness	NA: did not pass Threshold criteria	Provides short-term effectiveness by immediately isolating impacted media through construction of an engineered cap and extension of the existing sheet pile wall. The removal of NAPL impacted soils will help prevent further migration of contaminants into groundwater and ultimately toward surface water, eliminating sheen and providing short-term protection of downgradient ecological receptors. The short-term effectiveness of the remedy will be assessed through routine inspections of engineering controls and early monitoring of groundwater conditions to confirm that containment is functioning as intended. By stabilizing contaminant conditions and preventing further releases, these measures also lay the groundwork for achieving Final RGs over time.	Provides short-term effectiveness by immediately isolating impacted media through construction of an engineered cap. Immediate short-term protection of human health and the environment will be achieved by removing accessible NAPL, preventing exposure through engineered caps, and restricting groundwater use and site access via early implementation of ICs and LUCs. Short-term protection of human health and the environment is expected shortly after cap construction. Continued migration of sheen into the Coal Pier Channel may be observed in the short-term. Effectiveness will be assessed through early monitoring of groundwater and inspections of engineering controls. These actions will help reduce near-term risks and begin to drive COC concentrations toward Final RGs by removing a primary source of contamination.
Cost (a)	NA: did not pass Threshold criteria	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of hot spot excavation of vadose zone source material, installation of the sheet pile wall extension, and installation of wells for MNA monitoring. O&M costs include implementation of the MNA sampling plan. • Capital Costs: $511,000 • Present Worth of Annual O&M Costs: $137,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $659,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the excavation of vadose zone source material and installation of wells for MNA monitoring. O&M costs include implementation of the MNA sampling plan. • Capital Costs: $185,000 • Present Worth of Annual O&M Costs: $137,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $333,000

Table 38D - Balancing Criteria Evaluation of Corrective Measures Alternatives for GAA C
Coke Point Area CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Excavation, Sheet Pile/Slurry Wall Extension, Capping, and ECs/ICs	Alternative 3 Excavation, Capping, and ECs/ICs
Implementability	NA: did not pass Threshold criteria	This alternative is considered implementable with some of the process options implemented during redevelopment during and after construction. Implementation of the hot spot excavation and extension of the sheet pile wall will be challenging due to the presence of subsurface obstructions such as tank foundations and walls and the solidification of implaced slag (as observed during drilling across the site).	This alternative is considered implementable with some of the process options implemented during redevelopment during and after construction of the Container Terminal. Implementation of the excavation may be challenging due to the presence of subsurface obstructions such as tank foundations and walls.
Community Acceptance	NA: did not pass Threshold criteria	Yes. This alternative is protective of human health via source area removal and containment. It should be accepted by the community based on similar remedies that have been accepted for similar conditions. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.	Yes. This alternative is protective of human health via source area removal and exposure prevention/containment via cap construction. It should be accepted by the community based on similar remedies that have been accepted for similar conditions. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.
State Acceptance	NA: did not pass Threshold criteria	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.

Notes:
(a) Costs assume 15 years of MNA sampling. Long-term monitoring will be determined during analysis of MNA sampling results, as discussed in the Coke Point Area Groundwater Sampling Plan. See Appendix I for costing detail.

Table 39A - Applicability Evaluation of Technologies for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
No Action	No Action	None	Do nothing to achieve remedial action objectives.	NA	Applicable to GAA D.	Retained for comparison purposes.	
Institutional Controls	Administrative Restrictions	Restrictions on Site Use	Deed restrictions are used to specify land use for certain areas (e.g., prohibition of residential use.)	Impacted soil / slag	Applicable to GAA D.	Retained for use in combination with other process options.	
	Administrative Restrictions	Restrictions on Groundwater Use	Groundwater use restrictions are controls (generally at the local or county level) directed at limiting or prohibiting certain uses of groundwater (e.g., use as potable water.)	Impacted groundwater	Applicable to GAA D.	Retained for use in combination with other process options.	
	Administrative Controls	Inspection and Maintenance	Inspections of facilities and performance of preventative or corrective measures to ensure proper operation of engineered controls.	Impacted soil / slag and groundwater	Applicable to GAA D.	Retained for use in combination with other process options.	
	Sampling and Analysis	Monitored Natural Attenuation	Allow naturally-occurring processes (e.g., dispersion, volatilization, biodegradation, adsorption, and chemical reactions) to reduce contaminant levels.	Impacted soil / slag and groundwater	Applicable to GAA D. NAPL encountered at CT-006-SB and CT-007-SB has been removed via skimming and excavation (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).	Retained for use in combination with other process options. Quarterly groundwater sampling is performed in the Coke Oven Area.	
Engineering Controls	Engineering Controls	Fencing/Warning Signs/Access Restrictions	Placing physical restrictions on activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. May also include installation of security fence around impacted areas. Signs, fencing and/or other barriers designed to reduce or eliminate human exposure to COCs.	Impacted soil / slag and groundwater	Applicable to GAA D.	Retained for use in combination with other process options.	
	Engineering Controls	Vapor Mitigation - Sub-slab Vapor Barrier	Vapor barrier below floor slab of new building. Vapor barriers include impermeable barriers designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA D future development. Installation of sub-slab vapor barriers are proposed for the three buildings that will be constructed within GAA D to mitigate potential risks to Composite Workers.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
	Engineering Controls	Vapor Mitigation - Sub-slab Venting System	Sub-slab venting system (passive/active) below floor slab of new building. Venting systems include sub-slab piping designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA D future development.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
Removal Technologies	Excavation	Excavation	Excavate NAPL impacted or contaminated soil/slag in source areas to eliminate leaching of contaminants to groundwater.	Impacted soil / slag	Previously implemented: Applicable to GAA D NAPL impacted soils. Not applicable to dissolved phase naphthalene and benzene. NAPL encountered at CT-006-SB and CT-007-SB has been removed via skimming and excavation (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]). However, additional excavation may be performed within GAA D in support of preparing the site for development.	Retained - NAPL removal has been performed within GAA D. Nominal NAPL (3/4 -inch) identified in test pit CT-006-TP in December 2023 (Coke Point Container Terminal Interim Status Update [ARM, January 4, 2024]). Subsequently, sheen of less than 1-2 inches of NAPL have been observed. Measurable NAPL is removed with absorbent socks.	
Containment Technologies	In Situ Physical	Hydraulic Containment	A series of extraction wells are placed to induce groundwater flow towards the installed extraction wells, and prevent contaminated groundwater from migrating offsite.	Impacted groundwater	Applicable to GAA D.	Retained for use in combination with other process options.	

Table 39A - Applicability Evaluation of Technologies for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	Capping	Impermeable and low-permeability cap	In-place isolation of materials below an impermeable or low permeability cap	Impacted soil / slag	Applicable for GAA D to reduce infiltration and minimize migration of dissolved phase contamination. During site development, a significant portion of GAA D will be covered with paving. All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete) (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).	Retained for use in combination with other process options.	
		Sheet piling / slurry wall	Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration. Placement may be limited by slag or subsurface obstructions.	Impacted groundwater	Applicable for GAA D, specific to benzene and naphthalene plumes. As part of the planned wharf development at the Coke Point Container Terminal Area, a sheet pile wall is proposed to extend to a depth of -14 to -16 ft above mean seal level along 3,000 ft of the wharf development. For the northern portion of the wharf development, the sheet pile wall will intersect with the clay unit and minimize groundwater flux to surface water (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).	Retained for use in combination with other process options. (Note: the wharf redevelopment is to the east of GAA D.)	
Treatment Technologies	In Situ Physical	Air Sparge/Soil Vapor Extraction	Air sparging involves the installation of injection wells that introduce air below the water table. Soil Vapor Extraction involves the installation of extraction wells above the water table that pull air and vapors through the soil to the ground surface for treatment.	Impacted soil / slag and groundwater	Applicable to GAA D. Air sparge may be difficult to be effective but could be an option for benzene and naphthalene impacts.	Retained, for use in combination with other process options. The application of this type of technology coupled with the development plans in GAA D will be challenging.	
	In Situ Physical	Product Recovery (Absorbent/ Skimmers)	NAPL is removed from recovery wells using absorbent/skimmers (active or passive) or via enhanced fluid recovery where multiple phases of hydrocarbons (liquid, dissolved, adsorbed and vapor phase) are simultaneously removed.	NAPL in groundwater wells	Previously implemented: Applicable to GAA D. NAPL encountered at CT-006-SB and CT-007-SB has been removed via skimming and excavation.	Retained - NAPL removal has been performed within GAA D. Nominal NAPL (3/4 -inch) identified in test pit CT-006-TP in December 2023 (Coke Point Container Terminal Interim Status Update [ARM, January 4, 2024]). Subsequently, sheen of less than 1-2 inches of NAPL have been observed. Measurable NAPL is removed with absorbent socks.	
	In Situ Physical	Multi-Phase Extraction	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	Impacted soil / slag and groundwater	Not applicable to GAA D. NAPL encountered at CT-006-SB and CT-007-SB has been removed via skimming and excavation.		Eliminated - NAPL removal has been performed within GAA D. While nominal NAPL (3/4 -inch) was identified in test pit CT-006-TP in December 2023 (Coke Point Container Terminal Interim Status Update [ARM, January 4, 2024]), additional NAPL removal would likely only result in negligible NAPL recovery.

Table 39A - Applicability Evaluation of Technologies for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ Physical	Soil Flushing	In situ leaching method using extraction wells and liquid treatment to remove contaminants from soil.	Impacted soil	Not applicable to GAA D. NAPL encountered at CT-006-SB and CT-007-SB has been removed via skimming and excavation (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).		Eliminated - NAPL removal has been performed within GAA D. While nominal NAPL (3/4 -inch) was identified in test pit CT-006-TP in December 2023 (Coke Point Container Terminal Interim Status Update [ARM, January 4, 2024]), additional NAPL removal would likely only result in negligible NAPL recovery.
	In Situ Physical	Stabilization / solidification	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Impacted soil	Not applicable to GAA D. NAPL encountered at CT-006-SB and CT-007-SB has been removed via skimming and excavation (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).		Eliminated - NAPL removal has been performed within GAA D. Nominal NAPL (3/4 -inch) was identified in test pit CT-006-TP in December 2023 (Coke Point Container Terminal Interim Status Update [ARM, January 4, 2024]). Subsequently, sheen of less than 1-2 inches of NAPL have been observed. Measurable NAPL is removed with absorbent socks. Stabilization/solidification is not a practical option for treatment of residual NAPL.
	Ex Situ Physical	Groundwater Pump and Treat (GWPT)	A series of extraction wells are placed to remove contaminated groundwater. Extracted water is then treated and may be reinjected, transferred to a treatment system, or discharged with the proper permitting.	Impacted groundwater	Applicable to GAA D.	Retained for use in combination with other process options. This process option would target mass removal and reduction of dissolved phase COCs in GAA D.	
	In Situ Chemical	In-situ Chemical Oxidation (ISCO)	ISCO involves the introduction of a chemical oxidant into the subsurface to oxidize contaminants and transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Applicable to GAA D. Would need to be implemented prior to beginning any development work in GAA D. However, ISCO may drive chemical changes in emplaced slag, potentially increasing Mn, Fe, and Co concentration in treatment area.	Retained for use in combination with other process options to treat and reduce concentrations of dissolved phase COCs in GAA D.	
	In Situ Chemical	In-situ Chemical Reduction (ISCR)	ISCR involves the introduction of a chemical reductant into the subsurface to create reducing conditions (lower oxidation reduction potential and dissolved oxygen) to transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Not applicable to remaining COCs in GAA D, primarily naphthalene and benzene. Most applicable for CVOCs, also PCBs and Chromium VI.		Eliminated - GAA D does not have applicable COCs to support the implementation of ISCR.
	In Situ Biological	Enhanced Anaerobic Bioremediation	Subsurface delivery of electron donors within the target zone to stimulate anaerobic biodegradation of COCs. Different electron acceptor may be injected to promote availability of hydrogen that speed up the process.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA D. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the COCs within GAA D. Process option may have limited effectiveness due to high pH in impacted area.	
	In Situ Biological	Enhanced Aerobic Bioremediation	Injection of oxygen (other than bioventing), substrates, or nutrients to enhance microbial activities.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA D. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the COCs in GAA D. Process option may have limited effectiveness due to high pH in impacted area. Natural conditions indicate a highly reducing environment.	

Table 39A - Applicability Evaluation of Technologies for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ Biological	Biosparging	Similar to air sparging, air or oxygen is introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs	Impacted groundwater	Applicable to dissolved phase COCs in GAA D. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options. Process option may have limited effectiveness due to high pH and naturally reducing conditions in the impacted area.	
	Ex Situ Physical	Low-temperature thermal treatment / stripping	Excavation of impacted material, low temperature heating and agitation to drive off volatile contaminants coupled with collection and treatment of gases and condensate.	Impacted soil	Not applicable to dissolved phase COCs within GAA D.		Eliminated - The process not applicable to the dissolved phase COCs in GAA D.
	In Situ	Thermal Conductance Heating (TCH)	Installation of thermal wells into the ground to heat treatment volume to desired temperature based on contamination type. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Applicable to GAA D.	Retained for use in combination with other process options for use to treat and reduce any potential source areas identified. Volatilization temperatures of most PAHs requires dewatering of treatment volume and therefore would not target dissolved phase PAHs. Treatment technology would only target dissolved phase BEX and naphthalene.	
	In Situ	Electrical Resistance Heating (ERH)	Installation of electrodes into the ground, application of alternating current (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Not applicable to GAA D. Would cause implementation issues due to potential subsurface obstructions resulting in high variability of electrical conductivity.		Eliminated - would be difficult to successfully implement this strategy. Implementation issues would be experienced due to potential subsurface obstructions resulting in high variability of electrical conductivity. Additionally, technology would have limited effectiveness on PAHs (naphthalene).
	In Situ	Permeable Reactive Barriers (PRB)	A permeable wall containing reactive substances is installed across the groundwater flow path. Contaminants are chemically removed as groundwater flows through the wall.	Impacted groundwater	Applicable to GAA D.	Retained for use in combination with other process options for use to mitigate potential offsite migration.	
Disposal Technologies	Excavation & Disposal	On-Site or Off-Site Disposal/ Landfilling	Contaminated material is removed and transported to on-site landfill or permitted off-site disposal facilities.	Impacted soil / slag	Previously Implemented: Applicable to GAA D. NAPL encountered at CT-006-SB and CT-007-SB has been removed via skimming and excavation. Excavated materials were disposed at Grey's Landfill (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).	Retained - NAPL removal has been performed within GAA D. Nominal NAPL (3/4 -inch) identified in test pit CT-006-TP in December 2023 (Coke Point ContainerTerminal Interim Status Update [ARM, January 4, 2024]). Subsequently, sheen of less than 1-2 inches of NAPL have been observed. Measurable NAPL is removed with absorbent socks.	
	Excavation & Disposal	On-Site Disposal (CAMU)	CAMUs are used to facilitate treatment, storage, and disposal of CAMU-eligible wastes to implement corrective action or cleanup.	Impacted soil / slag	Not applicable to GAA D, there is no available area for a CAMU with planned development for this area.		Eliminated - There is no area available in GAA D for a CAMU.
	Disposal	Permitted Discharge	Discharge of treated groundwater via NPDES or other permit.	Treated groundwater	Applicable to GAA D. To be paired with GWPT.	Retained, for use in combination with other process options. Specifically, to be paired with GWPT.	

Table 39B - Corrective Measures Alternatives for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

General Response Action	Process Option	Alternative 1 No Action	Alternative 2 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, MNA, Revetment, LUCs, and ECs/ICs	Alternative 3 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, Bioremediation, MNA, Revetment, LUCs, and ECs/Ics	Alternative 4 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, ISCO, MNA, Revetment, LUCs, and ICs/Ecs
No Action	None	X			
Institutional Controls	Restrictions on Site Use		X	X	X
	Restrictions on Groundwater Use		X	X	X
	Inspection and Maintenance		X	X	X
	Monitored Natural Attenuation		X	X	X
Engineering Controls	Fencing/Warning Signs/Access Restrictions		X	X	X
	Vapor Mitigation - Sub-slab Vapor Barrier		X	X	X
	Vapor Mitigation - Sub-slab Venting System		X	X	X
Removal Technologies	Excavation (a)		X	X	X
Containment Technologies	*Hydraulic Containment*	*Hydraulic containment is not the best suited remedial option. Excavation of NAPL hot spots previously removed at CT-006-SB and CT-007-SB have resulted in a significant reduction in source mass. Exceedances of Final RGs in GAA D are limited in both magnitude and extent, with no exceedances identified at the shoreline.*			
	Impermeable or Low-permeability cap		X	X	X
	Sheet piling / slurry wall	*Sheet piling / slurry wall is not the best suited remedial option due to the current designs for wharf development. These plans consist of a revetment cap in the turning basin consisting of at least 5.9-inch-thick concrete.*			
Treatment Technologies	*Air Sparge/Soil Vapor Extraction*	*Air sparge is not the best suited remedial option. Naphthalene is the most wide spread COC in this area and does not readily volatilize. Injection approaches are better suited to address the impacts in this GAA.*			
	Product Recovery (Absorbent/Skimmers) [a]		X	X	X
	Groundwater Pump and Treat (GWPT)	*The implementation of a GWPT system is not the best suited remedial option. Exceedances of Final RGs in GAA D do not indicate a clear source area in which sufficient mass removal could be achieved by GWPT.*			
	In-situ Chemical Oxidation (ISCO)				X
	Enhanced Anaerobic Bioremediation			X	
	Enhanced Aerobic Bioremediation	*Aerobic bioremediation is not the best suited remedial option. The aquifer in the area of COC impacts is naturally reducing. Thus, aerobic bioremediation may be ineffective due to the challenges related to flipping redox conditions from reducing to oxidizing.*			
	Biosparging	*Biosparging is not the best suited remedial option. After completion of previous excavations, only 3-5 wells have observed naphthalene or benzene exceedances. Biosparging may be ineffective due to the challenges related to reversing redox conditions from reducing to oxidizing. Therefore, anaerobic bioremediation was selected as a better suited process to target individual well locations.*			
	Thermal Conductance Heating (TCH)	*The implementation TCH is not the best suited remedial option as the operation of heating wells at the temperatures needed to volatilize some of the COCs in GAA D may impact the stability of the subsurface prior to development activities. Soil temperatures during TCH operation can reach as high as 900 C, at which soil dessication occurs, possibly impacting the structural stability of the area.*			
	Permeable Reactive Barriers (PRB)	*Installation of a PRB is not the best suited remedial option. PRBs are typically placed in the distal or mid portion of the plume and do not necessarily address the source area contamination. The natural groundwater gradient in the area is extremely flat, potentially limiting the amount of treatment achieved via groundwater flow through a PRB. Installation of the revetment wall will further flatten this gradient.*			
Disposal Technologies	*Permitted Discharge*	*Typically paired with GWPT. See GWPT section above.*			
	Description of Alternative	No Action	- Capping of the area will occur during development and will include significant areas of impermeable cap installation. All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete). -Development of the wharf will include the construction of a revetment within the turning basin made up of at least 5.9-inch-thick concrete reducing the flux of contaminants from groundwater to surface water. - Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys potentially completed over multiple seasons. - LUCs will prevent groundwater use, require HASP for utility workers. - MNA: GW sampling for COCs, MNA parameters; sampling will remain consistent with current semi-annual sampling.	Alt 2, plus bioremediation injections in the impacted areas. Injections would occur prior to development of GAA D to support microbial populations even after development begins. Injections may include nutrients, pH buffer, and/or electron donors where anaerobic conditions need to be stimulated.	Alt 2, plus ISCO possibly via alkaline activated persulfate or peroxide. Injections would occur prior to development of GAA D to drive as much destruction of mass as possible before installation of a cap.

Table 39C - Threshold Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, MNA, Revetment, LUCs, and ECs/ICs	Alternative 3 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, Bioremediation, MNA, Revetment, LUCs, and ECs/Ics	Alternative 4 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, ISCO, MNA, Revetment, LUCs, and ICs/Ecs
THRESHOLD CRITERIA				
Protection of Human Health and the Environment	No, will not protect HH&E.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Long term GW concentrations would decrease due to natural attenuation, monitored per the current quarterly groundwater sampling program in the Coke Oven Area. Installation of a revetment wall during wharf development will minimize groundwater flux to surface water. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Will reduce contaminant mass of benzene, naphthalene, ethylbenzene, and xylense via bioremediation, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to natural attenuation, monitored per the current quarterly groundwater sampling program in the Coke Oven Area. Installation of a revetment cap during wharf development will minimize groundwater flux to surface water. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area.Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Will reduce contaminant mass of COCs via ISCO, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to natural attenuation, monitored per the current quarterly groundwater sampling program in the Coke Oven Area. Installation of a revetment cap during wharf development will minimize groundwater flux to surface water. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.
Achievement of Media Objectives (a)	No, will not address relevant cleanup objectives.	Yes - Containment of contaminant mass under an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of aromatic VOCs and SVOCs helping meet CAOs and Final RGs. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - Containment of contaminant mass under an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of aromatic VOCs and SVOCs helping meet CAOs and Final RGs. Bioremediation can decrease benzene, ethylbenzene, xylenes, and naphthalene concentrations in GW via destruction. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - Containment of contaminant mass under an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of aromatic VOCs and SVOCs helping meet CAOs in a shorter timeframe. ISCO can decrease COC concentrations in GW via destruction. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.
Source Control	No, will not control source or treatment of principal threat.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. During wharf development, the revetment cap will minimize groundwater flux to surface water.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. During wharf development, the revetment cap will minimize groundwater flux to surface water. Bioremediation would address benzene, ethylbenzene, xylenes, and naphthalene GW impacts.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. During wharf development, the revetment cap will minimize groundwater flux to surface water. ISCO would address all COC GW impacts.

Notes:
(a) Sitewide CAOs:
1) Control any releases of COPCs to the groundwater to the extent practicable;
2) Control human exposure to the COPCs remaining in the groundwater;
3) Ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors or adjacent surface water and pore water quality;
4) Achieve cleanup levels for groundwater based on its maximum beneficial use, to the extent practicable.

Table 39D - Balancing Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, MNA, Revetment, LUCs, and ECs/ICs	Alternative 3 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, Bioremediation, MNA, Revetment, LUCs, and ECs/Ics	Alternative 4 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, ISCO, MNA, Revetment, LUCs, and ICs/Ecs
BALANCING CRITERIA				
Long-Term Effectiveness	NA: did not pass Threshold criteria	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness of ECs and ICs. Once controls are installed, the continued maintenance of capped areas will increase the long- term effectiveness of reductions in vadose zone soil to GW pathway. The installation of a revetment cap during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark. Note that the plume is 50 years old, stable, not moving, and not impacing any receptors.	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long-term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of benzene, ethylbenzene, xylenes, and naphthalene impacts via bioremediation will increase the rate of destruction of COCs. The installation of a revetment cap during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark. Note that the plume is 50 years old, stable, not moving, and not impacing any receptors.	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long-term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of all COCs impacts via ISCO will increase the rate of destruction of COCs. The installation of a revetment cap during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark. Note that the plume is 50 years old, stable, not moving, and not impacing any receptors.
Reduction of Toxicity, Mobility, and Volume	NA: did not pass Threshold criteria	Toxicity, mobility, and volume have been reduced by NAPL-impacted soil removal. Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in volume of GW contaminants will be achieved via natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Reduction of volume of GW contaminants intercepting surface water will be reduced via installation of the revetment cap during wharf redevelopment. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.	Toxicity, mobility, and volume have been reduced by NAPL-impacted soil removal. Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in toxicity and volume will be achieved via degradation of COCs with application of bioremediation and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Reduction of volume of GW contaminants intercepting surface water will be reduced via installation of the revetment cap during wharf redevelopment. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.	Toxicity, mobility, and volume have been reduced by NAPL-impacted soil removal. Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in toxicity and volume will be achieved via destruction of COCs with application of ISCO and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Reduction of volume of GW contaminants intercepting surface water will be reduced via installation of the revetment cap during wharf redevelopment. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.
Short-Term Effectiveness	NA: did not pass Threshold criteria	Short-term source containment via the installation of a cap across the area and revetment construction. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap and revetment construction.	Short-term source containment via the installation of a cap across the area and revetment construction. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Bioremediation is considered a long-term remedial option that, once implemented, would help reduce contaminant concentrations over time and support progress toward meeting Final RGs. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap and revetment construction.	Short-term source containment via the installation of a cap across the area and revetment construction. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. ISCO is considered a longer-term treatment option due to the time needed for chemical reactions to degrade contaminants and would help reduce contaminant concentrations over time and support progress toward meeting Final RGs. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap and revetment construction.

Table 39D - Balancing Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area D - Parcel B10 East
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, MNA, Revetment, LUCs, and ECs/ICs	Alternative 3 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, Bioremediation, MNA, Revetment, LUCs, and ECs/Ics	Alternative 4 Hot Spot Excavation (previous IM), Product Recovery (previous IM), Capping, ISCO, MNA, Revetment, LUCs, and ICs/Ecs
Cost (a)	There are no capital costs associated with Alternative 1.	Costs associated with installation and management of the capping system, revetment cap, and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of installation of wells for MNA monitoring. O&M costs include implementation of the MNA sampling plan. • Capital Costs: $16,000 • Present Worth of Annual O&M Costs: $128,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $155,000	Costs associated with installation and management of the capping system, revetment cap, and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of bioremediation injection wells and monitoring wells. O&M costs include implementation of semi-annual bioremediation injections for 1 year and the MNA sampling plan. • Capital Costs: $125,000 • Present Worth of Annual O&M Costs: $389,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $525,000	Costs associated with installation and management of the capping system, revetment cap, and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of ISCO injection wells and monitoring wells. O&M costs include implementation of semi-annual ISCO injections for 1 year and the MNA sampling plan. • Capital Costs: $125,000 • Present Worth of Annual O&M Costs: $538,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $674,000
Implementability	NA: no institutional/administrative controls or remedial technology to implement.	This alternative is considered implementable with all Process Options implemented during and after planned development.	The bioremediation portion of this alternative may be challenging to implement if it occurs after completion of surface paving. Bioremediation would take place via injections on a regular basis to address the BET and naphthalene. Introduction of pH buffer would likely be required and may impact effectiveness as high pH is a major challenge. A pilot test would be required.	The ISCO portion of this alternative may be challenging to implement if it occurs after completion of surface paving. ISCO would take place via injections on a regular basis to address the COCs. Low permeable zones may be difficult to address. Due to the naturally high pH observed at many wells within this groundwater assessment area, an alkaline activated persulfate or peroxide would be utilized as the oxidant that has the best chances of success.
Community Acceptance	NA: did not pass Threshold criteria	This alternative should have community acceptance as it is protective of human health via source containment. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health via mass reduction by bioremediation. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health via mass reduction. However, injection of oxidant may be less appealing to the community due to it's reactive nature. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.
State Acceptance	NA: did not pass Threshold criteria	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.

Notes:
(a) Costs assume 15 years of MNA sampling. Long-term monitoring will be determined during analysis of quarterly MNA sampling results, as discussed in the Sitewide Groundwater Sampling Plan. See Appendix I for costing detail.

Table 40A - Applicability Evaluation of Technologies for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
No Action	No Action	None	Do nothing to achieve remedial action objectives.	NA	Applicable to GAA E.	Retained for comparison purposes.	
Institutional Controls	Administrative Restrictions	Restrictions on Site Use	Deed restrictions are used to specify land use for certain areas (e.g., prohibition of residential use.)	Impacted soil / slag	Applicable to GAA E.	Retained for use in combination with other process options.	
	Administrative Restrictions	Restrictions on Groundwater Use	Groundwater use restrictions are controls (generally at the local or county level) directed at limiting or prohibiting certain uses of groundwater (e.g., use as potable water.)	Impacted groundwater	Applicable to GAA E.	Retained for use in combination with other process options.	
	Administrative Controls	Inspection and Maintenance	Inspections of facilities and performance of preventative or corrective measures to ensure proper operation of engineered controls.	Impacted soil / slag and groundwater	Applicable to GAA E.	Retained for use in combination with other process options.	
	Sampling and Analysis	Monitored Natural Attenuation	Allow naturally-occurring processes (e.g., dispersion, volatilization, biodegradation, adsorption, and chemical reactions) to reduce contaminant levels.	Impacted soil / slag and groundwater	Applicable to GAA E. The majority of DNAPL encountered at Cell 4 has been skimmed and excavated, and dissolved phase COCs and soil vapor in Cell 5 is being removed by a dual-phase extraction system.	Retained for use in combination with other process options. Groundwater sampling is performed at Cell 4 and Cell 5 per the current groundwater sampling program in the Coke Oven Area. Within Cell 4, overall there appears to be a general decrease in benzene and naphthalene concentrations at several monitoring well locations. Within Cell 5, total VOCs concentrations in groundwater have been generally stable, with concentrations decreasing over time based on data collected and analyzed during sampling events summarized in the 2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report (ARM, March 4, 2024). It is noted that the Cell 4 excavation was completed in 2023 and GW response to removal of DNAPL has likely not been observed yet.	
Engineering Controls	Engineering Controls	Fencing/Warning Signs/Access Restrictions	Placing physical restrictions on activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. May also include installation of security fence around impacted areas. Signs, fencing and/or other barriers designed to reduce or eliminate human exposure to COCs.	Impacted soil / slag and groundwater	Applicable to GAA E.	Retained for use in combination with other process options.	
	Engineering Controls	Vapor Mitigation - Sub-slab Vapor Barrier	Vapor barrier below floor slab of new building. Vapor barriers include impermeable barriers designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA E future development.	Retained for use in combination with other process options. Applicable to buildings that may be constructed during future development.	
	Engineering Controls	Vapor Mitigation - Sub-slab Venting System	Sub-slab venting system (passive/active) below floor slab of new building. Venting systems include sub-slab piping designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA E future development.	Retained for use in combination with other process options. Applicable to buildings that may be constructed during future development.	

Table 40A - Applicability Evaluation of Technologies for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
Removal Technologies	Excavation	Excavation	Excavate NAPL impacted or contaminated soil/slag in source areas to eliminate leaching of contaminants to groundwater.	Impacted soil / slag	Previously implemented IM at Cell 4. Between January and June 2023 approximately 18,165 tons of impacted were excavated and disposed at Grey's Landfill. Backfilling was performed in October and November 2023 (Annual Interim Measures Report [ARM, March 4, 2024]). Cell 4 DNAPL source removal/excavation are expected to facilitate reductions in VOCs concentrations in groundwater in the vicinity of Cell 5.	Retained - Previously Implemented - excavation of approximately 18,165 tons of DNAPL-impacted material was performed between January and June 2023 as a Interim Measure (Annual Interim Measures Report [ARM, March 4, 2024]). (a)	
Containment Technologies	In Situ Physical	Hydraulic Containment	A series of extraction wells are placed to induce groundwater flow towards the installed extraction wells, and prevent contaminated groundwater from migrating offsite.	Impacted groundwater	Applicable for GAA E.	Retained for use in combination with other process options.	
	Capping	Impermeable and low-permeability cap	In-place isolation of materials below an impermeable or low permeability cap	Impacted soil / slag	Applicable for GAA E to reduce infiltration and minimize migration of dissolved phase contamination. During site development, a significant portion of GAA E will be covered with paving. All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete) (Container Terminal Response Area B and Development Work Plan [ARM, October 17, 2024]).	Retained for use in combination with other process options.	
	Vertical Barrier	Sheet piling / slurry wall	Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration. Placement may be limited by slag or subsurface obstructions.	Impacted groundwater	Applicable for GAA E. As part of the planned wharf development at the Coke Point Container Terminal Area, a sheet pile wall is proposed to extend to a depth of -14 to -16 ft above mean seal level along 3,000 ft of the wharf development. For the northern portion of the wharf development, the sheet pile wall will intersect with the clay unit and minimize groundwater flux to surface water (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).	Retained for use in combination with other process options. (Note: the wharf redevelopment will take place between GAA E and surface water in the Turning Basin.)	
Treatment Technologies	In Situ Physical	Air Sparge/Soil Vapor Extraction	Air sparging involves the installation of injection wells that introduce air below the water table. Soil Vapor Extraction involves the installation of extraction wells above the water table that pull air and vapors through the soil to the ground surface for treatment.	Impacted soil / slag and groundwater	Applicable to GAA E. Air sparge may be difficult to implement effectively but could be an option for dissolved phase impacts.	Retained for use in combination with other process options. Implementation of the air sparge system may be difficult due to the timeframe of effectiveness and the development plans within GAA E.	

Table 40A - Applicability Evaluation of Technologies for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ Physical	Product Recovery (Absorbent/ Skimmers)	NAPL is removed from recovery wells using absorbent/skimmers (active or passive) or via enhanced fluid recovery where multiple phases of hydrocarbons (liquid, dissolved, adsorbed and vapor phase) are simultaneously removed.	NAPL in groundwater wells	Previously Implemented IM: Applicable to GAA E. The skimmer pumps were last operated in January 2023, during which 18 gallons of DNAPL were removed. In mid-January 2023, the Cell 4 extraction and monitoring wells were abandoned due to excavation of the area (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]).	Retained - Previously Implemented - DNAPL removal via skimmers has been performed within Cell 4. The skimmer pumps were last operated in January 2023, and the extraction and monitoring wells have been abandoned. (a)	
	In Situ Physical	Multi-Phase Extraction (Including Dual-Phase Extraction)	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	Impacted soil / slag and groundwater	Previously Implemented IM: Applicable to GAA E. DNAPL encountered at Cell 5 is being removed via dual phase extraction (Interim Measure).	Retained - Previously Implemented - DNAPL removal within Cell 5 is being performed via dual-phase extraction (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]). (a)	
	In Situ Physical	Soil Flushing	In situ leaching method using extraction wells and liquid treatment to remove contaminants from soil.	Impacted soil	Not applicable to GAA E. The majority of DNAPL encountered at Cell 4 has been removed via skimming and excavation.		Eliminated - excavation of approximately 18,165 tons of DNAPL-impacted material was performed in 2023 as a Interim Measure (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]). Interim measures for DNAPL removal within GAA E Cell 5 is focused on dual-phase extraction that is recovering impacted groundwater.
	In Situ Physical	Stabilization / solidification	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Impacted soil	Not applicable to GAA E. The majority of DNAPL encountered at Cell 4 has been removed via skimming and excavation.		Eliminated - excavation of approximately 18,165 tons of DNAPL-impacted material was performed in 2023 as a Interim Measure (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]). Interim measures for DNAPL removal within GAA E Cell 5 is focused on dual-phase extraction that is recovering impacted groundwater.
	Ex Situ Physical	Groundwater Pump and Treat (GWPT)	A series of extraction wells are placed to remove contaminated groundwater. Extracted water is then treated and may be reinjected, transferred to a treatment system, or discharged with the proper permitting.	Impacted groundwater	Applicable to GAA E. Currently implemented as an Interim Measure at Cell 5. A dual-phase extraction system is operating at Cell 5; in 2023 approximately 4.7 million gallons of naphthalene-impacted groundwater were recovered and treated for onsite discharge (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]).	Retained for use in combination with other process options. The Interim Measure in place at Cell 5 has targeted mass removal and reduce mass of dissolved phase COCs in GAA E. Groundwater trends for total VOCs at Cell 5 are generally stable, with concentrations decreasing over time as discussed in the 2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report (ARM, March 4, 2024). Application of a GWPT system in this area would be challenging due to development of the Container Terminal.	

Table 40A - Applicability Evaluation of Technologies for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ Chemical	In-situ Chemical Oxidation (ISCO)	ISCO involves the introduction of a chemical oxidant into the subsurface to oxidize contaminants and transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Applicable to GAA E. Would need to be implemented prior to beginning any development work in GAA E. However, ISCO may drive chemical changes in implaced slag, potentially increasing Mn, Fe, and Co concentration in treatment area.	Retained for use in combination with other process options to treat and reduce concentrations of dissolved phase COCs in GAA E.	
	In Situ Chemical	In-situ Chemical Reduction (ISCR)	ISCR involves the introduction of a chemical reductant into the subsurface to create reducing conditions (lower oxidation reduction potential and dissolved oxygen) to transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Not applicable to remaining COCs in GAA E, primarily naphthalene and benzene. Most applicable for CVOCs, also PCBs and Chromium VI.		Eliminated - GAA E does not have applicable COCs.
	In Situ Biological	Enhanced Anaerobic Bioremediation	Subsurface delivery of electron donors within the target zone to stimulate anaerobic biodegradation of COCs. Different electron acceptor may be injected to promote availability of hydrogen that speed up the process.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in Groundwater Assessment Area E. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the COCs within Groundwater Assessment Area E. Process option may have limited effectiveness due to high pH in impacted area that may prohibit microbial growth. Natural conditions indicate a highly reducing environment.	
	In Situ Biological	Enhanced Aerobic Bioremediation	Injection of oxygen (other than bioventing), substrates, or nutrients to enhance microbial activities.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in Groundwater Assessment Area E. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the COCs in Groundwater Assessment Area E. Process option may have limited effectiveness due to high pH in impacted area that may prohibit microbial growth. Natural conditions indicate a highly reducing environment.	
	In Situ Biological	Biosparging	Similar to air sparging, air or oxygen is introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs	Impacted groundwater	Applicable to dissolved phase COCs in Groundwater Assessment Area E. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options. Process option may have limited effectiveness due to high pH in impacted area that may prohibit microbial growth. Natural conditions indicate a highly reducing environment.	
	Ex Situ Physical	Low-temperature thermal treatment / stripping	Excavation of impacted material, low temperature heating and agitation to drive off volatile contaminants coupled with collection and treatment of gases and condensate.	Impacted soil	Not applicable to dissolved phase COCs within Groundwater Assessment Area E.		Eliminated - not applicable to dissolved phase COCs.
	In Situ	Thermal Conductance Heating (TCH)	Installation of thermal wells into the ground to heat treatment volume to desired temperature based on contamination type. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Applicable to Groundwater Assessment Area E.	Retained for use in combination with other process options for use to treat and reduce any potential source areas identified. Volatilization temperatures of most PAHs requires dewatering of treatment volume and therefore would not target dissolved phase PAHs. Treatment technology would only target dissolved phase BTEX and naphthalene.	

Table 40A - Applicability Evaluation of Technologies for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ	Electrical Resistance Heating (ERH)	Installation of electrodes into the ground, application of alternating current (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Not applicable to Groundwater Assessment Area E. Would cause implementation issues due to potential subsurface obstructions resulting in high variability of electrical conductivity.		Eliminated, would be difficult to successfully implement this strategy due to potential subsurface obstructions resulting in high variability of electrical conductivity. Additionally, due to temperature limitations technology would have limited effectiveness on BTEX/naphthalene and no effectiveness on PAHs.
	In Situ	Permeable Reactive Barriers (PRB)	A permeable wall containing reactive substances is installed across the groundwater flow path. Contaminants are chemically removed as groundwater flows through the wall.	Impacted groundwater	Applicable to Groundwater Assessment Area E.	Retained for use in combination with other process options for use to mitigate potential offsite migration.	
Disposal Technologies	Excavation & Disposal	On-Site or Off-Site Disposal/ Landfilling	Contaminated material is removed and transported to on-site landfill or permitted off-site disposal facilities.	Impacted soil / slag	Previously implemented as an Interim Measure at Cell 4. Between January and June 2023 approximately 18,165 tons of impacted were excavated and disposed at Grey's Landfill. Backfilling was performed in October and November 2023 (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]).	Retained - Previously Implemented - excavation of approximately 18,165 tons of DNAPL-impacted material was performed in 2023 as a Interim Measure. Material was disposed at Grey's Landfill (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]).	
	Excavation & Disposal	On-Site Disposal (CAMU)	CAMUs are used to facilitate treatment, storage, and disposal of CAMU-eligible wastes to implement corrective action or cleanup.	Impacted soil / slag	Not applicable to Groundwater Assessment Area E, there is no available area for a CAMU with planned development for this area. Additionally, excavation has been previously implemented as an Interim Measure at Cell 4.		Eliminated - excavation of approximately 18,165 tons of DNAPL-impacted material was performed in 2023 as a Interim Measure (2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report [ARM, March 4, 2024]). Additionally, if future excavation were performed, there is no area available in Groundwater Assessment Area E for a CAMU.
	Disposal	Permitted Discharge	Discharge of treated groundwater via NPDES or other permit.	Treated groundwater	Applicable to Groundwater Assessment Area E. To be paired with GWPT.	Retained, for use in combination with other process options. Specifically, to be paired with GWPT.	

Notes:
(a) Existing or already implemented process option: Excavation of DNAPL impacted material, along with EFR for DNAPL recovery, was conducted in Cell 4 in June 2023 as discussed in the 2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report (ARM, March 4, 2024). NAPL skimming pumps were operated in Cell 4 until excavation was conducted. DNAPL removal and recovery are discussed in the 2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report (ARM, March 4, 2024).

Table 40B - Corrective Measures Alternatives for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

Groundwater Assessment Area E					
General Response Action	**Process Option**	**Alternative 1 No Action**	**Alternative 2 Hot Spot Excavation (previous IM), Revetment, Capping, MNA, and ECs/ICs**	**Alternative 3 Hot Spot Excavation (previous IM), Bioremediation, Revetment, Capping, MNA, and ECs/ICs**	**Alternative 4 Hot Spot Excavation (previous IM), ISCO, Revetment, Capping, MNA, and ECs/ICs**
No Action	None	X			
Institutional Controls	Restrictions on Site Use		X	X	X
	Restrictions on Groundwater Use		X	X	X
	Inspection and Maintenance		X	X	X
	Monitored Natural		X	X	X
Engineering Controls	Fencing/Warning Signs/Access Restrictions		X	X	X
	Vapor Mitigation - Sub-slab Vapor Barrier		X	X	X
	Vapor Mitigation - Sub-slab Venting System		X	X	X
Containment Technologies	Excavation		X	X	X
	Hydraulic Containment	*Hydraulic containment is not the best suited remedial option. Based on trends presented in Appendix G, there is a statistically significant decrease in BEX and naphthalene concentrations at several monitoring well locations. Within Cell 5, total VOCs concentrations in groundwater have been generally stable, based on data collected and analyzed during sampling events summarized in the 2023 TPA Parcel B10 Coke Oven Area Annual Interim Measures Report (ARM, March 4, 2024).*			
	Impermeable or Low-permeability cap		X	X	X
	Sheet piling / slurry wall	*Sheet piling / slurry wall is not the best suited remedial option due to the current designs for wharf development. These plans consist of a revetment cap in the turning basin consisting of at least a 5.9-inch concrete cap.*			
Treatment Technologies	*Air Sparge/Soil Vapor Extraction*	*Air sparge is not the best suited remedial option. Naphthalene is the most wide spread COC in this GAA and does not readily volatilize. Injection approaches (bioremediation and ISCO) are better suited to address the impacts in this GAA. Depending on the permeability and location of the contaminant mass, air sparging may require several years to effectively remove COC mass and reach Site CAOs.*			
	Product Recovery (Absorbent/ Skimmers)	(a)	(a)	(a)	(a)
	Multi-Phase Extraction (Including Dual-Phase Extraction)	(a)	(a)	(a)	(a)
	Groundwater Pump and Treat (GWPT)	*Although a dual-phase extraction system is currently in operation (as an Interim Measure) at Cell 5 to recovery and treat naphthalene-impacted groundwater, excavation in Cell 4 previously removed the source and post excavation groundwater sampling indicated concentrations below the Final RGs for both benzne and naphthalene within the excavation area. Post excavation, the naphthalene plume is not centralized with no remaining source, therefore there is no location to place a GWPT system to achieve effective mas removal.*			
	In-situ Chemical Oxidation (ISCO)				X
	Enhanced Anaerobic Bioremediation			X	
	Enhanced Aerobic Bioremediation	*Aerobic bioremediation is not the best suited remedial option because the aquifer in the area of COC impacts is naturally reducing. Aerobic bioremediation may be ineffective due to the challenges related to flipping redox conditions from reducing to oxidizing.*			
	Biosparging	*Biosparge is not the best suited remedial option. The redox conditions in GAA E favor anaerobic bioremediation which was selected as a better suited process option.*			
	Thermal Conductance Heating (TCH)	*TCH is not the best suited remedial option as the operation of heating wells at the temperatures needed to volatilize some of the COCs in Groundwater Assessment Area E may impact the stability of the subsurface prior to development activities. Soil temperatures during TCH operation can reach as high as 900 C, at which soil desiccation occurs, possibly impacting the structural stability of the area. TCH is typically used to address high concentration source zones.*			
	Permeable Reactive Barriers (PRB)	*Installation of a PRB is not the best suited remedial option as the groundwater gradient is extremely flat, potentially limiting the amount of treatment achieved via groundwater flow through a PRB. Additionally, planned redevelopment includes dredging and installation of a revetment wall that will further flatten the groundwater gradient.*			
Disposal Technologies	On-Site or Off-Site Disposal/ Landfilling	(a)	(a)	(a)	(a)
	Permitted Discharge	*Typically paired with GWPT. See GWPT section above.*			

Table 40B - Corrective Measures Alternatives for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

Groundwater Assessment Area E					
General Response Action	**Process Option**	**Alternative 1 No Action**	**Alternative 2 Hot Spot Excavation (previous IM), Revetment, Capping, MNA, and ECs/ICs**	**Alternative 3 Hot Spot Excavation (previous IM), Bioremediation, Revetment, Capping, MNA, and ECs/ICs**	**Alternative 4 Hot Spot Excavation (previous IM), ISCO, Revetment, Capping, MNA, and ECs/ICs**
	Description of Alternative	No Action	- Development of the wharf will include dredging and the construction of a revetment within the turning basin made up of at least 5.9-inch-thick concrete reducing the flux of contaminants from groundwater to surface water. -Capping of the area will occur during development and will include significant areas of impermeable cap installation (*Container Terminal RADWP,* [ARM, October 2024]). All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete). - Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys potentially completed over multiple seasons. - LUCs will prevent groundwater use, require HASP for utility workers. - MNA: GW sampling for COCs, MNA parameters; sampling will remain consistent with the current groundwater sampling program in the Coke Oven Area.	Alt 2, plus bioremediation injections in the impacted areas. Injections would likely occur prior to development of GAA E to support microbial populations even after development begins. Injections may include nutrients, pH buffer, and/or other amendments as needed.	Alt 2, plus ISCO injections in the impacted areas. Injections would likely occur prior to development of GAA E to drive as much destruction of mass as possible before installation of a cap.

Notes:
(a) Existing or already implemented process option: Excavation of DNAPL impacted material, along with EFR for DNAPL recovery, was conducted in Cell 4 in June 2023 as discussed in the 2023 TPA Parcel 10 Coke Oven Area Annual Interim Measures Report (ARM, March 4, 2024). NAPL skimming pumps were operated in Cell 4 until excavation was conducted. DNAPL removal and recovery are discussed in the 2023 TPA Parcel B10 Coke Oven Area Annual Interim Measures Report (ARM, March 4, 2024).

Table 40C - Threshold Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

Groundwater Assessment Area E				
EVALUATION CRITERION	**Alternative 1 No Action**	**Alternative 2 Hot Spot Excavation (previous IM), Revetment, Capping, MNA, and ECs/ICs**	**Alternative 3 Hot Spot Excavation (previous IM), Bioremediation, Revetment, Capping, MNA, and ECs/ICs**	**Alternative 4 Hot Spot Excavation (previous IM), ISCO, Revetment, Capping, MNA, and ECs/ICs**
THRESHOLD CRITERIA				
Protection of Human Health and the Environment	No, will not protect HH&E.	Yes - Will prevent human exposure to aromatic VOCs (benzene, ethylbenzene, toluene) and naphthalene in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Long term GW concentrations would decrease due to natural attenuation, monitored per the current groundwater sampling program in the Coke Oven Area. Installation of a revetment cap during wharf development will minimize groundwater flux to surface water.	Yes - Will prevent human exposure to aromatic VOCs (benzene, ethylbenzene, toluene) and naphthalene in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Will reduce contaminant mass of SVOCs and VOCs via bioremediation, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to natural attenuation, monitored per the current groundwater sampling program in the Coke Oven Area. Installation of a revetment cap during wharf development will minimize groundwater flux to surface water.	Yes - Will prevent human exposure to aromatic VOCs (benzene, ethylbenzene, toluene) and naphthalene in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Will reduce contaminant mass of SVOCs and VOCs via ISCO, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to natural attenuation, monitored per the current groundwater sampling program in the Coke Oven Area. Installation of a revetment cap during wharf development will minimize groundwater flux to surface water.
Achievement of Media Objectives (a)	No, will not address relevant cleanup objectives.	Yes - Containment of contaminant mass under an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of aromatic VOCs and naphthalene helping meet CAOs in a shorter timeframe. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - Containment of contaminant mass under an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of aromatic VOCs and naphthalene helping meet CAOs in a shorter timeframe. Bioremediation can decrease benzene, ethylbenzene, toluene, and naphthalene concentrations in GW via destruction. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - Containment of contaminant mass under an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of aromatic VOCs and naphthalene helping meet CAOs in a shorter timeframe. ISCO can decrease benzene, ethylbenzene, toluene, and naphthalene concentrations in GW via destruction. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.
Source Control	No, will not control source or treatment of principal threat.	Yes - During wharf development, the revetment cap will minimize groundwater flux to surface water. The installation of at least a 5.9-inch-thick revetment cap further minimizes groundwater flux to surface water. Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping will occur during redevelopment in the source area.	Yes - During wharf development, the revetment cap will minimize groundwater flux to surface water. The installation of at least a 5.9-inch-thick revetment cap further minimizes groundwater flux to surface water. Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping will occur during redevelopment in the source area. Bioremediation would address most GW impacts, but reductions of PAHs may be a slower biodegradation process.	Yes - During wharf development, the revetment cap will minimize groundwater flux to surface water. The installation of at least a 5.9-inch-thick revetment cap further minimizes groundwater flux to surface water. Dredging will remove source material present along the shoreline that contribute to current pore water impacts. Capping will occur during redevelopment. ISCO would address COC GW impacts.

Notes:
(a) Sitewide CAOs:
1) Control any releases of COPCs to the groundwater to the extent practicable;
2) Control human exposure to the COPCs remaining in the groundwater;
3) Ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors or adjacent surface water and pore water quality;
4) Achieve cleanup levels for groundwater based on its maximum beneficial use, to the extent practicable.

Table 40D - Balancing Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

Groundwater Assessment Area E				
EVALUATION CRITERION	**Alternative 1 No Action**	**Alternative 2 Hot Spot Excavation (previous IM), Revetment, Capping, MNA, and ECs/ICs**	**Alternative 3 Hot Spot Excavation (previous IM), Bioremediation, Revetment, Capping, MNA, and ECs/ICs**	**Alternative 4 Hot Spot Excavation (previous IM), ISCO, Revetment, Capping, MNA, and ECs/ICs**
BALANCING CRITERIA				
Long-Term Effectiveness	NA: did not pass Threshold criteria	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness of ECs and ICs. Once controls are installed, the continued maintenance of capped areas will increase the long- term effectiveness of reductions in vadose zone soil to GW pathway. The installation of a revetment cap during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long-term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of benzene and naphthalene impacts via bioremediation will increase the rate of destruction of COCs. The installation of a revetment cap during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long-term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of COC impacts via ISCO will increase the rate of destruction of COCs. The installation of a revetment cap during wharf development will increase the long-term effectiveness of reductions in the groundwater to surface water pathway. With the wharf development, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark.
Reduction of Toxicity, Mobility, and Volume	NA: did not pass Threshold criteria	Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in volume of GW contaminants will be achieved via natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Reduction of volume of GW contaminants intercepting surface water will be reduced via installation of the revetment cap during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the Coke Point Container Terminal RADWP (ARM, 2024).	Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in toxicity and volume will be achieved via degradation of COCs with application of bioremediation and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Reduction of volume of GW contaminants intercepting surface water will be reduced via installation of the revetment cap during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the Coke Point Container Terminal RADWP (ARM, 2024).	Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in toxicity and volume will be achieved via destruction of COCs with application of ISCO and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Reduction of volume of GW contaminants intercepting surface water will be reduced via installation of the revetment cap during wharf redevelopment. Additionally, the future sediment and pore water receptor will be moved to the toe of the concrete-capped revetment, about 120 feet offshore and 50 feet below the mean lower low water mark, as outlined in the Coke Point Container Terminal RADWP (ARM, 2024).
Short-Term Effectiveness	NA: did not pass Threshold criteria	Short-term source containment via the installation of a cap across area and revetment construction. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap and revetment construction.	Short-term source containment via the installation of a cap across area and revetment construction. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. Bioremediation injections enhance short-term reductions in contaminant volume but face implementation challenges due to high groundwater pH, low-permeability soils, and contaminant depth. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap and revetment construction.	Short-term source containment via the installation of a cap across area and revetment construction. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. ISCO injections may leverage the naturally elevated pH in groundwater to enhance treatment but face challenges in low-permeability soils and may mobilize slag-related contaminants due to geochemical changes. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap and revetment construction.

Table 40D - Balancing Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area E - Parcel B10 Cells 4 and 5
Coke Point CMS

Groundwater Assessment Area E				
EVALUATION CRITERION	**Alternative 1 No Action**	**Alternative 2 Hot Spot Excavation (previous IM), Revetment, Capping, MNA, and ECs/ICs**	**Alternative 3 Hot Spot Excavation (previous IM), Bioremediation, Revetment, Capping, MNA, and ECs/ICs**	**Alternative 4 Hot Spot Excavation (previous IM), ISCO, Revetment, Capping, MNA, and ECs/ICs**
Cost (a)	There are no capital costs associated with Alternative 1.	Costs associated with installation and management of the capping system, any building vapor barriers, and revetment cap are considered under development programs and have not been included here. Capital costs consist of the installation of MNA monitoring wells. O&M costs include the MNA sampling plan. • Capital Costs: $16,000 • Present Worth of Annual O&M Costs: $182,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $209,000	Costs associated with installation and management of the capping system, any building vapor barriers, and revetment cap are considered under development programs and have not been included here. Capital costs consist of the installation of bioremediation injection wells and monitoring wells. O&M costs include implementation of semi-annual bioremediation injections for 1 year and the MNA sampling plan. • Capital Costs: $123,000 • Present Worth of Annual O&M Costs: $469,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $603,000	Costs associated with installation and management of the capping system, any building vapor barriers, and revetment cap are considered under development programs and have not been included here. Capital costs consist of the installation of ISCO injection wells and monitoring wells. O&M costs include implementation of semi-annual ISCO injections for 1 year and the MNA sampling plan. • Capital Costs: $123,000 • Present Worth of Annual O&M Costs: $513,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $647,000
Implementability	NA: no institutional/administrative controls or remedial technology to implement.	This alternative is considered implementable with all Process Options implemented during and after planned development.	The bioremediation portion of this alternative may be challenging to implement if it occurs after completion of surface paving . Bioremediation would take place via injections to address the benzene and naphthalene. Introduction of pH buffer would likely be required and may impact effectiveness as high pH is a major challenge. A pilot test would be required.	The ISCO portion of this alternative may be challenging to implement if it occurs after completion of surface paving. ISCO would take place via injections to address the COCs. Low permeable zones may be difficult to address. Due to the naturally high pH observed at many wells within this groundwater assessment area, oxidant would be utilized that has the best chances of success.
Community Acceptance	NA: did not pass Threshold criteria	This alternative should have community acceptance as it is protective of human health via source containment, however, as natural attenuation will be relied upon to decrease concentrations, concerns for long term effectiveness may be raised. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health via mass reduction by bioremediation. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health via mass reduction. However, injection of oxidant may be less appealing to the community due to it's reactive nature. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.
State Acceptance	NA: did not pass Threshold criteria	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.

Notes:
(a) Costs assume 15 years of MNA sampling. Long-term monitoring will be determined during analysis of quarterly MNA sampling results, as discussed in the Sitewide Groundwater Sampling Plan. See Appendix I for costing detail.

Table 41A - Applicability Evaluation of Technologies for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
No Action	No Action	None	No further action to achieve remedial action objectives.	NA	Applicable to GAA F.	Retained for comparison purposes.	
Institutional Controls	Administrative Restrictions	Restrictions on Site Use	Deed restrictions are used to specify land use for certain areas (e.g., prohibition of residential use.)	Impacted soil / slag	Applicable to GAA F.	Retained for use in combination with other process options.	
	Administrative Restrictions	Restrictions on Groundwater Use	Groundwater use restrictions are controls (generally at the local or county level) directed at limiting or prohibiting certain uses of groundwater (e.g., use as potable water.)	Impacted groundwater	Applicable to GAA F.	Retained for use in combination with other process options.	
	Administrative Controls	Inspection and Maintenance	Inspections of facilities and performance of preventative or corrective measures to ensure proper operation of engineered controls.	Impacted soil / slag and groundwater	Applicable to GAA F.	Retained for use in combination with other process options.	
	Sampling and Analysis	Monitored Natural Attenuation	Allow naturally-occurring processes (e.g., dispersion, volatilization, biodegradation, adsorption, and chemical reactions) to reduce contaminant levels.	Impacted soil / slag and groundwater	Applicable to GAA F.	Retained for use in combination with other process options.	
Engineering Controls	Engineering Controls	Fencing/Warning Signs/Access Restrictions	Placing physical restrictions on activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. May also include installation of security fence around impacted areas. Signs, fencing and/or other barriers designed to reduce or eliminate human exposure to COCs.	Impacted soil / slag and groundwater	Applicable to GAA F.	Retained for use in combination with other process options.	
	Engineering Controls	Vapor Mitigation - Sub-slab Vapor Barrier	Vapor barrier below floor slab of new building. Vapor barriers include impermeable barriers designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA F future development.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
	Engineering Controls	Vapor Mitigation - Sub-slab Venting System	Sub-slab venting system (passive/active) below floor slab of new building. Venting systems include sub-slab piping designed to reduce or eliminate human exposure to COCs caused by vapor intrusion.	Impacted soil / slag	Applicable to GAA F future development.	Retained for use in combination with other process options. Would likely be a requirement for all new indoor facilities installed on the site.	
Removal Technologies	Excavation	Excavation	Excavate NAPL impacted or contaminated soil/slag in source areas to eliminate leaching of contaminants to groundwater.	Impacted soil / slag	Applicable to GAA F.	Retained for use in combination with other process options. The NAPL at B11-026C-MWS has been difficult to recover due to its high viscosity, and recovery methods such as absorbent socks, bailers, or enhanced fluid recovery have been used intermittently. The well B11-026C-MWS has now been abandoned, and an excavation to remove the residual NAPL is proposed, as outlined in the Well Abandonment Request Letter for Parcels B1, B10, and B12 (ARM, 2024h).	
Containment Technologies	In Situ Physical	Hydraulic Containment	A series of extraction wells are placed to induce groundwater flow towards the installed extraction wells, and prevent contaminated groundwater from migrating offsite.	Impacted groundwater	Applicable for GAA F .	Retained for use in combination with other process options.	

Table 41A - Applicability Evaluation of Technologies for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	Capping	Impermeable and low-permeability cap	In-place isolation of materials below an impermeable or low permeability cap	Impacted soil / slag	Applicable for GAA F to reduce infiltration and minimize migration of dissolved phase contamination. During site development, a significant portion of GAA F will be covered with paving. All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete) (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).	Retained for use in combination with other process options. This is the presumptive remedy for landfill closure.	
	Vertical Barrier	Sheet piling / slurry wall	Sheet piling consists of thin interlocking sheets of steel driven into the ground with impact or vibratory hammers to obtain a continuous barrier in the ground, blocking off lateral ground water migration. Placement may be limited by slag or subsurface obstructions.	Impacted groundwater	Applicable for GAA F, specific to benzene and naphthalene plumes.	Retained for use in combination with other process options. Applicable to southern shoreline, however, no shoreline exceedances are observed in GAA F.	
Treatment Technologies	In Situ Physical	Air Sparge/Soil Vapor Extraction	Air sparging involves the installation of injection wells that introduce air below the water table. Soil Vapor Extraction involves the installation of extraction wells above the water table that pull air and vapors through the soil to the ground surface for treatment.	Impacted soil / slag and groundwater	Applicable to GAA F. Effective air spraging may be difficult to achieve due to tighter layers of clay (observed around 21-27 ft bgs in CP08R-PZM034) but could be an option for benzene impacts in the shallow zone.	Retained, for use in combination with other process options. This process option may be challenging with heterogeneity of the local geology but can be applicable to benzene impacts. At location of highest concentration of benzene, a clay layer that would prevent deeper air sparge is observed at 21-27 ft bgs.	
	In Situ Physical	Product Recovery (Absorbent/ Skimmers)	NAPL is removed from recovery wells using absorbent/skimmers (active or passive) or via enhanced fluid recovery where multiple phases of hydrocarbons (liquid, dissolved, adsorbed and vapor phase) are simultaneously removed.	NAPL in groundwater wells	Currently implemented IM: Applicable to GAA F. NAPL was identified in soil boring B11-026-SB in August 2020 and B11-026C-PZ/MWS in October 2020. Delineation piezometers B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ were installed in February 2021; no NAPL has been identified in the delineation piezometers. NAPL removal at B11-026-MWS is performed via bailer or absorbant sock as needed (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).	Retained - Monthly NAPL gauging is performed at B11-026-MWS, B11-026A-PZ, and B11-026C-PZ (well B11-026C-PZ has been damaged/destroyed since June 2021). NAPL removal has been performed within GAA F. Measurable NAPL in B11-026-MWS is removed via absorbant sock, bailer, or enhanced fluid recovery (1st Half 2024 Semi-Annual NAPL Update, Area B: Parcel B11 [ARM, August 29, 2024]).	

Table 41A - Applicability Evaluation of Technologies for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ Physical	Multi-Phase Extraction	Use of groundwater collection system to lower water table to expose soil. Soil vapor extraction is then used to removed absorbed or trapped contaminants.	Impacted soil / slag and groundwater	Not applicable to GAA F. NAPL removal at B11-026-MWS is performed via bailer or absorbent sock as needed (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).		Eliminated - NAPL removal is currently performed within GAA F at well B11-026-MWS. Measurable NAPL in B11-026-MWS is removed via absorbent sock, bailer, or enhanced fluid recovery (1st Half 2024 Semi-Annual NAPL Update, Area B: Parcel B11 [ARM, August 29, 2024]). Surrounding delineation piezometers do not have measureable NAPL observed. This localized NAPL does not appear to be moving or impacting nearby peizometers. Implementation of an MPE system would not provide further benefit than the implemented Product Recovery IM.
	In Situ Physical	Soil Flushing	In situ leaching method using extraction wells and liquid treatment to remove contaminants from soil.	Impacted soil	Not applicable to GAA F. NAPL encountered was identified in soil boring B11-026-SB in August 2020 and B11-026C-PZ/MWS in October 2020. Delineation piezometers B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ were installed in February 2021; no NAPL has been identified in the delineation piezometers. NAPL removal at B11-026-MWS is performed via bailer or absorbant sock as needed (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).		Eliminated - NAPL removal is currently performed within GAA F at well B11-026-MWS. Measurable NAPL in B11-026-MWS is removed via absorbant sock, bailer, or enhanced fluid recovery (1st Half 2024 Semi-Annual NAPL Update, Area B: Parcel B11 [ARM, August 29, 2024]). Surrounding delineation piezometers do not have measureable NAPL observed. This localized NAPL does not appear to be moving or impacting nearby peizometers. Implementation of a soil flushing remedy would not provide further benefit than the implemented Product Recovery IM.
	In Situ Physical	Stabilization / solidification	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Impacted soil	Not applicable to GAA F. NAPL encountered was identified in soil boring B11-026-SB in August 2020 and B11-026C-PZ/MWS in October 2020. Delineation piezometers B11-026A-PZ, B11-026B-PZ, and B11-026C-PZ were installed in February 2021; no NAPL has been identified in the delineation piezometers. NAPL removal at B11-026-MWS is performed via bailer or absorbant sock as needed (Container Terminal Area B Response and Development Work Plan [ARM, October 17, 2024]).		Eliminated - NAPL removal is currently performed within GAA F at well B11-026-MWS. Measurable NAPL is B11-026-MWS is removed via absorbant sock, bailer, or enhanced fluid recovery (1st Half 2024 SEmi-Annual NAPL Update, Area B: Parcel B11 [ARRM, August 29, 2024]). Surrounding delineation piezometers do not have measureable NAPL observed. This localized NAPL does not appear to be moving or impacting nearby peizometers. Implementation of a stabilization/solidification remedy would not provide further benefit than the implemented Product Recovery IM.

Table 41A - Applicability Evaluation of Technologies for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	Ex Situ Physical	Groundwater Pump and Treat (GWPT)	A series of extraction wells are placed to remove contaminated groundwater. Extracted water is then treated and may be reinjected, transferred to a treatment system, or discharged with the proper permitting.	Impacted groundwater	Applicable to GAA F.	Retained for use in combination with other process options. This process option would target mass removal and reduction of dissolved phase COCs in GAA F.	
	In Situ Chemical	In-situ Chemical Oxidation (ISCO)	ISCO involves the introduction of a chemical oxidant into the subsurface to oxidize contaminants and transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Applicable to GAA F. However, ISCO may drive chemical changes in implaced slag, potentially increasing Mn, Fe, and Co concentration in groundwater.	Retained for use in combination with other process options to treat and reduce naphthalene and benzene at potential source areas identified.	
	In Situ Chemical	In-situ Chemical Reduction (ISCR)	ISCR involves the introduction of a chemical reductant to transform groundwater or soil contaminants into less harmful end products.	Impacted groundwater	Not applicable to remaining COCs in GAA F, naphthalene and benzene. Most applicable for CVOCs, PCBs, and hexavalent chromium.		Eliminated - GAA A does not have applicable COCs.
	In Situ Biological	Enhanced Anaerobic Bioremediation	Subsurface delivery of electron donors within the target zone to stimulate anaerobic biodegradation of compounds by cometabolic remediation. Different electron acceptor may be injected to promote availability of hydrogen to speed up the process.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA F. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the benzene and naphthalene plumes. This process option may have limited effectiveness due to high pH in impacted area. Natural conditions indicate supporting a reducing environment.	
	In Situ Biological	Enhanced Aerobic Bioremediation	Injection of oxygen (other than bioventing), substrates, or nutrients to enhance microbial activities.	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA F. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the benzene and naphthalene plumes. Process option may be ineffective due to high pH in impacted area. Additionally, natural conditions indicate a highly reducing environment.	
	In Situ Biological	Biosparging	Similar to air sparging, air or oxygen ins introduced to stimulate aerobic degradation of hydrocarbons, PAHs and VOCs	Impacted groundwater	Applicable to dissolved phase naphthalene and benzene in GAA F. The historical range of pH in this area ranges from 10-12 s.u.	Retained, for use in combination with other process options for application to the benzene and naphthalene plumes. Process option may be ineffective due to high pH in impacted area. Additionally, natural conditions indicate a highly reducing environment.	
	Ex Situ Physical	Low-temperature thermal treatment / stripping	Excavation of impacted material, low temperature heating and agitation to drive off volatile contaminants coupled with collection and treatment of gases and condensate.	Impacted soil	Not applicable to GAA F. No NAPL impacted soil has been observed.		Eliminated - Not applicable to dissolved phase COCs in this GAA. No soil impacted NAPL observed.
	In Situ	Thermal Conductance Heating (TCH)	Installation of thermal wells into the ground, heat treatment volume to desired temperature based on contamination type. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Applicable to GAA F.	Retained for use in combination with other process options to treat and reduce naphthalene and benzene at potential source areas identified.	

Table 41A - Applicability Evaluation of Technologies for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Applicability	Retained	Eliminated
	In Situ	Electrical Resistance Heating (ERH)	Installation of electrodes into the ground, application of alternating current (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Impacted soil / groundwater	Not applicable to GAA F. Areas of naphthalene and benzene plumes in the proximity to the Coke Point Landfill would cause implementation issues due to subsurface waste or obstructions resulting in high variability of electrical conductivity.		Eliminated - Areas of naphthalene and benzene plumes in the proximity to the Coke Point Landfill may cause implementation issues due to subsurface waste or obstructions resulting in high variability of electrical conductivity.
	In Situ	Permeable Reactive Barriers (PRB)	A permeable wall containing reactive substances is installed across the groundwater flow path. Contaminants are chemically removed as groundwater flows through the wall.	Impacted groundwater	Applicable to GAA F.	Retained for use in combination with other process options to mitigate potential offsite migration.	
Disposal Technologies	Excavation & Disposal	On-Site or Off-Site Disposal/ Landfilling	Contaminated material is removed and transported to on-site landfill or permitted off-site disposal facilities.	Impacted soil / slag	Not applicable to naphthalene and benzene plumes in the vicinity of the Coke Point Landfill near the western boundary of GAA F.		Eliminated - This process would require excavation in the vicinity of the Coke Point Landfill, which may not be feasibile due to subsurface obstructions.
	Excavation & Disposal	On-Site Disposal (CAMU)	CAMUs are used to facilitate treatment, storage, and disposal of CAMU-eligible wastes to implement corrective action or cleanup.	Impacted soil / slag	Not applicable to GAA F, there is no available area for a CAMU.		Eliminated - There is no area available in GAA A for a CAMU.
	Disposal	Permitted Discharge	Discharge of treated groundwater via NPDES or other permit.	Treated groundwater	Applicable to GAA F. To be paired with GWPT.	Retained, for use in combination with other process options. Specifically, to be paired with GWPT.	

Notes:
Treatment technologies retained based on applicability will likely require the completion of treatability studies, bench scale testing, or pilot installations to establish feasibility in this GAA.

Table 41B - Corrective Measures Alternatives for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

General Response Action	Process Option	Alternative 1 No Action	Alternative 2 Excavation, Capping, MNA, and ECs/ICs	Alternative 3 Biosparging, Excavation, Capping, MNA, and ECs/ICs	Alternative 4 ISCO, Excavation, Capping, MNA, and ECs/ICs
No Action	None	X			
Institutional Controls	Restrictions on Site		X	X	X
	Restrictions on Groundwater Use		X	X	X
	Inspection and Maintenance		X	X	X
	Monitored Natural Attenuation		X	X	X
Engineering Controls	Fencing/Warning Signs/Access Restrictions		X	X	X
	Vapor Mitigation - Sub-slab Vapor Barrier		X	X	X
	Vapor Mitigation - Sub-slab Venting System		X	X	X
Removal Technologies	Excavation		X	X	X
Containment Technologies	*Hydraulic Containment*	*Hydraulic containment is not the best suited remedial option. Partial attenuation of COC impacts are observed between the source area and the property boundary or surface water. The potential for offiste migration of COCs is not significant and remedial options should be focused on potential source areas.*			
	Impermeable or Low-permeability cap		X	X	X
	Sheet piling / slurry wall	*A sheet pile or slurry wall is not the best suited remedial option. Partial attenuation of COC impacts is observed between the source area and the property boundary or surface water. The potential for offiste migration of COCs is not significant and remedial options should be focused on potential source areas.*			
Treatment Technologies	*Air Sparge/Soil Vapor Extraction*	*The application of air spare/soil vapor extraction is not the best suited remedial option. Based on the concentration of COCs. Naphthalene is unlikely to strip using air sparging and biosparging was selected as a more effective approach for GAA F.*			
	Product Recovery (Absorbent / Skimmers)	*Product recovery has been implemented at Assessment Area F. NAPL removal at B11-026-MWS is performed via bailer or absorbant sock as needed (Container Terminal Area B Response and Development Work Plan [dated October 17, 2024]). Abandonment of well B11-026-MWS may occur in coordination with site preparation activities in advance of paving the area.*			
	Groundwater Pump and Treat (GWPT)	*The implementation of a GWPT system is not the best suited remedial option. Benzene trends at shoreline wells indicate statistically significant decreases in concentrations, suggesting the plume is attenuating. Naphthalene and bis(2-ethylhexyl)phthalate exceedance magnitudes do not warrant an active remedial system.*			
	In-situ Chemical Oxidation (ISCO)				X
	Enhanced Anaerobic Bioremediation	*Bioremediation was not selected as a preferred process option in GAA F because the primary COCs in this area are benzene and naphthalene, which are both more effectively treated via biosparging. Unlike other GAAs where bioremediation was considered to address persistent PAH exceedances, GAA F does not have PAH exceedances requiring more aggressive amendment loading or injection strategies.*			
	Enhanced Aerobic Bioremediation	*Bioremediation was not selected as a preferred process option in GAA F because the primary COCs in this area are benzene and naphthalene, which are both more effectively treated via biosparging. Unlike other GAAs where bioremediation was considered to address persistent PAH exceedances, GAA F does not have PAH exceedances requiring more aggressive amendment loading or injection strategies.*			
	Biosparging			X	
	Thermal Conductance Heating (TCH)	*The implementation of TCH is not the best suited remedial option. The installation of heating wells in proximity to the eastern boundary of the Coke Point Landfill is not practicable and may impact the stability of the landfill. Soil temperatures during TCH operation can reach as high as 900 C, at which soil desiccation occurs, possibly impacting the structural stability of the soils/slag in the GAA.*			
	Permeable Reactive Barriers (PRB)	*Installation of a PRB is not the best suited remedial option. Partial attenuation of COC impacts are observed between the source area and the property boundary or surface water. The potential for offiste migration of COCs is not significant and remedial options should be focused on potential source areas. In addition, because a significant portion of Assessment Area F will be covered in paving during development activities, replacement of reactive materials in the PRB may require removal of asphalt/concrete paving and subsequent replacement .*			
Disposal Technologies	*Permitted Discharge*	*Typically paired with GWPT. See GWPT section above.*			
Description of Alternative		No Action	- Capping of the area will occur during development and will include significant areas of impermeable cap installation. All paved areas will have a minimum of 4 inches of compacted aggregate base and a minimum of 4 inches of overlying pavement surface (asphalt or concrete). - Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys potentially completed over multiple seasons. - The well B11-026-MWS has now been abandoned, and an excavation to remove the residual NAPL is proposed, as outlined in the *Well Abandonment Request Letter for Parcels B1, B10, and B12 (ARM, 2024h)* . This excavation is intended to effectively address the remaining NAPL contamination in the area. - LUCs will prevent groundwater use, require HASP for utility workers. - MNA: GW sampling for COCs, MNA parameters; sampling will remain consistent with current semi-annual sampling.	Alt 2, plus biosparging in the naphthalene and benzene impacted areas in the vicinity of the eastern boundary of the Coke Point Landfill. Naturally reducing geochemical conditions and elevated pH within the shallow aquifer of GAA F may introduce challenges for the implementation of this approach.	Alt 2, plus ISCO possibly via alkaline activated persulfate. Injections could occur via a low volume continuous injecting system to attack the low permeability zones (silts and clays below the water table).

Table 41C - Threshold Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Excavation, Capping, MNA, and ECs/ICs	Alternative 3 Biosparging, Excavation, Capping, MNA, and ECs/ICs	Alternative 4 ISCO, Excavation, Capping, MNA, and ECs/ICs
THRESHOLD CRITERIA				
Protection of Human Health and the Environment	No, will not protect HH&E.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Long term GW concentrations would decrease due to natural attenuation, monitored per the Coke Point Sampling Plan.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Will reduce contaminant mass of benzene and naphthalene via biosparging, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to natural attenuation, monitored per the Coke Point Sampling Plan.	Yes - Will prevent human exposure to COCs in GW in the short and long term through LUCs, and capping of the area. Planned buildings will include a presumed vapor barrier or venting system below the floor slabs to prevent vapor intrusion but will be confirmed via soil gas surveys per a sampling plan to be submitted and approved by the Agencies. Will reduce contaminant mass of COCs via ISCO, thereby reducing the potential for human exposure. Long term GW concentrations would decrease due to natural attenuation, monitored per the Coke Point Sampling Plan.
Achievement of Media Objectives (a)	No, will not address relevant cleanup objectives.	Yes - installation of an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of COCs helping meet Final RGs and CAOs. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - installation of an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of COCs helping meet Final RGs and CAOs. Biosparging can decrease benzene and naphthalene concentrations in GW via destruction to expedite cleanup timeframe. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.	Yes - installation of an impermeable/low-permeability cap reduces potential for impacted soil to act as a continuing source to GW and expedites natural attenuation in GW of COCs helping meet Final RGs and CAOs. ISCO can rapidly decrease all COC concentrations in GW via destruction to expedite cleanup timeframe. MNA provides a route to documenting and demonstrating reductions in GW concentrations and confirmation that caps are successfully inhibiting additional impacts to GW.
Source Control	No, will not control source or treatment of principal threat.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. In addition to capping, excavation of residual NAPL in GAA F will further reduce contaminant sources and enhance the overall effectiveness of the remedy.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. In addition to capping, excavation of residual NAPL in GAA F will further reduce contaminant sources and enhance the overall effectiveness of the remedy. Biosparging would address benzene and naphthalene GW impacts.	Yes - Capping will occur during redevelopment. Capping reduces the pathway between the vadose zone and groundwater, effectively containing any potentially remaining impacted soils. In addition to capping, excavation of residual NAPL in GAA F will further reduce contaminant sources and enhance the overall effectiveness of the remedy. ISCO would address COCs GW impacts.

Notes:
(a) Sitewide CAOs:
1) Control any releases of COPCs to the groundwater to the extent practicable;
2) Control human exposure to the COPCs remaining in the groundwater;
3) Ensure that groundwater containing elevated concentrations of COPCs will not adversely impact ecological receptors or adjacent surface water and pore water quality;
4) Achieve cleanup levels for groundwater based on its maximum beneficial use, to the extent practicable.

Table 41D - Balancing Criteria Evaluation of Corrective Measures Alternatives for Groundwater Assessment Area F - Parcels B11 and B12
Coke Point CMS

EVALUATION CRITERION	Alternative 1 No Action	Alternative 2 Excavation, Capping, MNA, and ECs/ICs	Alternative 3 Biosparging, Excavation, Capping, MNA, and ECs/ICs	Alternative 4 ISCO, Excavation, Capping, MNA, and ECs/ICs
BALANCING CRITERIA				
Long-Term Effectiveness	NA: did not pass Threshold criteria	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness of ECs and ICs. Once controls are installed, the continued maintenance of capped areas will increase the long term effectiveness of reductions in vadose zone soil to GW pathway.	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of benzene and naphthalene impacts via biosparging will increase the rate of destruction of non-slag related COCs.	Risks from residual contamination would be low with ICs/LUCs. MNA provides a way to document and analyze the long-term effectiveness. Once controls are installed, the continued maintenance of capped areas will increase the long term effectiveness of reductions in vadose zone soil to GW pathway. Active remediation of COCs impacts via bioremediation will increase the rate of destruction of non-slag related COCs.
Reduction of Toxicity, Mobility, and Volume	NA: did not pass Threshold criteria	Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in volume of GW contaminants will be achieved via natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Excavation of residual NAPL in GAA F will further reduce the source contamination.	Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in toxicity and volume will be achieved via degradation of benzene and naphthalene with application of biosparging and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Excavation of residual NAPL in GAA F will further reduce the source contamination.	Reduction of toxicity and mobility will be achieved via capping (prevention of infiltration through impacted soil and prevention of exposure). Reduction in toxicity and volume will be achieved via destruction of COCs with application of ISCO and then further by natural attenuation. Reduction of GW contamination will be documented and analyzed via MNA. Excavation of residual NAPL in GAA F will further reduce the source contamination.
Short-Term Effectiveness	NA: did not pass Threshold criteria	Short-term effectiveness via excavation of residual NAPL and the installation of a cap across the area. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap construction.	Short-term effectiveness via excavation of residual NAPL and the installation of a cap across the area. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. Biosparging is considered a long-term remedial option that, once implemented, would help reduce contaminant concentrations over time and support progress toward meeting Final RGs. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap construction.	Short-term effectiveness via excavation of residual NAPL and the installation of a cap across the area. The cap will prevent exposure to impacted soil and shallow groundwater and reduce infiltration of surface water, thereby limiting contaminant mobility. ISCO is considered a longer-term treatment option due to the time needed for chemical reactions to degrade contaminants and would help reduce contaminant concentrations over time and support progress toward meeting Final RGs. Construction risks, including potential contact with residual contamination, will be addressed through site-specific health and safety plans. MNA presents low implementation risk. LUCs and ICs will be applied to restrict groundwater use, manage site access, and prevent unnecessary soil disturbance. Short-term protection of human health and the environment is expected immediately following cap construction.
Cost (a)	NA: did not pass Threshold criteria	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of MNA monitoring wells. O&M costs include the MNA sampling plan. • Capital Costs: $38,000 • Present Worth of Annual O&M Costs: $182,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $231,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of biosparge injection wells and monitoring wells. O&M costs include implementation of biosparge for 5 years and the MNA sampling plan. • Capital Costs: $336,000 • Present Worth of Annual O&M Costs: $674,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $1,021,000	Costs associated with installation and management of the capping system and any building vapor barriers are considered under development programs and have not been included here. Capital costs consist of the installation of ISCO injection wells and monitoring wells. O&M costs include implementation of semi-annual ISCO injections for 2 years and the MNA sampling plan. • Capital Costs: $144,000 • Present Worth of Annual O&M Costs: $647,000 • Present Worth of Periodic Costs: $11,000 • Total Present Worth: $802,000
Implementability	NA: did not pass Threshold criteria	This alternative is considered implementable with all process options implemented during and after planned development.	The biosparging portion of this alternative may be challenging to implement. Biosparging will face significant challenges related to elevated pH, dissolved oxygen demand, and development schedule. Introduction of pH buffer may be required due to the high pH in groundwater.	The ISCO portion of this alternative may be challenging to implement. ISCO would take place via injections on a regular basis to address the COC plumes. Low permeable zones may be difficult to address. Due to the naturally high pH observed at many wells within this Assessment Area, an alkaline activated persulfate would be utilized as the oxidant that has the best chances of success.
Community Acceptance	NA: did not pass Threshold criteria	This alternative should have community acceptance as it is protective of human health via source containment. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health. alternatives will be included in a public comment period to enable meaningful community involvement.	This alternative should have community acceptance as it is protective of human health. However, injection of oxidant may be less appealing to the community due to it's reactive nature. Additionally, alternatives will be included in a public comment period to enable meaningful community involvement.
State Acceptance	NA: did not pass Threshold criteria	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.	This approach has been accepted by the State for similar conditions in the past.

Notes:
(a) Costs assume 15 years of MNA sampling. Long-term monitoring will be determined during analysis of quarterly MNA sampling results, as discussed in the Sitewide Groundwater Sampling Plan. See Appendix I for costing detail.

Table 42 - Generalized Remediation Difficulty Scale
Coke Point Area
Groundwater CMS

Contaminant Characteristics		*Increasing Difficulty* →		**Site-Specific Information**
Site Use	Nature of Release	Small Volume →	Large Volume	There is an extensive amount of slag fill present at Trade Point Atlantic Property including Coke Point Area / Container Terminal (CPA/TC). Slag fill was used to fill historical estuaries, level grades, and extend the property into the Patapsco River resulting in the creation of over 1,000 additional acres of made land since the early 1900s. It is estimated that up to 7 to 19 Million CY of slag are present at CPA/TC.
		Short Duration →	Long Duration	The slag fill has been in place for many decades. Fill was used to reclaim land at the site beginning in the early 1900s. This practice extended until the 1980s.
		Slug Release →	Continual Release	Slag fill is present in both the vadose zone and shallow groundwater in a water bearing zone referred to as the Slag Fill Unit. Slag extends beyond the shoreline into near-shore areas in surrounding surface water bodies.
Chemical Properties	Biotic/Abiotic Decay Potential	High →	Low	The inorganic consituents associated with the slag fill (i.e., cobalt, iron, managnese and vandaium) cannot be destroyed through biotic or abiotic processes.
	Volatility	High →	Low	The inorganic consituents associated with the slag fill (i.e., cobalt, iron, managnese and vandaium) are not volatile.
	Contaminant Retardation (Sorption) Potential	Low →	High	Sorption potential for metals largely dependent on pH and oxidation-reduction conditions in groundwater. Large volume of slag fill source material makes pH adjusment in groundwater infeasible due to high pH conditions (> 10).
Contaminant Distribution	Contaminant Phase	Aqueous, Gaseous → Sorbed → LNAPLs →	DNAPLs	The primary detections of slag-related constituents are within the dissolved phase in groundwater and part of the mineral structure of the slag.
	Volume of Contaminated Media	Small →	Large	There is an extensive volume of source material (estimated up to 19,000,000 CY).
	Contaminant Depth	Shallow →	Deep	Slag fill is present at depths more than 10 feet beneath the water table.
Hydrogeologic Characteristics				
Geology	Stratigraphy	Simple Geology, (e.g., Planar Bedding) →	Complex Geology, e.g., Interbedded and Discontinuous Strata	Irregular placement of slag fill together with the uppermost natural soils exhibiting texture ranging from clay to sand results in complex geology.
	Texture of Unconsolidated Deposits	Sand →	Clay	Slag fill comprised of a mixture of textures, most larger than clay.
	Degree of Heterogeneity	Homogenous (e.g., well sorted sand) →	Heterogeneous (e.g., interbedded sand and silts, fractured media, karst)	Large volume of anthropogenic slag fill present in uppermost portions of soil column, which is heterogenous by nature. Additionally, uppermost native soils (Talbot Fm) comprised of layers of sand, as well as silts and clays.
Hydraulic Flow	Hydraulic conductivity (k)	High (>10^{-2} cm/sec) →	Low (<10^{-4} cm/sec)	Historic slug testing in uppermost aquifer has exhibited k ranging from 10^{-2} to 10^{-5} cm/sec. Wide range over 3 orders of magnitude consistent/anticipated based on the uncontrolled placement of the slag fill material.
	Temporal Variation	Little/none →	High	Generally minimal temporal variation in hydraulic flow (groundwater gradients are relatively consistent).
	Vertical Flow	Little →	Large Downward Flow Component	Mostly horizontal groundwater flow in the uppermost aquifer. Minimal downward flow observed in uppermost aquifer. Downward flow limited by silts/clays of the Talbot Fm. Some vertical flow observed where Talbot Clay Aquitard is absent.

Table 43 - Initial Screening of Technologies for Alternative Remedy Development
Coke Point Area
Groundwater CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Engineering Feasibility	Reliability	Decision
No Action	No Action	None	Do nothing to achieve remedial action objectives.	Not Applicable (NA)	Feasible but slag-related iron is only likely to attenuate over an extended timeframe (i.e., up to hundreds of years).	NA	Accepted: Retained for comparison purposes.
Institutional & Engineering Controls	Institutional Controls	Restrictions on Site Use	Placing legal restrictions on land use and activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. Deed restrictions are used to specify land use for certain areas (e.g., prohibition of residential use.)	Impacted slag fill	Feasible and practical for future use of impacted areas. Designation of industrial use area only are practical institutional controls.	Reliable to mitigate potential exposure of human receptors	Accepted: For use in combination with other process options.
	Institutional Controls	Restrictions on Groundwater Use	Placing legal restrictions on groundwater use and activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. Groundwater use restrictions are controls (generally at the local or county level) directed at limiting or prohibiting certain uses of groundwater (e.g., use as potable water.)	Slag-related impacted groundwater	Feasible and practical for future use of impacted areas. Per the USEPA memorandum dated April 13, 2018, the maximum beneficial use of shallow and intermediate groundwater is restricted to industrial, commercial, or dewatering purposes. A groundwater use restriction can be implemented across Coke Point Area / Container Terminal (CPA/CT, the Site).	Reliable to mitigate potential exposure of human receptors	Accepted: For use in combination with other process options.
	Institutional Controls	Inspection and Maintenance	Inspections of facilities and performance of preventative or corrective measures to ensure proper operation of engineered controls.	Impacted slag fill and slag-related impacted groundwater	Feasible and practical for future use of impacted areas where corrective measures have been implemented. This is currently being implemented for buildings with vapor barrier and/or vapor mitigation systems.	Reliable to mitigate potential exposure of human receptors	Accepted: For use in combination with other process options.
	Sampling & Analysis	Monitored Natural Attenuation (MNA)	Allow naturally-occurring processes (e.g., dispersion, volatilization, biodegradation, adsorption, and chemical reactions) to reduce contaminant levels.	Impacted slag fill and slag-related impacted groundwater	Theoretically feasible for relevant slag-related iron. Metals related to the slag fill are unlikely to attenuate at a rate in which MNA would be realistic. The nondestructive reactions that are important to the natural attenuation of iron in the sediments, soils, groundwaters, and/or surface waters are limited to sorption or flushing and are also limited by geochemical conditions at the Site. Dispersion and sorption may be possible, however, as it is technically infeasible to remove or contain the existing slag, the decrease in concentrations of slag-related iron is unlikely within an observable timeframe. (See Technical Impracticability Section 6).	Timeframe for natural attenuation of groundwater is unreliable due to potential on-going contribution of slag-related constituents to groundwater.	Rejected: Will meet a portion but not all of the threshold criteria even when used in combination with other process options. Limited reliability to meet cleanup objectives in a reasonable timeframe.
	Engineering Controls	Fencing/Warning Signs/Access Restrictions	Placing physical restrictions on activities that may cause erosion, create subsurface disturbance, or result in direct contact with impacted soil or groundwater. May also include installation of security fence around impacted areas. Signs, fencing and/or other barriers designed to reduce or eliminate human exposure to iron.	Impacted slag fill and slag-related impacted groundwater	Feasible and practical where determined necessary to prevent human contact with impacted groundwater. The entire Trade Point Atlantic property is zoned for industrial use. Fencing may be used to control non-authorized access to selected areas.	Reliable to mitigate potential exposure of human receptors	Accepted: For use in combination with other process options.
	Engineering Controls	Vapor Mitigation - Sub-slab Vapor Barrier	Sub-slab vapor barrier restricts the migration of vapors into proposed structures.	Soil vapor	Not feasible. Iron is not volatile.	Not reliable. Iron is not volatile.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	Engineering Controls	Vapor Mitigation - Sub-slab Venting System	Sub-slab venting system (either passive or active), restricts the migration of vapors into proposed structures.	Soil vapor	Not feasible. Iron is not volatile.	Not reliable. Iron is not volatile.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.

Table 43 - Initial Screening of Technologies for Alternative Remedy Development
Coke Point Area
Groundwater CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Engineering Feasibility	Reliability	Decision
Removal Technologies	Excavation	Excavation	Excavate impacted or contaminated soil in source area to eliminate leaching of contaminants to groundwater and dermal contact pathway for receptors.	Impacted slag fill	Not feasible or practical. The majority of the Site overburden consists of slag fill. Excavation and removal of this material would not be feasible due to it's volume and existing buildings on the site. Additionally, it would not be practical to excavate even smaller areas with slag-related impacts due to the eventual reinfiltration/migration of slag-related iron from remaining slag fill in both the vadose and saturated zones.	Not reliable at reducing groundwater concentrations as a stand-alone option.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
Containment Technologies	In Situ Physical	Hydraulic Containment	Hydraulic containment is used to control the migration of contaminants via pumping wells or with the use of trenches and drains.	Slag-related impacted groundwater	Not feasible or practical. To provide hydraulic containment around the Site boundary is impractical due to size. Implementation of discrete hydraulic containment areas presents challenges in preventing short circuiting and handling/processing of potentially large amounts of water due to direct connection to the bay. In addition, slag fill extends beyond the current shoreline into surrounding surface water bodies which would preclude the ability to isolate slag impacts (See Technical Impracticability Section 6).	Not reliable for controlling impacts on such a large scale basis.	Rejected: Will meet a portion but not all of the threshold criteria even when used in combination with other process options.
	Capping	Consolidation under a cap	In-place containment of materials below concrete slab, asphalt pavement, or soil cap.	Impacted slag fill	Not feasible or practical. To provide capping around the full Site boundary is impractical due to size. The entire Trade Point Atlantic property is zoned for industrial use. Buildings and hardscape parking areas provide limited protection via capping and will reduce some infiltration however, there remains slag within the saturated zone. (See Technical Impracticability Section 6).	Not reliable. Slag still present in saturated zone and may continue to act as a source to groundwater.	Rejected: Will meet a portion but not all of the threshold criteria even when used in combination with other process options. Will not meet media objectives.
	Vertical Barrier	Sheet piling / Slurry Wall	Vertical barrier walls limit groundwater movement and prevent groundwater from lateral infiltration.	Slag-related impacted groundwater	Not feasible or practical. To provide hydraulic containment around the full Site boundary is impractical due to size. Implementation of discrete vertical barrier areas presents challenges in preventing short circuiting and handling/processing of potentially large amounts of water due to direct connection to the bay. (See Technical Impracticability Section 6).	Not reliable as a stand alone option. Will not contain groundwater without a mechanism to provide additional hydraulic control to prevent short circuiting.	Rejected: Will meet a portion but not all of the threshold criteria even when used in combination with other process options. Will not meet media objectives.
Treatment Technologies	In Situ Physical	Air Sparge/Soil Vapor Extraction	Air sparging involves the installation of injection wells that introduce air below the water table. Soil Vapor Extraction involves the installation of extraction wells above the water table that pull air and vapors through the soil to the ground surface for treatment.	Soil vapor	Not feasible. Does not address iron though volatlization of dissolved metals in groundwater.	Not reliable. Iron is not volatile.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.

Table 43 - Initial Screening of Technologies for Alternative Remedy Development
Coke Point Area
Groundwater CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Engineering Feasibility	Reliability	Decision
	Ex Situ Physical	Groundwater Recovery & Treatment (Pump & Treat)	A series of extraction wells are placed to remove contaminated groundwater. Groundwater is pumped from the extraction wells to a treatment system.	Slag-related impacted groundwater	Not feasible or practical. The large size of the Site and significant amount of existing slag fill preclude a practical remedial option for slag-related iron to include pump and treat. Pumping may not decrease slag-related metal concentrations in groundwater due to the slow desorption and diffusion from the remaining slag. Additionally, geochemical changes caused by pump and treat may lead to increased slag-related inorganic concentrations.	Not reliable for operation in perpetuity due to inability to practically remove or contain slag source to groundwater. The presence of slag at locations offshore may continue to act as a source of groundwater and surface water contamination.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	In Situ Chemical	In Situ Chemical Oxidation (ISCO)	ISCO involves the introduction of a chemical oxidant into the subsurface to oxidize contaminants and transform groundwater or soil contaminants into less harmful end products.	Slag-related impacted groundwater	Not feasible. Does not address iron in groundwater though direct oxidation of the slag material may ultimately contribute to dissolved metals in groundwater, particularly other slag-related metals.	Not reliable. Long term effectiveness and stability unlikely to be feasibly maintained due to site-specific geochemical conditions and may result in increased leaching from slag.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	In Situ Chemical	In Situ Chemical Reduction (ISCR)	ISCR involves the introduction of a chemical reductant into the subsurface to create reducing conditions (lower oxidation reduction potential and dissolved oxygen) to transform groundwater or soil contaminants into less harmful end products.	Slag-related impacted groundwater	Not feasible or practical. The extensive size of the Site and substantial volume of existing slag fill make injection-based remedial options impracticable for slag-related iron. Achieving and maintaining geochemical control in this large of an area long enough to drive mineralization of metals is impractical.	Not reliable. Long term effectiveness and stability unlikely to be feasibly maintained due to site-specific geochemical conditions.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	In Situ Biological	Bioremediation	Bioremediation techniques are destruction techniques directed toward stimulating the indigenous or introduced microorganisms to grow and use the contaminants as a food and energy source by creating a favorable environment for the microorganisms.	Slag-related impacted groundwater	Not feasible or practical. The extensive size of the Site and substantial volume of existing slag fill make injection-based remedial options impracticable for slag-related iron. Achieving and maintaining geochemical control in this large of an area long enough to drive reducing conditions. Bioremediation only treats selective metals (i.e. reduction of chrome VI to chrome III).	Not reliable. Bioremediation is not a viable technology for iron.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
		Solidification/Stabilization	Solidification/stabilization immobilizes contaminants within the soil matrix and does not remove them. Solidification is when the matrix and contaminant material are physically bound together using a reagent to encapsulate the contaminant of concern (COC). The physical properties of the media are modified to result in decreased permeability. Stabilization is based on a chemical reaction that decreases the leachability of the COC.	Impacted slag fill	Not feasible or practical. The extensive size of the Site and substantial volume of existing slag fill make injection-based remedial options impracticable for slag-related iron. Achieving and maintaining geochemical control in this large of an area long enough to drive mineralization of metals is impractical.	Not reliable as a stand alone option. Will not directly reduce concentrations in groundwater.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	Ex Situ	Low-temperature thermal treatment / stripping	Excavation of impacted material, low temperature heating and agitation to drive off volatile contaminants coupled with collection and treatment of gases and condensate.	Slag-related impacted groundwater	Not feasible. Does not address iron.	Not reliable.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	In Situ	Thermal Conductance Heating (TCH)	Installation of thermal wells into the ground, heat treatment volume to desired temperature based on contamination type. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Slag-related impacted groundwater	Not feasible. Does not address iron.	Not reliable	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.

Table 43 - Initial Screening of Technologies for Alternative Remedy Development
Coke Point Area
Groundwater CMS

General Response Action	Remedial Technology	Process Option	Description	Media	Engineering Feasibility	Reliability	Decision
	In Situ	Electrical Resistance Heating (ERH)	Installation of electrodes into the ground, application of alternating current (AC) electricity to the electrodes and heating the subsurface to temperatures that promote the evaporation of contaminants. Volatilized contaminants are captured by a subsurface vapor recovery system and conveyed to the surface for treatment if needed.	Slag-related impacted groundwater	Not feasible. Does not address iron.	Not reliable.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	In Situ	Permeable Reactive Barriers	A permeable wall containing reactive substances is installed across the groundwater flow path. Contaminants are chemically removed or degraded as groundwater flows through the wall.	Slag-related impacted groundwater	Not feasible or practical. The size of the Site means that there are multiple groundwater flow paths that would require a prohibitive length of PRB.	Not reliable.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
Disposal Technologies	Excavation & Disposal	On-Site or Off-Site Disposal/Landfilling	Contaminated material is removed and transported to Greys Landfill or a permitted off-site treatment and disposal facilities. Pre-treatment may be required.	Impacted soil	Not feasible or practical. The majority of the Site's overburden consists of slag fill. Excavation and removal of this material are not feasible due to the extensive size of the Site and the presence of existing buildings. Additionally, it would not be practical to excavate even smaller areas with slag-related iron impacts due to the eventual reinfiltration/migration of slag-related iron from remaining slag fill.	Not reliable at reducing groundwater concentrations as a stand-alone option.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	Excavation & Disposal	On-Site Disposal (CAMU)	A Corrective Action Management Unit is used to facilitate treatment, storage, and disposal of CAMU-eligible wastes to implement corrective action or cleanup.	Impacted soil	Not feasible or practical. The majority of the Site's overburden consists of slag fill. Excavation and removal of this material are not feasible due to the extensive size of the Site and the presence of existing buildings. Additionally, it would not be practical to excavate even smaller areas with slag-related iron impacts due to the eventual reinfiltration/migration of slag-related iron from remaining slag fill.	Not reliable at reducing groundwater concentrations as a stand-alone option.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.
	Disposal	Permitted Discharge	Discharge of treated groundwater via National Pollutant Discharge Elimination System (NPDES) or other permit.	Treated groundwater	Not feasible or practical. Treatment and discharge of treated groundwater would required a recovery system. As stated for pump & treat and hydraulic containment, these are both infeasible and impractical.	Not reliable for operation in perpetuity due to inability to practically remove or contain slag source to groundwater.	Rejected: Does not meet threshold criteria. Not feasible. Not reliable.

APPENDIX A

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

SUBJECT: Groundwater Use Determination — April 13, 2018
Sparrows Point Site (Tradepoint Atlantic)
Sparrows Point, MD
MDD053945432

FROM: Erich Weissbart, P.G.
Project Manager
Office of Remediation

TO: Luis Pizarro
Associate Director
Office of Remediation

Introduction

The purpose of this memo is to establish the basis for determining the maximum beneficial use of groundwater at the Sparrows Point Site located in Sparrows Point, MD. This determination is necessary to select appropriate groundwater cleanup objectives for the facility under the Resource Conservation and Recovery Act (RCRA) Corrective Action program.

EPA policy for groundwater cleanup at RCRA Corrective Action facilities is to return usable groundwater to its maximum beneficial use in a timeframe that is reasonable given the circumstances of the site. A determination of maximum beneficial use is based on how groundwater is actually used or could be used, and should also be based on the hydrogeologic and geochemical characteristics of the groundwater aquifer. EPA prefers to rely on State groundwater use determinations, but can use its own in the absence of a State determination. The policy applies to impacted aquifers beneath a Corrective Action facility, however there are sites where it applies offsite as a result of migrating contaminant plumes. The majority of RCRA Corrective Action facilities are required to restore contaminated groundwater to levels acceptable for drinking, since drinking water is generally the most beneficial use of groundwater, requiring the lowest cleanup levels. However, groundwater cleanup levels can also be based on other uses and exposures, or to protect surface water to which groundwater discharges.

Without a formal aquifer use determination at the Sparrows Point facility, EPA's presumption is that the groundwater is usable as drinking water and must be restored to drinking water standards. Likewise, Maryland Department of the Environment Interim Final Guidance, Cleanup Standards for Soil and Groundwater (June 2008) defines aquifers of the State as Type I and Type II, which would also require the groundwater beneath Sparrows Point be restored to drinking

water standards. The remainder of this memorandum is to present the basis for excluding drinking water use from consideration at Sparrows Point and thereby establish alternative uses upon which to base groundwater cleanup levels. This groundwater use determination applies to impacted groundwater from immediately below the land surface at Sparrows Point, called "shallow" in historical reports, and groundwater immediately beneath the shallow called "intermediate" in historical reports. This document will define the depths of these two aquifers, the basis for the determination, and the basis for limiting the determination to the shallow and intermediate aquifers. Once this determination is made and accepted by stakeholders, groundwater cleanup levels will be proposed in a Statement of Basis (SB) proposing a remedy for sitewide groundwater. Once the usage determination and groundwater cleanup objectives are proposed, both will go through public participation as part of the proposed remedy decision for groundwater.

If groundwater use as drinking water is excluded as a basis for setting cleanup levels, an important component of final remedies is to establish institutional controls that prevent the usage of groundwater for potable use. Restrictions can be placed on the land using enforceable controls (e.g., with environmental covenants) preventing the installation of any types of wells other than monitoring wells, preventing the use of groundwater for anything other than monitoring and cleanup, or requiring treatment before use or discharge. However, the groundwater must still ultimately be restored to the cleanup objectives established for other potential uses and exposures, or attempts made to achieve the groundwater cleanup levels.

Background

Sparrows Point is a unique RCRA site in that that it is much larger than most, greater than 3,000 acres in areal extent, and it is surrounded by water on three sides. Sparrows Point is a peninsula, bounded to the east by Old Road Bay and Jones Creek; to the south and west by the Patapsco River; and to the northwest by Bear Creek, all of which directly or indirectly drain into the Chesapeake Bay. Throughout most of the peninsula, the elevation of the ground surface is between 10 and 20 feet above mean sea level (amsl). Surface water runoff is diverted and collected by a network of culverts, underground pipes, and drainage ditches within former process areas. Storm water is then discharged to Bear Creek, Jones Creek/Old Road Bay, and the Patapsco River under existing National Pollutant Discharge Elimination System (NPDES) discharge permits.

In 1887 Maryland Steel built an iron furnace on the Facility, and the first iron was cast in 1889. The Bethlehem Steel Corporation (BSC) purchased the property in 1916 and enlarged it, building mills to produce hot rolled sheet, cold rolled sheet, galvanized sheet tin mill products, and steel plate. During peak production in 1959, BSC operated 12 coke oven batteries, 10 blast furnaces, and four open hearth furnaces. The land no longer resembles that which was initially encountered prior to construction of the steel mill in the late 1800's, nor does the Facility resemble that which terminated steel making in 2012.

Geology and Hydrogeology

The Sparrows Point Facility lies within the Atlantic Coastal Plain physiographic province. This province is characterized by a relatively thick wedge of alternating layers of sand, gravel, silt, and clay sediments. Near Baltimore, these unconsolidated sediments are primarily of Cretaceous age, but at Sparrows Point are overlain by up to 125 feet of later Pleistocene sediments. These complexly stratified deposits comprising the Atlantic Coastal Plain form an inter-layered sequence of aquifers and confining beds in a thickening wedge from the "fall line" to the southeast. The lithology, permeability, and structure of the sediments define the geologic setting and provide the framework for the groundwater-flow system. The geologic setting controls the occurrence, movement, and quality of groundwater. Predominantly sandy and gravelly layers, capable of yielding water, form aquifers, while fine-grained layers (silts and clays) impede the flow of groundwater and form confining units.

Stratigraphy at the site from deepest to shallow begins with crystalline basement rocks that are unconformably overlain by the Patuxent Formation, which is conformably overlain by the Arundel Formation. The Arundel Formation is disconformably overlain by the Patapsco Formation, which represents uppermost Cretaceous-age sediments. The Patuxent, Arundel, and Patapsco Formations are collectively called the Potomac Group. Pleistocene sediments of the Talbot Formation unconformably overlie the Cretaceous sediments. The thickness of the Atlantic Coastal Plain sediments vary across the site but notably, for the purpose of this memorandum, the shallow, intermediate, and deep aquifers investigated at Sparrows Point comprise sediments approximately 220 feet to 270 feet thick and are underlain by the Arundel Formation. The Arundel Formation, or Arundel Clay, is the middle unit of the Potomac Group. In the Baltimore area, it is a red to red-yellow, dense, plastic clay with thin lenses of silt. The Arundel Clay completely confines the Patuxent Formation and subsequent aquifers beneath.

Land reclamation and fill placement have occurred at the Facility since the early 1900s. In general, stream channels and estuaries that originally extended into the Sparrows Point peninsula were filled; the southern shoreline of the peninsula was expanded southward into the Patapsco River with fill; and fill was used to create level grades (Figure 1). The fill deposits are thickest (up to 40 feet) in the historic stream channels and estuaries, particularly Humphrey Creek, Greys Creek, Jones Creek, and Old Road Bay and in the two landfill areas, including Greys Landfill and Coke Point Landfill, where fill thickness may be as thick as 70 feet. More recent fill deposits are entirely manmade and were related to land reclamation associated with the expansion and development of the facility. The fill deposits consist primarily of iron- and steel-making slag. Because of its extensive presence across the Sparrows Point site, these manmade fill deposits are called the Slag-Fill Unit.

The Slag-Fill Unit is the uppermost hydrostratigraphic unit at the site. The shallow water table occurs within the Slag-Fill Unit, and groundwater within the Slag-Fill Unit is unconfined. In some areas the Slag-Fill Unit is directly underlain by and connected to the coarser grained beds or lenses within the Pleistocene Talbot Formation that comprise the Upper Talbot Channel Unit. In these areas, the Slag-Fill and Upper Talbot Channel Units form a single groundwater flow system. In much of the site, the Slag-Fill unit is underlain by finer-grained silts and clays that comprise the Talbot Clay Aquitard. In these areas, groundwater flow in the Slag-Fill Unit is separated from groundwater flow in any underlying coarse-grained beds or lenses. Wells

designated as shallow are screened within the slag/fill unit. The "shallow" bottom-of-screen elevations generally range from +5 to -20 feet amsl.

The thickness of the Talbot deposits (125 feet in the Sparrows Point area) may indicate an area of deeper paleo-channel erosion and subsequent backfill. The intermediate hydrogeologic zone includes the unconfined to partially confined groundwater in the Upper Talbot unit. The "intermediate" bottom-of-screen elevations generally range from -20 to -50 feet amsl. The presence of clay and silt layers within the intermediate hydrogeologic zone likely retard the vertical recharge of groundwater from the upper fill material.

The lower hydrogeologic zone includes the confined groundwater in the Lower Talbot or Upper Patapsco Sand unit. At Sparrows Point the Patapsco Formation has been interpreted to have a thickness of up to 255 feet. The "lower" bottom-of-screen elevations generally range from -50 to -141 feet amsl. Hydrogeologic zones at greater depth are known to exist based on a review of the regional geology; however, these deeper units are isolated from the upper three units by the Arundel Clay and impacts have not been identified from former operations.

Aquifers in the Patuxent and Patapsco Formations are the primary groundwater sources in the Baltimore area. Local water supplies can be produced from the Talbot Formation, however where the Talbot Formations outcrop close by to estuaries, nearby water supply wells are susceptible to chloride contamination. No municipal water supply wells are located on the Sparrows Point peninsula. Elevated chloride concentrations in the Talbot Formation are wide-spread along the Patapsco River and its estuaries, and salt-water encroachment is a significant factor limiting the development of water supplies in the Talbot Formation. Groundwater recharge to the Talbot Formation occurs primarily through the percolation of local precipitation to the water table. It is estimated that approximately 10 inches of rainwater per year recharges the surficial shallow water table aquifer. Discharge is primarily by natural means to springs and surface waters of local rivers, streams, and estuaries.

The Patapsco Formation is also a source of groundwater for the Baltimore area. A sand facies in the lower part of the Patapsco Formation is considered the principal source of water for the Patapsco aquifer. The Patapsco aquifer is confined at Sparrows Point by the overlying Pleistocene Talbot sediments that serve as the upper confining bed, and the Arundel Formation defines the lower confining bed.

The Patapsco aquifer was used as a source of groundwater prior to 1900 and during the early part of the 20th century. Because the Patapsco aquifer widely subcrops beneath the brackish Patapsco River, elevated chloride concentrations became a major problem in areas near the Patapsco River estuary. By 1945, almost all water production from the Patapsco had ended due to excessive chloride near the Harbor, Canton, and Dundalk areas. The BSC plant was the only major user of the Patapsco aquifer in 1945. Water production totaled about 3 million gallons per day (Mgal/d); however, by the later 1940's and 1950's, many of the Sparrows Point wells were affected by elevated levels of chlorides and were abandoned. As of 1985, there were no major use of the Patapsco aquifer in the immediate vicinity of the Patapsco River estuary.

Usage

Current

There is no current ongoing usage of groundwater beneath the Facility, but there is groundwater extraction at an adjacent property as described below. Groundwater is monitored for various purposes on a regular frequency to assess remediation efforts at the former Rod and Wire Mill and Coke Oven Area.; regular groundwater monitoring also occurs at Greys Landfill. Across the entire Sparrows Point facility there are dozens to hundreds of monitoring wells constructed into the shallow aquifer and a lesser number into the intermediate aquifer. There are few monitoring wells constructed into the deeper aquifer. There are no monitoring wells into the Arundel Formation and none into the Patuxent below the Arundel. There are six deep production wells constructed into the Patuxent, but none are currently in use.

An adjacent property called Sparrows Point Shipyard (Shipyard) contains a "graving dock," used for the repair or scrapping of ships under dry conditions. Ships enter the graving dock when it is filled with water, via the Patapsco River, and then a gate is closed and water is removed. A central feature of the graving dock is the underdrain pumping system. The underdrain pumping system collects groundwater and pumps the water to the Patapsco River. The Shipyard's pumping system causes groundwater from the Coke Oven Area of Sparrow's Point to flow towards the graving dock. The discharge of the water from the underdrain pumps to the Patapsco River is regulated by the Clean Water Act; specifically by a NPDES discharge permit issued by MDE.

Because of sampling performed by MDE in 2005 where high concentrations of benzene were detected in the discharge, a 2006 permit renewal included a discharge limit of 0.51 mg/1 on benzene in certain graving dock discharges that applied to dewatering/trim pumps, and not to the underdrain pumping system. In January 2009, MDE revised the permit to impose the same 0.51 mg/1 limit to the underdrain pump discharge, and the revision went into effect in February 2010. To comply with the benzene limitation, the Shipyard installed a benzene treatment system that removes benzene from the groundwater.

The Shipyard operates the water treatment system to remain within the 0.51 mg/1 benzene limit imposed by MDE, however the need for the treatment is caused by the operation of the graving dock. The Shipyard pump systems remove an average rate of 750 gallons per minute (i.e. roughly 1.08 Mgal/day). The influence from the dewatering system at the graving dock on water levels in the intermediate zone of groundwater in the Coke Oven Area is depicted on the potentiometric figures created from monitoring well water levels measured over time and submitted by the Facility in investigations and progress reports. Influence on the shallow zone of groundwater is not apparent. This condition is attributed to: location of the pumps at depths that correspond with the stratigraphy of the intermediate unit and decreased recharge from the Patapsco River, and the partially-confined condition of the intermediate zone in this area. The spread of a cone of depression from a pumping center under partially-confined conditions occurs more quickly than that under unconfined conditions. The influence of the graving dock pumping is observable over 2,000 feet away, where flow in the Coke Oven Area is shifted to the northwest in the intermediate zone, while flow in the shallow zone is to the southwest.

Potential Future Usage

Groundwater beneath the Sparrows Point Facility has value as a resource whether it is potable use or another use. How groundwater could be used depends upon multiple factors: vulnerability to contamination; hydrogeologic regimes (recharge and discharge areas); flow patterns; quantity and potential yield; ambient and/or background quality; and existing contamination are some[1]. If each factor were addressed satisfactorily (e.g. sufficient quantity and yield and absence of contamination) then the groundwater could potentially be a potable source. However, if some factors were met successfully and others were not the groundwater could still have potential uses. The following list of groundwater uses was collected from the United States Geologic Survey and MDE:

1. **Public and domestic supply** - water used for indoor and outdoor household purposes—all the things you do at home: drinking, preparing food, bathing, washing clothes and dishes, brushing your teeth, watering the yard and garden.
2. **Aquaculture** water use is water associated with raising creatures that live in water—such as finfish and shellfish—for food, restoration, conservation, or sport.
3. **Industrial** water use includes water used for purposes such as fabricating, processing, washing, diluting, cooling, or transporting a product; incorporating water into a product; or for sanitation needs within the manufacturing facility. Some industries that use large amounts of water produce such commodities as food, paper, chemicals, refined petroleum, or primary metals.
4. **Irrigation** water is essential for keeping fruits, vegetables, and grains growing. Throughout the world, irrigation (water for agriculture, or growing crops) is probably the most important use of water. Estimates vary, but about 70 percent of all the world's freshwater withdrawals go towards irrigation uses (http://www.globalagriculture.org/report-topics/water.html). Large-scale farming could not provide food for the world's large populations without the irrigation of crop fields by water gotten from rivers, lakes, reservoirs, and wells.
5. **Livestock** water use is water associated with livestock watering, feedlots, dairy operations, and other on-farm needs. Livestock includes dairy cows and heifers, beef cattle and calves, sheep and lambs, goats, hogs and pigs, horses, and poultry. Other livestock water uses include cooling of facilities for the animals and animal products such as milk, dairy sanitation and wash down of facilities, animal waste-disposal systems, and incidental water losses.
6. **Mining** water use is water used for the extraction of minerals that may be in the form of solids, such as coal, iron, sand, and gravel; liquids, such as crude petroleum; and gases, such as natural gas. The category includes quarrying, milling (crushing, screening, washing, and flotation of mined materials), and other operations associated with mining activities.

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[1] Factors to Assess Use, Value, and Vulnerability from: Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action; EPA 530-R-04-030; April 2004. Current use and exposures (including public water supply systems and private drinking water supply wells); Reasonably expected future uses (based on demographics, remoteness, and availability of alternative water supplies; Connections to surface waters; Impacts to ecological receptors; Value attributed to a groundwater resource, including public opinion; Governmental and legal boundary considerations (e.g., groundwater migrating across State boundaries).

Value

Because of the native unconsolidated sediments where groundwater is resident on the peninsula there is groundwater available for the typical uses described above. It is reported that BSC previously extracted 3 Mgal/d from the Patapsco Aquifer and the Shipyard currently extracts approximately 1 Mgal/d from the intermediate aquifer located in the Talbot Formation. Equally apparent from the former and current usage is that unconsolidated sediments possess the hydrogeologic characteristics necessary to extract groundwater at a sustainable rate. Aquifer characteristics are less important, as are most of the factors, than an assessment of the background quality of the groundwater. Groundwater background quality is the most important factor because the shallow aquifer resides in iron/manganese bearing slag fill and because the Sparrow's Point peninsula is surrounded by brackish water.

Background is the condition of groundwater including water quality indicators prior to the introduction of anthropogenic contamination. Water quality standards, i.e. pH, turbidity, temperature, etc. are typically collected from monitoring wells prior to groundwater sample collection. The purpose of collecting water quality indicators is to establish that a monitoring well groundwater sample reflects the conditions of an aquifer and not the well bore. The water quality indicators are recorded as evidence of proper sample collection.

In this effort to assess groundwater usage at the Sparrow's Point site, EPA requested an evaluation of site-wide groundwater, including an analysis of pH and total dissolved solids (TDS), from the current property owners. The Site-Wide Groundwater Study Report, (EnviroAnalytics Group (EAG) August 17, 2017), was submitted in response and included the requested groundwater data for both the shallow and intermediate aquifers as detailed below.

The EAG Report included an evaluation of boring logs and well construction logs constructed in the shallow aquifer that identified groundwater monitoring locations completed in the slag fill. The purpose was to determine and map the thickness of slag fill within the saturated zone. The conclusion presented was that most of the locations where groundwater is present in slag fill are located beyond the historical 1916 shoreline (Figures 1 and 2).

A Site-Wide Investigation (SWI) report completed in 2001 by CH2M-Hill provided hydrogeological and general water quality data across the entire Sparrow's Point Facility and addressed a number of objectives. Data collected to meet the objectives were used to develop a site-specific groundwater flow model with particle tracking simulating contaminant flow (MODFLOW). Water quality data collected to address the objectives were TDS and chloride concentrations from shallow and deep zones for comparing groundwater quality and determining surficial and groundwater connectivity.

The chloride and TDS data from the SWI report were combined with specific conductance (SC) data collected during the routine sampling of monitoring wells as part of current ongoing parcel investigations. The SC data that was collected during parcel investigations was converted to equivalent TDS values (1000 uS/cm = 534 mg/L TDS). These data points were used to develop TDS isoconcentration maps for the shallow and intermediate groundwater (Figures 3 and 4).

Groundwater associated with slag fill can exhibit extremely basic pH concentrations rendering it unusable. pH values collected from recent sampling events from each well or piezometer were contoured to create maps (shallow and intermediate) showing pH contours and delineating areas of the site where the pH exceeds 10 (Figures 5 and 6). These areas/zones are not usable as potable aquifers, both due to the high pH and the occurrence of the groundwater in non-natural slag fill which additionally contributes iron and manganese.

Iron and manganese (Fe/Mn) are common in shallow and intermediate groundwater at Sparrows Point. Manganese was detected in 95% of groundwater samples and iron was detected in 94% of groundwater samples. High levels of iron and manganese do not pose any known adverse health risks and EPA has not set MCLs for iron and manganese; however there are Project Action Levels (PALs) established as screening levels for the Facility. Secondary maximum contaminant levels (SMCL) recommended in the National Secondary Drinking Water Regulations are set for aesthetic reasons and are not enforceable by EPA, but are intended as guides to the States. The SMCL for iron is 0.3 mg/L (site-specific PAL is 14 mg/L) and the SMCL for manganese is 0.05 mg/L (site-specific PAL is 0.43 mg/L). High levels of these contaminants can result in discolored water, stained plumbing fixtures, and an unpleasant metallic taste to the water. For groundwater samples collected at Sparrows Point, 47% exceeded site-specific PALs for manganese and 30% exceeded PALs for iron.

Saltwater intrusion was an issue at the Facility previously because of historical pumping for industrial water use. Data and analysis have been provided showing total dissolved solids and pH in groundwater across the site in the shallow and intermediate levels. Based on this data, (TDS and pH) shallow and intermediate groundwater is not suitable for potable use, primarily because of the largely man-made slag fill contributing elevated pH, Mn, and Fe, but also because of the connection to surface water and elevated chloride. The groundwater in these areas is not suitable for potable use. The table below summarizes the potential uses of groundwater in the shallow and intermediate zones, the potential cleanup standard that would have to be attained, and EPA's determination of usage.

Designation	Standard	Shallow Use	Intermediate Use
Domestic Potable Supply and Residential Irrigation	MCLs	No. Shallow groundwater contains excess TDS and elevated pH	No. Intermediate groundwater contains elevated TDS.
Farming (Livestock Watering and Agricultural Irrigation)	Ecological RBC or other risk based std.	No. Shallow groundwater contains excess TDS and both low and high pH	No. Intermediate groundwater contains elevated TDS.
Industrial, Commercial, Dewatering (Mining, aquaculture)	State Surface Water Quality Discharge Standards	Yes.	Yes. Current dewatering at Sparrows Point Shipyard.
Public Water Supply Well	MCLs	No. Shallow groundwater contains excess TDS and both low and high pH	No. Intermediate groundwater contains elevated TDS.
Test, Observation, Monitoring	None	Yes	Yes
Open Loop Geothermal[2]	State Surface Water Quality Discharge Standards	yes	yes

Conclusion

Based on the above analysis, EPA has determined that drinking water use of groundwater in the shallow and intermediate aquifers at Sparrows Point can be excluded from consideration when developing groundwater cleanup levels. Maximum beneficial use should include the uses outlined in the above table, and groundwater cleanup levels should be developed based on State surface water quality discharge standards. More stringent groundwater cleanup levels may be appropriate in specific areas of the Sparrows Point Site, based on other potential exposures or pathways not associated with groundwater use (e.g., vapor intrusion or direct contact during construction excavation).

[2] The evaluation of geothermal systems is beyond the scope of this memorandum. In the case where the Facility or a Parcel owner/lessee proposes to use groundwater for geothermal heating or cooling EPA will then assess the viability of the proposal.



N

ARM Group Inc.
Earth Resource Engineers and Consultants

0 375 750 1,500
Feet

- Site Boundary
- Area A Boundaries
- Area B Boundaries
- Land
- Marsh
- Water

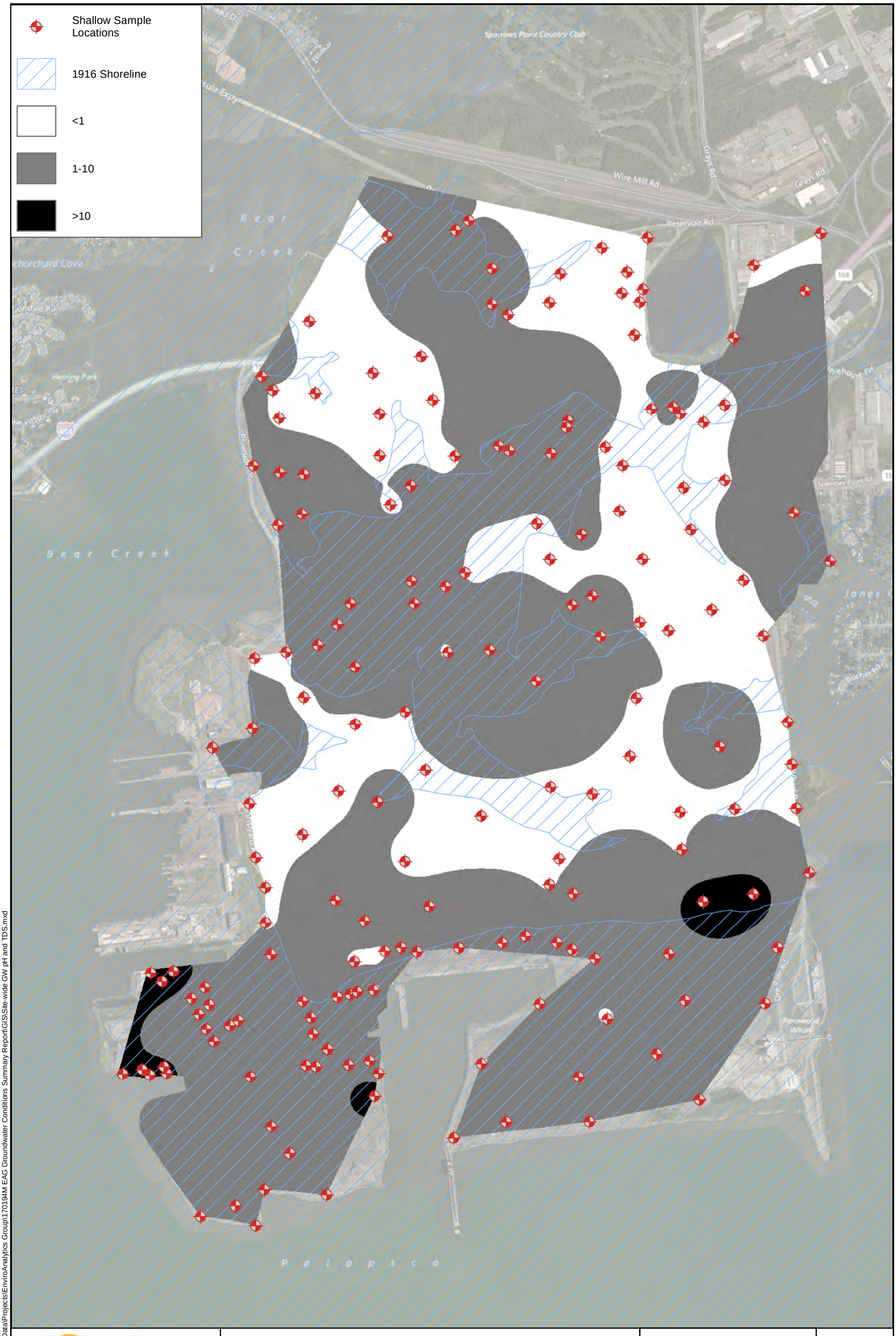
Approximate Shoreline 1916

July 19, 2017

Adapted from Figure 2-5 of the Description of Current Conditions Report prepared by Rust Environmental and Infrastructure, dated January 1998

EnviroAnalytics Group	Tradepoint Atlantic
Area A: Project 150298M Area B: Project 150300M	Baltimore County, MD

Figure 1



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0 500 1,000 2,000 Feet

Site-Wide Groundwater Saturated Slag Thickness (ft)

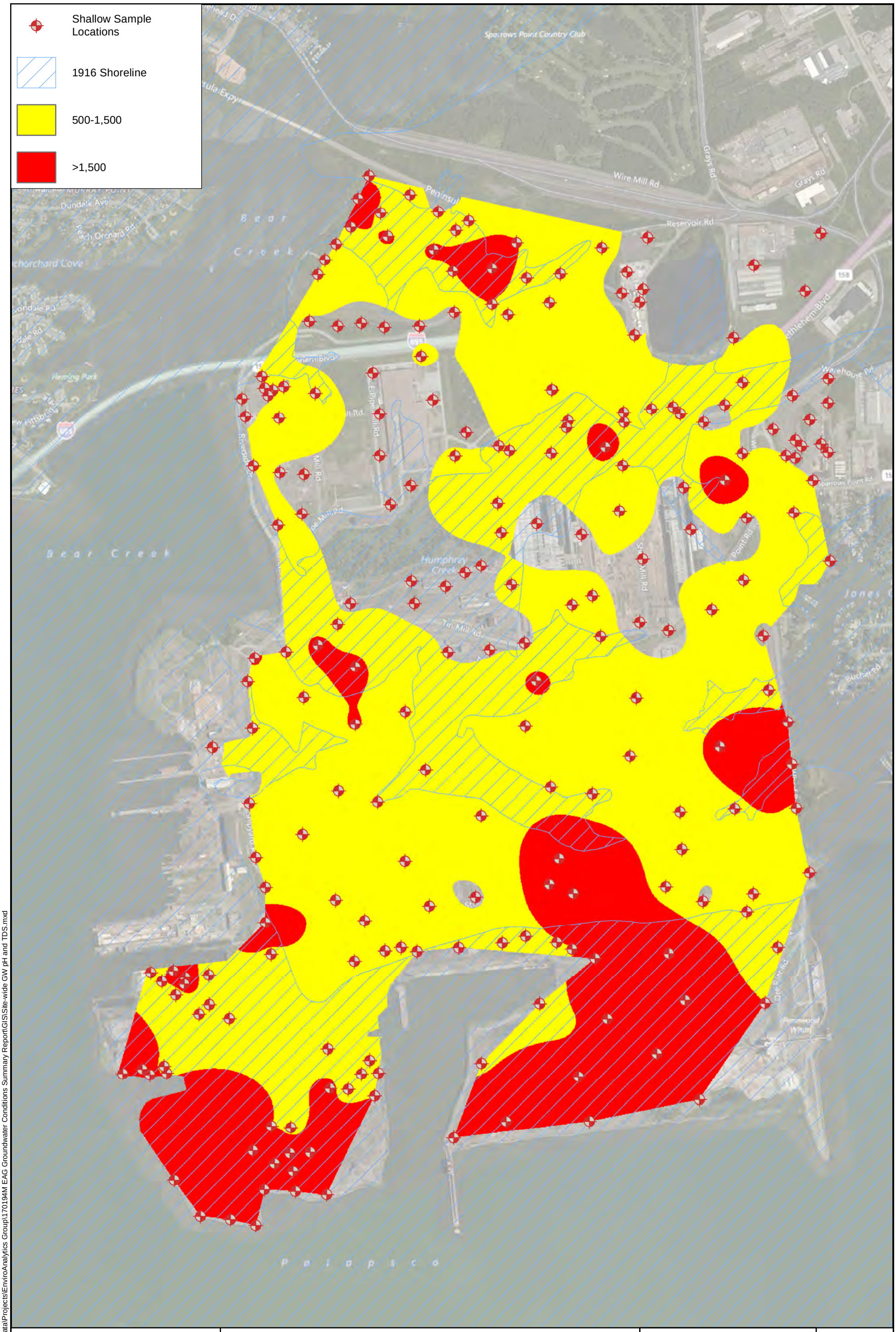
March 16, 2018

EnviroAnalytics Group

Tradepoint Atlantic
Baltimore County, MD

Figure
2

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd



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ARM Group Inc.
Earth Resource Engineers and Consultants

0 500 1,000 2,000
Feet

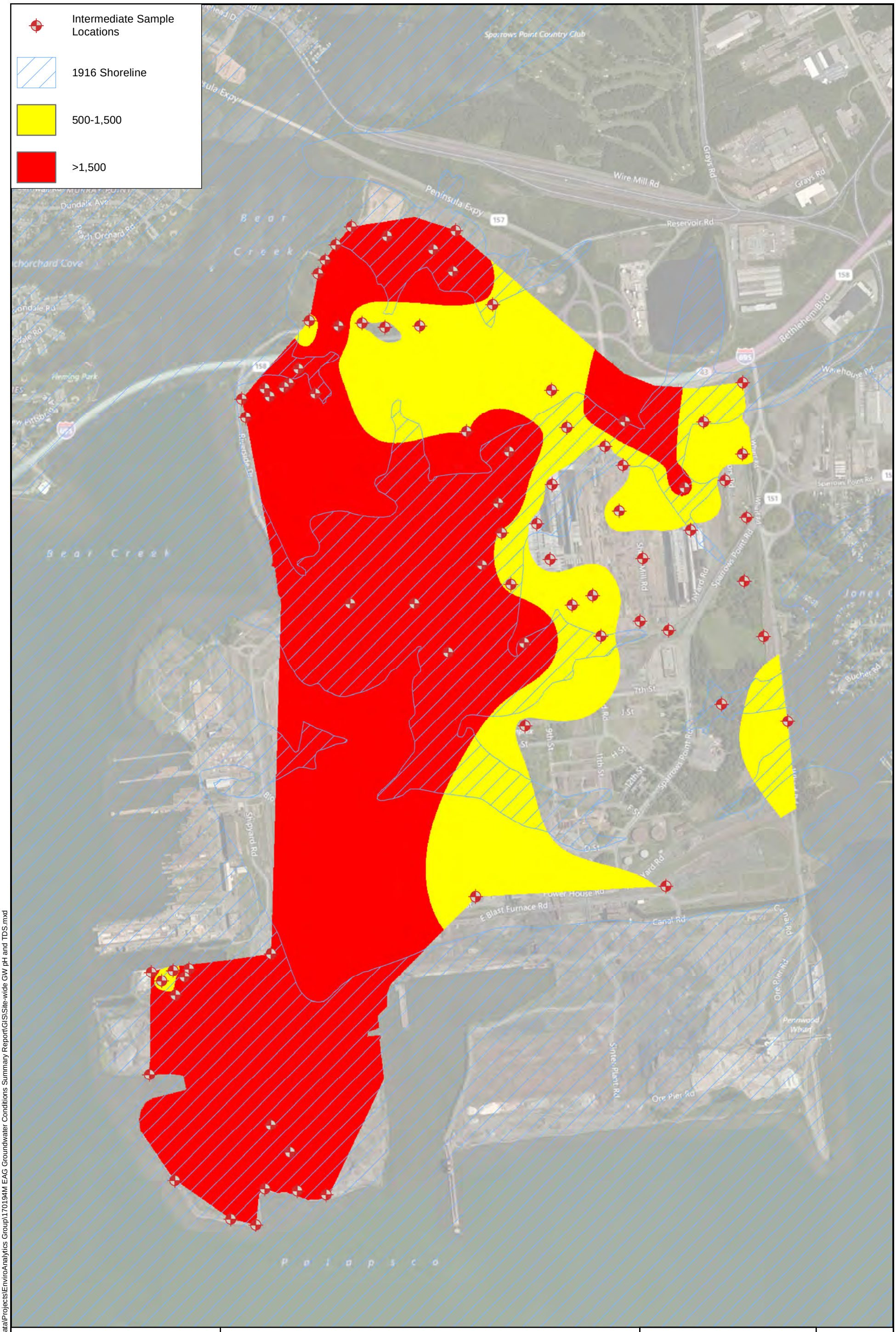
Site-Wide Groundwater Shallow TDS Concentrations (mg/L)

March 16, 2018

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Tradepoint Atlantic
Baltimore County, MD

Figure
3



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0 500 1,000 2,000 Feet

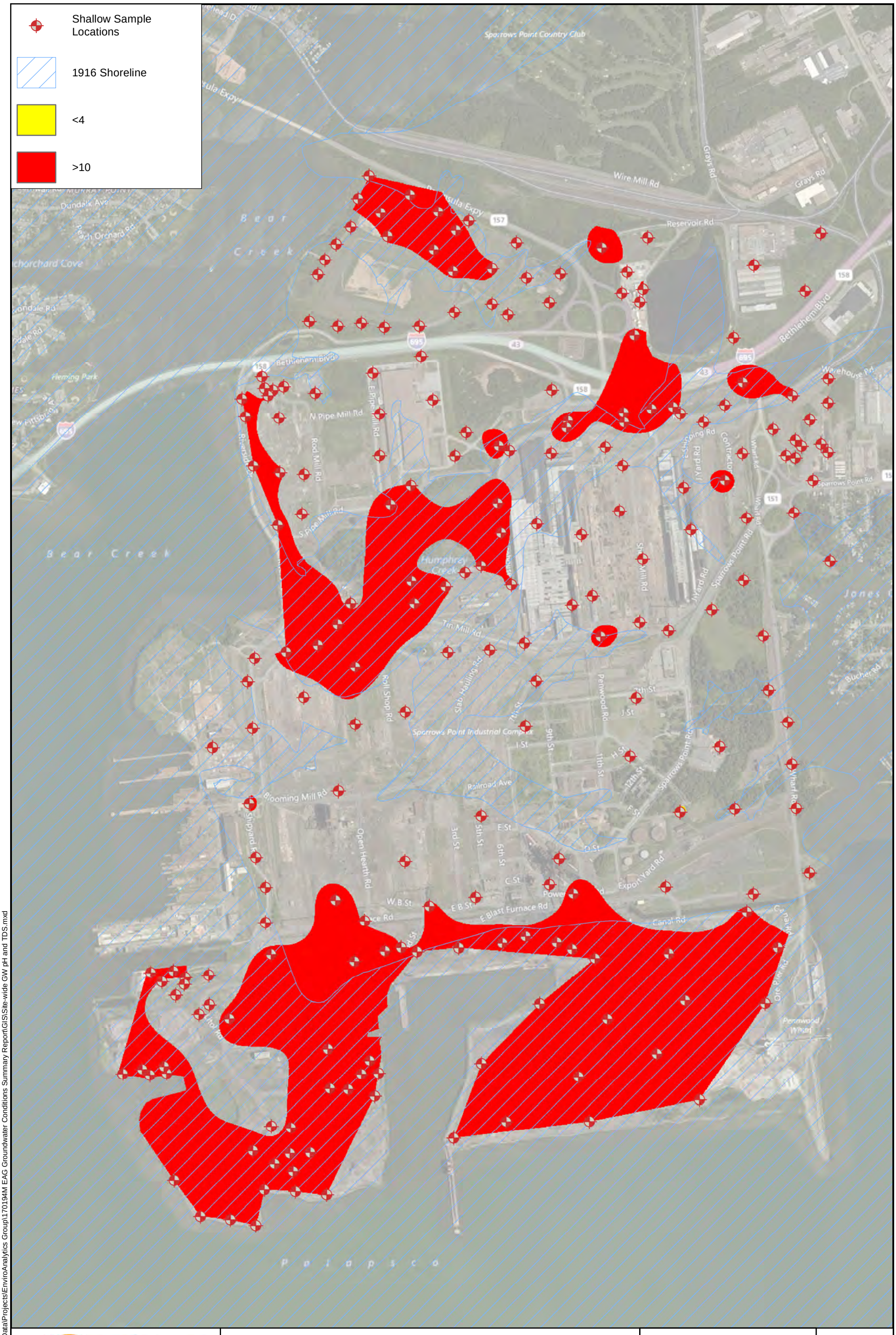
Site-Wide Groundwater Intermediate TDS Concentrations (mg/L)

March 16, 2018

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Tradepoint Atlantic
Baltimore County, MD

Figure
4



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0 500 1,000 2,000 Feet

Site-Wide Groundwater Shallow pH Concentrations

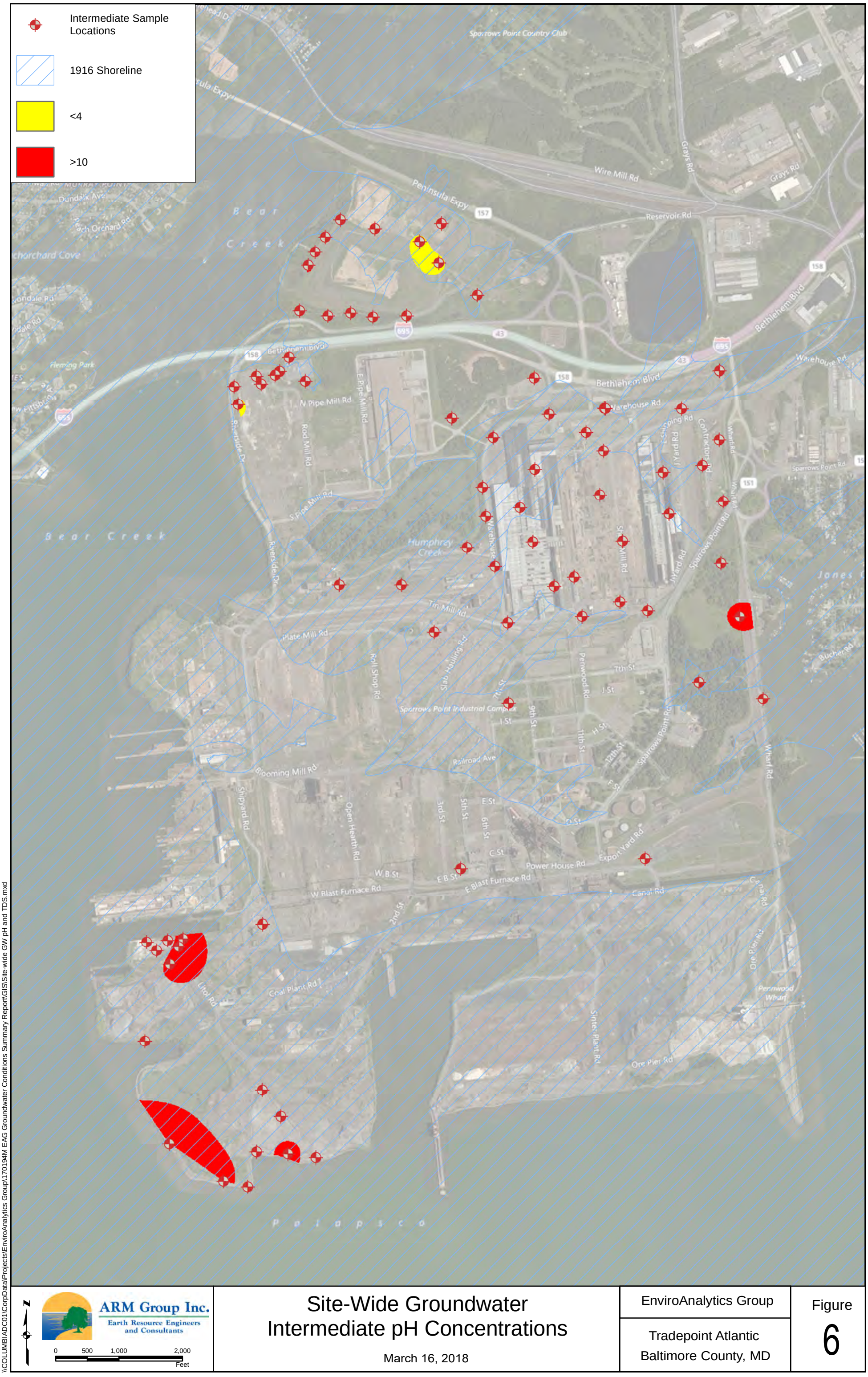
March 16, 2018

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Tradepoint Atlantic
Baltimore County, MD

Figure
5

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Site-Wide Groundwater Intermediate pH Concentrations

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Baltimore County, MD

Figure
6

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Site-wide GW pH and TDS.mxd

APPENDIX B

APPENDIX B-1

Appendix B-1 - Monitoring Well Construction and Sampling Details
CPA Groundwater CMS
Sparrows Point, MD

Well ID	Well Type	Northing	Easting	Date of Installation	Top of Casing (ft AMSL)	Ground Surface Elevation (ft AMSL)	Screen Interval or Screen Length (ft bgs)	Well Depth (ft bgs)	GW Zone	Well Status	Abandonment Date	Shoreline Well	Date for Most Recent Sampling Event					Associated Report for Most Recent Sampling Event
													BTEX+N	VOCs	SVOCs	Metals	MNA	
B18-044-PZ	Monitoring	563460.13	1455863.71	10/20/2016	11.88	8.82	2.5-12.5	12.5	Shallow	Abandoned		No		2018	2018			(c)
B18-046-PZ	Monitoring	563301.2512	1456053.716	10/26/2016	17	13.81	7-17	17	Shallow	Abandoned		No		2018	2018			(c)
B18-077-PZ	Monitoring	563516.695	1456183.33	6/28/2017	16.16	13.03	3-13	13	Shallow	Abandoned		No		2018	2018			(c)
B18-078-PZ	Monitoring	563371.19	1456050.52	7/12/2018	15.49	12.9	3-20	20	Shallow	Abandoned		No		2018	2018			(c)
B18-079-PZ	Monitoring	563603.26	1456035.85	7/13/2018	14.08	10.63	3-20	20	Shallow	Abandoned		No		2018	2018			(c)
B18-070R-MWS	Monitoring	NS	NS	11/13/2024	NS	NS	5-20	20	Shallow	Existing	N/A	No				2024		(n)
B18-080-PZ	Monitoring	563633.106	1455835.703	7/16/2018	12.76	9.23	3-20	20	Shallow	Abandoned		No		2018	2018			(c)
B18-081-PZ	Monitoring	563336.29	1455886.62	7/12/2018	12.42	9.99	3-20	20	Shallow	Abandoned		No		2018	2018			(c)
B18-082-PZ	Monitoring	563332.304	1456223.743	7/11/2018	15.37	12.96	3-20	20	Shallow	Abandoned		No		2018	2018			(c)
B18-083-PZ	Monitoring	563609.39	1456194.21	7/12/2018	14.23	12.44	3-20	20	Shallow	Abandoned		No		2018	2018			(c)
BA-81-7945	Monitoring	563559.2516	1455907.983	N/A	11.53	10.95	N/A	18.5	Shallow	Existing	N/A	No		2018	2018			(c)
BA-81-7946	Monitoring	563448.4379	1455971.203	N/A	12.19	10.56	N/A	8.5	Shallow	Existing	N/A	No		2018	2018			(c)
SW-086-MWS	Monitoring	563417.036	1455762.932	10/23/2018	6.96	4.39	4.6-17.6	17.6	Shallow	Existing	N/A	Yes		2018	2018			(c)
SW-085-MWS	Monitoring	563464.168	1455756.767	10/24/2018	7.04	4.57	3-16	16	Shallow	Existing	N/A	Yes		2018	2018	2025		(c), (o)
B18-007-PZ	Monitoring	563152.5601	1456556.528	11/29/2016	16.82	14.12	6-16	17	Shallow	Abandoned	4/2/2020	No		2016	2016	2016		(e)
B18-061-PZ	Monitoring	563243.8731	1456297.975	2/12/2019	16.17	13.29	2-12	13	Shallow	Damaged / Lost		No		2016	2016	2016		(e)
B18-070-PZ	Monitoring	563864.9161	1458116.903	12/2/2016	14.63	11.74	3-18	20	Shallow	Abandoned	3/31/2020	No		2016	2016	2016		(e)
B18-071-PZ	Monitoring	563752.9641	1458120.807	12/5/2016	14.75	11.93	6-16	17	Shallow	Abandoned	3/31/2020	No		2016	2016	2016		(e)
B18-072-PZ	Monitoring	563629.2464	1458125.913	11/28/2016	14.28	11.53	3-15	17	Shallow	Abandoned	3/31/2020	No		2016	2016	2016		(e)
B18-074-PZ	Monitoring	563204.9798	1458049.272	11/30/2016	15.74	12.87	6-16	16	Shallow	Abandoned	4/2/2020	Yes		2016	2016	2016		(e)
CO02-PZM006	Monitoring	562580.156	1455306.910	12/12/2001	15.44	12.19	8-18	18	Shallow	Existing	N/A	No		2020	2015			(a), (g)
CO02-PZM041	Monitoring	562569.216	1455309.193	10/16/2001	15.09	11.97	48-53	53	Intermediate	Existing	N/A	No		2024	2024	2025	2024	(n), (o)
CO03-PZM005	Monitoring	562990.808	1455397.266	12/12/2001	13.46	10.93	7-17	17	Shallow	Damaged / Lost		No		2020	2015			(a), (f)
CO04-PZM048	Monitoring	562780.738	1456891.485	10/11/2001	11.92	12.18	55-60	60	Intermediate	Existing	N/A	No		2020	2015	2025		(a), (f), (o)
CO05A-PZM	Monitoring	562761.053	1457196.25	4/13/2021	15.13	12.26	6.6-16.6	17	Shallow	Existing	N/A	No		2024	2024	2025	2024	(n), (o)
CO05B-PZM	Monitoring	563066.974	1457427.255	4/14/2021	14.40	11.65	8.6-13.6	14	Shallow	Existing	N/A	No		2021	2021			(h)
CO05C-PZM	Monitoring	562730.548	1457783.413	4/15/2021	14.63	12.21	9-19	19	Shallow	Damaged / Lost		No		2021	2021			(h)
CO05-PZM006	Monitoring	562838.816	1457420.746	11/29/2001	11.01	N/A	7-17	17	Shallow	Damaged / Lost		No		2015	2015			(a)
CO07-PZM008	Monitoring	562166.005	1455535.775	12/17/2001	13.74	N/A	7-17	17	Shallow	Damaged / Lost		No		2020	2015			(a), (f)
CO07-PZM050	Monitoring	562168.926	1455543.93	12/18/2001	13.48	N/A	55-60	60	Intermediate	Existing	N/A	No		2020				(f)
CO08A-PZM	Monitoring	562396.798	1456302.029	4/9/2021	15.27	12.22	7-17	17	Shallow	Existing	N/A	No	2024	2021	2021			(h), (n)
CO08B-PZM	Monitoring	562041.151	1456400.030	4/12/2021	14.84	12.10	7-17	17	Shallow	Existing	N/A	No		2021	2021			(h)
CO08C-PZM	Monitoring	562401.648	1456301.831	4/9/2021	15.36	12.27	52-57	57	Intermediate	Existing	N/A	No		2021	2021			(h)
CO08D-PZM	Monitoring	562038.952	1456390.177	4/9/2021	14.58	12.18	37.5-47.5	48	Intermediate	Existing	N/A	No		2021	2021			(h)
CO08-PZM005	Monitoring	562225.06	1456380.16	10/11/2000	11.68	N/A	7-17	17	Shallow	Damaged / Lost		No		2015	2015			(a)
CO08-PZM036	Monitoring	562223.329	1456375.341	11/8/2000	11.53	N/A	43.5-48.5	48.5	Intermediate	Damaged / Lost		No		2015	2015			(a)
CO09-PZM007	Monitoring	562277.726	1457052.234	11/29/2001	11.15	N/A	8-18	18	Shallow	Damaged / Lost		No		2015	2015			(a)
CO100-PZM	Monitoring	562610.55	1455726.5	9/7/2010	12.27	9.98	5-15	15	Shallow	Existing	N/A	No	2024	2019				(d), (n)
CO101-PZM	Monitoring	561680.07	1454815.22	2/1/2011	12.39	10.38	N/A	11.62	Shallow	Existing	N/A	Yes		2020				(g)
CO102-PZM	Monitoring	561785.09	1454771.31	2/1/2011	12.88	10.84	N/A	19.32	Shallow	Existing	N/A	No		2020				(g)
CO103-PZM	Monitoring	561741.99	1454440.73	2/1/2011	13.48	11.57	N/A	20.38	Shallow	Existing	N/A	No		2020				(g)
CO104-PZM	Monitoring	561670.74	1454145.53	2/1/2011	13.29	11.31	N/A	19.29	Shallow	Existing	N/A	Yes		2020				(g)
CO10-PZM006	Monitoring	562369.267	1457804.988	8/8/2000	11.42	N/A	5-18	18	Shallow	Damaged / Lost		Yes		2015	2015			(a)

Appendix B-1 - Monitoring Well Construction and Sampling Details
CPA Groundwater CMS
Sparrows Point, MD

Well ID	Well Type	Northing	Easting	Date of Installation	Top of Casing (ft AMSL)	Ground Surface Elevation (ft AMSL)	Screen Interval or Screen Length (ft bgs)	Well Depth (ft bgs)	GW Zone	Well Status	Abandonment Date	Shoreline Well	Date for Most Recent Sampling Event					Associated Report for Most Recent Sampling Event
													BTEX+N	VOCs	SVOCs	Metals	MNA	
CO121-PZM	Monitoring	563301.93	1455356.12	N/A	11.87	8.93	N/A	14	Shallow	Existing	N/A	Yes	2024	2019	2015			(a), (d), (n)
CO152-PZM	Monitoring	562756.1395	1455929.875	8/3/2016	N/A	N/A	8-18	18	Shallow	Existing	N/A	No		2024	2024		2024	(n)
CO159-PZM	Monitoring	562686.4431	1456057.154	8/4/2016	N/A	N/A	6.5-16.5	16.5	Shallow	Existing	N/A	No	2024	2020		2025		(f), (n), (o)
CO15-PZM005	Monitoring	562817.329	1455197.568	12/12/2001	12.33	N/A	7-17	17	Shallow	Damaged / Lost		No		2015	2015			(a)
CO167-PZM	Monitoring	562805.4268	1456118.942	6/1/2016	N/A	N/A	5-15	15	Shallow	Existing	N/A	No	2024	2020				(f), (n), (o)
CO16-PZM006	Monitoring	562353.289	1455417.415	12/13/2001	12.56	12.04	7.5-17.5	17.5	Shallow	Existing	N/A	No		2019	2015	2025		(a), (d), (o)
CO177-MWI	Monitoring	563234.6287	1454749.248	4/12/2019	6.83	4.6	30-50	50	Intermediate	Existing	N/A	Yes		2019				(d)
CO177-MWS	Monitoring	563234.9584	1454751.722	4/12/2019	6.62	4.61	5-15	15	Shallow	Existing	N/A	Yes		2019				(d)
CO178-MWI	Monitoring	563246.3327	1454911.001	4/11/2019	7.56	4.62	30-50	50	Intermediate	Existing	N/A	Yes		2019	2025	2025		(d), (o)
CO178-MWS	Monitoring	563247.8482	1454916.386	4/11/2019	7.38	4.65	5-15	15	Shallow	Existing	N/A	Yes		2019	2025	2025		(d), (o)
CO179-MWI	Monitoring	563262.063	1455059.266	4/11/2019	12.39	8.86	30-50	50	Intermediate	Existing	N/A	Yes		2019				(d)
CO179-MWS	Monitoring	563262.580	1455064.627	4/11/2019	7.66	7.81	5-15	15	Shallow	Existing	N/A	Yes	2023					(k)
CO180-MWI	Monitoring	563192.093	1454354.584	4/12/2019	11.56	9.75	30-50	50	Intermediate	Existing	N/A	Yes	2023		2025	2025		(k), (o)
CO180-MWS	Monitoring	563190.132	1454350.584	4/12/2019	11.67	9.67	5-15	15	Shallow	Existing	N/A	Yes	2023		2025	2025		(k), (o)
CO181-MWI	Monitoring	563028.3786	1454319.031	4/13/2019	12.68	10.38	30-50	50	Intermediate	Existing	N/A	Yes	2023					(k)
CO181-MWS	Monitoring	563024.2517	1454318.335	4/13/2019	12.7	10.31	5-15	15	Shallow	Existing	N/A	Yes	2023					(k)
CO182-MWI	Monitoring	563127.6624	1454935.03	4/24/2019	7.53	5.11	30-50	50	Intermediate	Existing	N/A	No	2024					(m)
CO183-MWI	Monitoring	563001.768	1454908.364	4/24/2019	15.97	12.06	30-50	50	Intermediate	Existing	N/A	No		2019				(d)
CO184-MWI	Monitoring	562836.8538	1454628.124	4/23/2019	11.65	9.59	22-37	37	Intermediate	Existing	N/A	No		2024	2024			(n)
CO185-MWI	Monitoring	562668.695	1454537.443	1/13/2020	13.94	11.25	35-50	50	Intermediate	Existing	N/A	No		2024	2024			(n)
CO185-MWS	Monitoring	562664.644	1454530.197	4/17/2019	14.14	11.27	5-20	20	Shallow	Existing	N/A	No		2019				(d)
CO186-MWS	Monitoring	562911.8036	1455128.854	4/23/2019	11.74	9.39	5-20	20	Shallow	Existing	N/A	No	2024					(m)
CO187-MWS	Monitoring	562820.5954	1455382.444	4/23/2019	14.48	11.64	5-20	20	Shallow	Existing	N/A	No	2024	2019				(d), (n)
CO188-MWI	Monitoring	562760.947	1455004.600	4/16/2019	11.88	10.02	30-50	50	Intermediate	Existing	N/A	No		2024	2024		2024	(n)
CO189-MWS	Monitoring	562667.5496	1455015.345	4/16/2019	13.97	11.75	5-20	20	Shallow	Existing	N/A	No	2024	2019		2025		(d), (n), (o)
CO18-PZM006	Monitoring	562722.38	1455463.838	12/13/2001	13.57	N/A	7.5-17.5	17.5	Shallow	Existing	N/A	No		2024	2024	2025	2024	(n), (o)
CO190-MWS	Monitoring	562623.2296	1455434.171	4/16/2019	15.45	12.18	10-20	20	Shallow	Existing	N/A	No	2024					(m)
CO191-MWS	Monitoring	562392.8294	1455088.298	4/16/2019	13.48	11.49	5-20	20	Shallow	Existing	N/A	No	2024					(m)
CO192-MWS	Monitoring	562421.6605	1455560.773	4/16/2019	14.7	11.88	10-20	20	Shallow	Existing	N/A	No		2019				(d)
CO193-MWI	Monitoring	562129.946	1454636.600	1/22/2020	16.12	13.52	35-50	50	Intermediate	Existing	N/A	No		2024	2024	2025		(n), (o)
CO193-MWS	Monitoring	562114.447	1454658.383	4/28/2019	15.29	13.19	20-35	35	Shallow	Existing	N/A	No		2019		2025		(d), (n), (o)
CO194-MWS	Monitoring	561768.0654	1454242.766	4/27/2019	14.23	11.3	10-25	25	Shallow	Existing	N/A	No	2024	2024	2024		2024	(n)
CO195-MWS	Monitoring	561775.5812	1454539.223	4/27/2019	14.32	11.56	20-35	35	Shallow	Existing	N/A	No	2024					(m)
CO196-MWS	Monitoring	561792.5741	1454723.993	4/10/2019	13.74	11.63	12-28	28	Shallow	Existing	N/A	No	2024					(m)
CO197-MWS	Monitoring	561802.986	1454926.090	4/24/2019	13.71	11.05	10-25	25	Shallow	Existing	N/A	No		2019		2025		(d), (o)
CO198-MWS	Monitoring	561671.4191	1454219.187	4/27/2019	14.51	11.62	20-35	35	Shallow	Existing	N/A	Yes	2024					(m)
CO199-MWS	Monitoring	561660.6153	1454465.549	4/26/2019	13.77	11.28	20-35	35	Shallow	Existing	N/A	Yes		2019				(d)
CO19-PZM004	Monitoring	562485.768	1455909.586	12/17/2001	13.27	N/A	6-16	16	Shallow	Existing	N/A	No	2024	2015	2015			(a), (n)
CO200-MWS	Monitoring	561707.1415	1454648.497	4/26/2019	13.76	10.6	20-35	35	Shallow	Existing	N/A	No		2019				(d)
CO201-MWS	Monitoring	561676.6134	1454778.725	4/26/2019	13.3	10.77	12-20	32	Shallow	Existing	N/A	Yes	2024					(m)
CO202-MWS	Monitoring	561684.2185	1454936.945	4/25/2019	13.86	10.38	10-25	25	Shallow	Existing	N/A	Yes		2019				(d)
CO203-MWS	Monitoring	561979.808	1457971.019	4/13/2019	10.53	10.78	5-25	25	Shallow	Existing	N/A	Yes	2023		2025	2025		(k), (o)
CO204-MWS	Monitoring	561776.1523	1457813.75	4/13/2019	16.27	13.61	5-25	25	Shallow	Existing	N/A	No	2023					(k)

Appendix B-1 - Monitoring Well Construction and Sampling Details
CPA Groundwater CMS
Sparrows Point, MD

Well ID	Well Type	Northing	Easting	Date of Installation	Top of Casing (ft AMSL)	Ground Surface Elevation (ft AMSL)	Screen Interval or Screen Length (ft bgs)	Well Depth (ft bgs)	GW Zone	Well Status	Abandonment Date	Shoreline Well	Date for Most Recent Sampling Event					Associated Report for Most Recent Sampling Event
													BTEX+N	VOCs	SVOCs	Metals	MNA	
CO205-MWS	Monitoring	561794.4843	1457978.386	4/13/2019	15.55	13.16	5-25	25	Shallow	Existing	N/A	Yes	2023					(k)
CO206R-MWS	Monitoring	561600.409	1457593.351	2/2/2024	14.32	11.70	5-20	20	Shallow	Existing	N/A	No	2024	2024	2024	2025	2024	(n), (o)
CO207-MWS	Monitoring	561492.2737	1458030.691	4/14/2019	14.78	11.72	5-25	25	Shallow	Existing	N/A	Yes	2023					(k)
CO208-MWS	Monitoring	561156.3204	1458040.33	4/14/2019	12.69	10.6	5-25	25	Shallow	Existing	N/A	Yes		2019				(d)
CO209-MWI	Monitoring	562605.766	1453757.167	1/16/2020	10.08	7.55	40-50	50	Intermediate	Existing	N/A	Yes		2024	2024	2025	2024	(n), (o)
CO209-MWS	Monitoring	562600.431	1453758.027	1/17/2020	10.35	7.59	15-25	25	Shallow	Existing	N/A	Yes		2024	2024	2025	2024	(n), (o)
CO20-PZM004	Monitoring	562530.225	1457019.087	12/7/2001	12.75	N/A	7-17	17	Shallow	Damaged / Lost		No		2015	2015			(a)
CO210-MWI	Monitoring	561803.532	1453885.339	1/20/2020	13.93	11.39	40-55	55	Intermediate	Existing	N/A	Yes		2024	2024	2025	2024	(n), (o)
CO210-MWS	Monitoring	561799.694	1453887.105	1/17/2020	14.15	11.27	15-25	25	Shallow	Existing	N/A	Yes		2024	2024	2025	2024	(n), (o)
CO211-MWI	Monitoring	561592.274	1456079.844	1/23/2020	14.69	12.13	40-50	50	Intermediate	Existing	N/A	No		2020	2020	2020		(f)
CO211-MWS	Monitoring	561588.378	1456083.727	1/24/2020	14.93	12.38	15-25	25	Shallow	Existing	N/A	No		2020	2020	2020		(f)
CO212A-PZM	Monitoring	562397.727	1456634.716	4/15/2021	12.96	13.2	9.5-19.5	20	Shallow	Existing	N/A	No		2021	2021			(h)
CO212-MWI	Monitoring	562245.067	1456674.775	1/28/2020	14.74	11.99	40-50	50	Intermediate	Existing	N/A	No		2020				(f)
CO212-MWS	Monitoring	562250.258	1456675.448	1/24/2020	14.69	11.99	10-20	20	Shallow	Existing	N/A	No		2024	2024		2024	(n)
CO213-RIW	Monitoring	562831.954	1455443.552	2/17/2020	13.5	10.74	9-19	19	Shallow	Existing	N/A	No	2024					(n)
CO214-RIW	Monitoring	562787.887	1455524.665	2/14/2020	13.02	10.36	9-19	19	Shallow	Existing	N/A	No	2024					(n)
CO215-RIW	Monitoring	562885.087	1455424.366	2/17/2020	14.08	11.53	9-19	19	Shallow	Existing	N/A	No	2024					(n)
CO216-MWS	Monitoring	562869.9035	1457726.957	4/6/2020	14.93	12.20	10-20	20	Shallow	Existing	N/A	No		2020				(f)
CO23-PZM008	Monitoring	561792.025	1457087.541	7/19/2017	15.45	11.62	8.6-18.6	18.6	Shallow	Existing	N/A	No	2024		2015			(a), (m)
CO24-PZM007	Monitoring	562053.834	1457273.019	12/6/2001	15.15	12.72	9-19	19	Shallow	Existing	N/A	No	2024		2015	2025		(a), (m), (o)
CO25-PZM008	Monitoring	561813.657	1457587.483	12/4/2001	15.79	12.17	10-20	20	Shallow	Existing	N/A	No	2024					(m)
CO26-PZM007	Monitoring	561679.050	1458040.163	12/5/2001	15.84	12.97	10-20	20	Shallow	Existing	N/A	Yes	2024		2015	2025		(a), (m), (o)
CO26-PZM032	Monitoring	561688.125	1458037.777	12/12/2002	14.65	13.55	35-45	45	Intermediate	Existing	N/A	Yes	2022		2015	2025		(a), (j), (o)
CO27-PZM012	Monitoring	563239.593	1454916.960	1/13/2003	4.65	4.00	5-15	15	Shallow	Existing	N/A	Yes	2024					(m)
CO27-PZM046	Monitoring	563239.625	1454913.513	1/14/2003	4.67	4.01	39-49	49	Intermediate	Existing	N/A	Yes	2024					(m)
CO28-PZM010	Monitoring	562891.927	1454280.619	Prior to 2005	12.34	N/A	N/A	19.94	Shallow	Existing	N/A	Yes	2023		2015	2025		(a), (k), (o)
CO28-PZM048	Monitoring	562888.758	1454283.654	1/17/2003	12.69	N/A	48-58	58	Intermediate	Existing	N/A	Yes	2023		2015	2025		(a), (k), (o)
CO29-PZM010	Monitoring	562130.682	1453851.243	1/17/2003	15.01	13.34	12-22	22	Shallow	Existing	N/A	Yes		2024	2024		2024	(n)
CO29-PZM051	Monitoring	562122.719	1453832.100	1/23/2003	13.29	10.94	52-62	62	Intermediate	Existing	N/A	Yes		2019	2015			(a), (d)
CO30-PZM015	Monitoring	561656.383	1454556.580	1/13/2003	11.97	9.85	10-25	25	Shallow	Existing	N/A	Yes	2024		2025	2025		(m), (o)
CO30-PZM060	Monitoring	561656.088	1454552.600	12/6/2002	13.13	9.79	10	70.6	Intermediate	Existing	N/A	Yes	2024		2025	2025		(m), (o)
CO32-PZM004	Monitoring	561638.514	1455283.205	8/9/2000	13.37	11.02	5-15	15	Shallow	Existing	N/A	No		2020	2015	2020		(a), (f)
CO32-PZM041	Monitoring	561634.1972	1455276.749	12/17/2003	12.80	10.60	42-52	52	Intermediate	Existing	N/A	No		2020	2020	2020		(f)
CO34-PZM048	Monitoring	561895.770	1457149.605	2/15/2003	14.64	12.27	53-63	63	Intermediate	Existing	N/A	No		2015	2015	2025		(a), (o)
CO35-PZM013	Monitoring	560858.570	1458161.157	1/10/2003	10.60	8.58	7-22	22	Shallow	Existing	N/A	Yes	2023		2015			(a), (k)
CO35-PZM056	Monitoring	560861.646	1458161.055	N/A	10.72	8.58	N/A	68.4	Intermediate	Existing	N/A	Yes		2020	2020	2020		(f)
CO36-PZM008	Monitoring	563212.31	1454571.76	2/1/2014	6.94	N/A	5-15	15	Shallow	Existing	N/A	Yes	2023			2025		(a), (k), (o)
CO36-PZM043	Monitoring	563214.49	1454578.37	2/1/2014	6.92	N/A	30-50	50	Intermediate	Existing	N/A	Yes	2023			2025		(k), (o)
CO37-PZM003	Monitoring	563268.52	1455158.69	2/1/2014	12.34	N/A	5-15	15	Shallow	Existing	N/A	Yes	2024			2025		(m), (o)
CO37-PZM038	Monitoring	563268.5	1455154.68	2/1/2014	12.12	N/A	30-50	50	Intermediate	Existing	N/A	Yes	2024					(m)
CO38-PZM006	Monitoring	563078.8	1454743.79	2/1/2014	6.75	N/A	3-13	13	Shallow	Existing	N/A	No	2023			2025		(a), (k), (o)
CO38-PZM043	Monitoring	563078.33	1454737.75	2/1/2014	6.65	N/A	30-50	50	Intermediate	Existing	N/A	No	2023			2025		(k), (o)
CO39-PZM007	Monitoring	563141.66	1455095.7	2/1/2014	7.75	N/A	5-15	15	Shallow	Existing	N/A	No	2023			2025		(a), (k), (o)

Appendix B-1 - Monitoring Well Construction and Sampling Details
CPA Groundwater CMS
Sparrows Point, MD

Well ID	Well Type	Northing	Easting	Date of Installation	Top of Casing (ft AMSL)	Ground Surface Elevation (ft AMSL)	Screen Interval or Screen Length (ft bgs)	Well Depth (ft bgs)	GW Zone	Well Status	Abandonment Date	Shoreline Well	Date for Most Recent Sampling Event					Associated Report for Most Recent Sampling Event
													BTEX+N	VOCs	SVOCs	Metals	MNA	
CO39-PZM042	Monitoring	563140.07	1455089.8	2/1/2014	7.91	N/A	30-50	50	Intermediate	Existing	N/A	No	2023			2025		(k), (o)
CO40-PZM008	Monitoring	563039.41	1455081.7	2/1/2014	7.47	N/A	5-15	15	Shallow	Existing	N/A	No	2023					(a), (k)
CO41-PZM001	Monitoring	562873.18	1454953	2/1/2014	13.57	N/A	5-15	15	Shallow	Existing	N/A	No	2024		2015			(a), (m)
CO41-PZM036	Monitoring	562865.34	1454950.75	2/1/2014	13.6	N/A	30-50	50	Intermediate	Existing	N/A	No	2024		2015			(a), (m)
CO42-PZM004	Monitoring	563177.72	1455458.51	2/1/2014	10.83	N/A	5-15	15	Shallow	Existing	N/A	No	2024		2015			(a), (m)
CO43-PZM048	Monitoring	563202.59	1454621.23	3/1/2014	1.96	N/A	35-50	50	Intermediate	Existing	N/A	Yes	2022					(j)
CO44-PZM048	Monitoring	563206.63	1454719.44	3/1/2014	1.73	N/A	35-50	50	Intermediate	Existing	N/A	Yes	2022					(j)
CO45-PZM047	Monitoring	563218.62	1454818.73	3/1/2014	2.68	N/A	35-50	50	Intermediate	Existing	N/A	Yes	2022					(j)
CO46-PZM047	Monitoring	563226.7	1454918.44	3/1/2014	3.08	N/A	35-50	50	Intermediate	Existing	N/A	Yes	2022					(j)
CO47-PZM046	Monitoring	563234.85	1455018.95	3/1/2014	3.85	N/A	35-50	50	Intermediate	Existing	N/A	Yes	2022					(j)
CO48-PZM044	Monitoring	563243.86	1455117.45	3/1/2014	5.55	N/A	35-50	50	Intermediate	Existing	N/A	Yes	2022					(j)
CO55-PZM000	Monitoring	561434.42	1457585.9	N/A	15.1	N/A	5-15	15	Shallow	Existing	N/A	No	2024					(m)
CO56-PZP001	Monitoring	561668.41	1457790.05	N/A	15.92	N/A	5-15	15	Shallow	Existing	N/A	No	2024					(m)
CO57-PZP002	Monitoring	561122.52	1457530	N/A	16.59	N/A	5-15	15	Shallow	Existing	N/A	No	2024		2015			(a), (m)
CO58-PZM001	Monitoring	561331.31	1457989.13	N/A	14.31	N/A	5-15	15	Shallow	Existing	N/A	Yes	2024		2025	2025		(m), (o)
CO59-PZP002	Monitoring	561446.98	1457308.79	N/A	16.75	N/A	5-15	15	Shallow	Existing	N/A	No	2024		2015	2025		(a), (m), (o)
CO60-PZP001	Monitoring	561872.55	1457913.36	N/A	15.83	N/A	5-15	15	Shallow	Existing	N/A	No	2022					(j)
CO61-PZM007	Monitoring	561330.96	1457592.28	3/21/2023	10.26	N/A	15-25	25	Shallow	Existing	N/A	No	2023					(k)
CO62-PZM007	Monitoring	561357.45	1457625.28	3/21/2023	9.66	N/A	15-25	25	Shallow	Existing	N/A	No	2023					(k)
CO63-PZM007	Monitoring	561382.08	1457657.57	3/21/2023	10.29	N/A	15-25	25	Shallow	Existing	N/A	No	2024					(m)
CO64-PZM006	Monitoring	561407.02	1457691.78	3/21/2023	11.16	N/A	15-25	25	Shallow	Existing	N/A	No	2024					(m)
CO65-PZM005	Monitoring	561431.95	1457724.23	3/21/2023	11.6	N/A	15-25	25	Shallow	Existing	N/A	No	2024					(m)
CO66-PZM005	Monitoring	561458.25	1457755.59	3/21/2023	11.57	N/A	15-25	25	Shallow	Existing	N/A	No	2024					(m)
CO67-PZM006	Monitoring	561503.24	1457809.88	3/21/2023	11.2	N/A	15-25	25	Shallow	Existing	N/A	No	2024					(m)
CO68-PZM005	Monitoring	561537.61	1457830.32	3/21/2023	12.03	N/A	15-25	25	Shallow	Existing	N/A	No	2024					(m)
CO69-PZM005	Monitoring	561579.1	1457852.16	Aug2013 - Oct2014	11.92	N/A	15-17	17	Shallow	Existing	N/A	No	2023					(k)
CO70-PZM005	Monitoring	561618.53	1457867.42	Aug2013 - Oct2014	12.28	N/A	15-17	17	Shallow	Existing	N/A	No	2023					(k)
CO71-PZM006	Monitoring	561654.51	1457886.12	Aug2013 - Oct2014	11.33	N/A	15-17	17	Shallow	Existing	N/A	No	2023					(k)
CO72-PZM005	Monitoring	561694.2	1457904.22	Aug2013 - Oct2014	11.96	N/A	15-17	17	Shallow	Existing	N/A	No	2023					(k)
CO79-PZM	Monitoring	562711.275	1455446.84	5/28/2009	N/A	N/A	4.5-14.5	14.5	Shallow	Existing	N/A	No		2015	2015			(a)
CO88-PZM	Monitoring	562452.16	1455339.41	5/22/2009	14.07	11.69	16-26	26	Shallow	Existing	N/A	No	2024	2019	2015			(a), (d), (n)
CO93-PZM	Monitoring	562511.91	1455769.43	6/15/2009	12.12	9.94	8-18	18	Shallow	Existing	N/A	No	2024		2015			(a), (k)
COA-MW-001	Monitoring	563315.96	1456216.01	3/22/2024	NS	NS	5-20	20	Shallow	Existing	N/A	No	2024			2025		(n), (o)
COA-MW-002	Monitoring	563137.7835	1456105.727	3/21/2024	NS	NS	5-20	20	Shallow	Existing	N/A	No	2024					(n)
COA-MW-003	Monitoring	561964.170	1455789.165	2/1/2024	15.27	12.82	5-20	20	Shallow	Existing	N/A	No	2024					(n)
COA-MWI-004	Monitoring	562087.832	1456250.567	1/31/2024	15.94	13.24	10	42	Intermediate	Existing	N/A	No	2024			2025		(n), (o)
COA-MWS-004	Monitoring	562088.974	1456245.753	1/30/2024	16.09	13.34	5-20	20	Shallow	Existing	N/A	No	2024			2025		(n), (o)
COA-MWI-006	Monitoring	562867.190	1455446.843	11/6/2024	NS	NS	35-45	45	Intermediate	Existing	N/A	No	2024					(n)
COA-MWI-007	Monitoring	563283.725	1455544.379	10/29/2024	NS	NS	32-42	42	Intermediate	Existing	N/A	Yes	2024					(n)

Appendix B-1 - Monitoring Well Construction and Sampling Details
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Sparrows Point, MD

Well ID	Well Type	Northing	Easting	Date of Installation	Top of Casing (ft AMSL)	Ground Surface Elevation (ft AMSL)	Screen Interval or Screen Length (ft bgs)	Well Depth (ft bgs)	GW Zone	Well Status	Abandonment Date	Shoreline Well	Date for Most Recent Sampling Event					Associated Report for Most Recent Sampling Event
													BTEX+N	VOCs	SVOCs	Metals	MNA	
COA-MWI-009	Monitoring	561890.782	1454512.443	10/30/2024	NS	NS	45-55	55	Intermediate	Existing	N/A	No	2024					(n)
COA-MWI-011	Monitoring	561638.758	1454389.836	10/31/2024	NS	NS	25-35	35	Intermediate	Existing	N/A	Yes	2024					(n)
CP02-PZM007	Monitoring	560866.45	1456414.85	11/14/2001	22.44	18.92	21.6-31.6	31.6	Shallow	Existing	N/A	No		2024	2024	2024		(l)
CP02-PZM026	Monitoring	560881.50	1456402.74	11/8/2001	27.31	N/A	45-50	50	Intermediate	Existing	N/A	No		2024	2024	2024		(l)
CP05-PZM008	Monitoring	560044.17	1454931.55	10/12/2000	9.66	N/A	5-15	15	Shallow	Existing	N/A	Yes		2024	2024	2024		(l)
CP05-PZM019	Monitoring	560034.23	1454939.13	10/16/2000	10.48	N/A	21-26	26	Intermediate	Existing	N/A	Yes		2024	2024	2024		(l)
CP05-PZM028	Monitoring	560050.93	1454920.88	10/17/2000	7.07	N/A	32-35	35	Intermediate	Existing	N/A	Yes		2024	2024	2024		(l)
CP07-PZM006	Monitoring	560493.41	1456130.90	10/12/2000	14	N/A	7-17	17	Shallow	Existing	N/A	No		2024	2024	2024		(l)
CP08R-PZM008	Monitoring	560468.24	1456686.79	2/18/2020	13.67	10.63	10-20	25	Shallow	Existing	N/A	No		2024	2024	2024		(l)
CP08R-PZM034	Monitoring	560472.08	1456673.79	2/19/2020	14.03	11.17	49-54	55	Intermediate	Existing	N/A	No		2024	2024	2024		(l)
CP09-PZM010	Monitoring	559500.55	1455329.32	10/30/2001	7.63	N/A	5-15	15	Shallow	Existing	N/A	Yes		2024	2024	2024		(l)
CP09-PZM047	Monitoring	559502.14	1455331.19	10/31/2001	7.39	N/A	47-52	52	Intermediate	Existing	N/A	Yes		2024	2024	2024		(l)
CP10-PZM008	Monitoring	559659.30	1455865.00	11/5/2001	36.16	N/A	31-41	41	Shallow	Abandoned	4/21/2023	No		2021	2021	2021		(i)
CP11-PZM010	Monitoring	559357.46	1456177.23	10/30/2001	8.43	N/A	5-15	15	Shallow	Existing	N/A	Yes		2024	2024	2024		(l)
CP12-PZM012	Monitoring	559903.58	1456306.57	11/5/2001	5.35	N/A	5-15	15	Shallow	Existing	N/A	Yes		2024	2024	2024		(l)
CP12-PZM052	Monitoring	559905.18	1456313.75	11/2/2001	4.71	N/A	49-54	54	Intermediate	Existing	N/A	Yes		2024	2024	2024		(l)
CP14-PZM009	Monitoring	559826.42	1457257.14	11/12/2001	13.06	N/A	9-19	19	Shallow	Existing	N/A	Yes		2024	2024	2024		(l)
CP14-PZM062	Monitoring	559816.39	1457250.14	11/6/2001	13.67	N/A	68-73	73	Intermediate	Existing	N/A	Yes		2024	2024	2024		(l)
CP15-PZM020	Monitoring	559446.96	1455789.36	12/26/2002	7.08	N/A	5-25	27	Shallow	Existing	N/A	Yes		2024	2024	2024		(l)
CP15-PZM042	Monitoring	559446.05	1455792.82	12/10/2002	7.98	N/A	37-47	51	Intermediate	Existing	N/A	Yes		2024	2024	2024		(l)
CP16-PZM008	Monitoring	559874.69	1456782.83	3/16/2015	18.52	15.35	3 - 23	25	Shallow	Existing	N/A	Yes		2024	2024	2024		(l)
CP16-PZM035	Monitoring	559874.19	1456808.80	12/18/2002	20.01	N/A	15-35	36	Intermediate	Existing	N/A	Yes		2024	2024	2024		(l)
CP17-MWI	Monitoring	560370.434	1458095.781	2/7/2020	14.56	11.68	50-60	60	Intermediate	Existing	N/A	Yes		2020	2020	2020		(f)
CP17-PZM013	Monitoring	560364.966	1458109.186	12/30/2002	8.60	7.03	5-20	20	Shallow	Existing	N/A	Yes		2020	2020	2020		(f)
CP18R-PZM009	Monitoring	560191.10	1456757.66	2/18/2020	15.26	12.19	15-25	25	Shallow	Existing	N/A	No		2024	2024	2024		(l)
CP19R-PZM008	Monitoring	560300.09	1456463.71	2/18/2020	14.89	12.00	13-23	25	Shallow	Existing	N/A	No		2024	2024	2024		(l)
CP20-PZM011	Monitoring	560467.73	1457004.72	3/17/2015	14.34	11.44	6 - 26	25.7	Shallow	Existing	N/A	No		2024	2024	2024	2024	(l), (n)
CP21-PZM004	Monitoring	560847.25	1456709.07	3/17/2015	15.08	12.04	6 - 16	19.4	Shallow	Existing	N/A	No		2024	2024	2024		(l)
CP22-MWI	Monitoring	561329.358	1455054.520	1/29/2020	15.00	12.26	55-60	60	Intermediate	Existing	N/A	Yes		2020	2020	2020		(f)
CP22-MWS	Monitoring	561330.889	1455059.944	1/30/2020	15.30	12.36	15-25	25	Shallow	Existing	N/A	Yes		2024	2024		2024	(n)
CP23-MWI	Monitoring	561057.729	1454441.496	1/31/2020	10.61	7.77	55-60	60	Intermediate	Existing	N/A	Yes		2020	2020	2020		(f)
CP23-MWS	Monitoring	561061.601	1454442.408	2/3/2020	10.74	7.80	15-25	25	Shallow	Existing	N/A	Yes		2024	2024		2024	(n)
CP24-MWI	Monitoring	560439.860	1454701.019	2/4/2020	10.25	7.28	35-45	45	Intermediate	Existing	N/A	Yes		2020	2020	2020		(f)
CP24-MWS	Monitoring	560442.089	1454697.467	2/4/2020	10.56	7.50	15-25	25	Shallow	Existing	N/A	Yes		2020	2020	2020		(f)
CP25-MWI	Monitoring	560481.616	1455478.228	2/5/2020	18.05	15.01	40-50	50	Intermediate	Existing	N/A	No		2020	2020	2020		(f)
CP25-MWS	Monitoring	560478.719	1455474.382	2/5/2020	17.99	15.04	15-25	25	Shallow	Existing	N/A	No		2020	2020	2020		(f)
CP26-MWI	Monitoring	559995.635	1457952.613	2/10/2020	9.37	8.38	65-70	70	Intermediate	Existing	N/A	Yes		2020	2020	2020		(f)
CP26-MWS	Monitoring	559995.198	1457948.169	2/10/2020	9.55	7.79	15-25	25	Shallow	Existing	N/A	Yes		2020	2020	2020		(f)
CT-037-GW-12.5	Grab	562196.243	1458029.763	2/6/2024	NS	NS	12.5	12.5	Shallow	N/A	N/A	Yes		2024				(n)
CT-037-GW-41	Grab	562196.243	1458029.763	2/6/2024	NS	NS	41	41	Intermediate	N/A	N/A	Yes		2024				(n)
SW-030-MWS	Monitoring	563547.833	1458146.580	1/7/2016	14.72	12.30	3.3-13	13.3	Shallow	Existing	N/A	No		2016	2016	2016		(b)
B18-075-PZ	Monitoring	563168.4935	1457705.413	12/1/2016	16.07	13.24	5-20	20	Shallow	Abandoned	4/2/2020	No		2016	2016	2016		(e)
B18-076-PZ	Monitoring	563171.241	1457422.049	12/6/2016	15.34	12.55	3-15	16	Shallow	Abandoned	3/31/2020	No		2016	2016	2016		(e)

Appendix B-1 - Monitoring Well Construction and Sampling Details
CPA Groundwater CMS
Sparrows Point, MD

Well ID	Well Type	Northing	Easting	Date of Installation	Top of Casing (ft AMSL)	Ground Surface Elevation (ft AMSL)	Screen Interval or Screen Length (ft bgs)	Well Depth (ft bgs)	GW Zone	Well Status	Abandonment Date	Shoreline Well	Date for Most Recent Sampling Event					Associated Report for Most Recent Sampling Event
													BTEX+N	VOCs	SVOCs	Metals	MNA	
SW13-PZM003	Monitoring	563487.324	1456411.989	7/26/2017	17.51	13.64	5.5-15.5	15.5	Shallow	Existing	N/A	No		2016	2016	2016		(b)
SW13-PZM025	Monitoring	563498.550	1456410.385	10/10/2000	15.22	13.39	N/A	39	Intermediate	Existing	N/A	No		2016	2016	2016		(b)
SW13-PZM111	Monitoring	563502.75	1456409.98	11/28/2000	15.37	13.66	N/A	125	Deep	Existing	N/A	No		2015	2015	2015		(b)
SW14-PZM004	Monitoring	563392.23	1457680.38	2/5/2016	15.85	13.8	3.4-13.4	13.4	Shallow	Damaged / Lost		No		2016	2016	2016		(b)
SW18-PZM008	Monitoring	560776.042	1457572.926	10/12/2000	12.87	12.38	N/A	18	Shallow	Existing	N/A	No		2020	2020	2020		(f)
SW18-PZM053	Monitoring	560781.435	1457591.085	11/22/2000	13.18	12.39	N/A	63	Intermediate	Existing	N/A	No		2020	2020	2020		(f)
TS06-PPM008	Monitoring	561608.214	1455187.923	8/9/2000	13.21	N/A	8-18	18	Shallow	Existing	N/A	Yes		2015	2015			(a)

Acronyms:

ft AMSL = feet above mean sea level
ft bgs = feet below ground surface
NS = Not Surveyed
N/A = Not Available
BTEX+N = Benzene, Toluene, Ethylbenzene, Xylenes plus Naphthalene
VOC = volatile organic compound
SVOC = semivolatile organic compound
MNA = monitored natural attenuation

Associated Reports:

(a) Pre-Design Investigation Summary Report (Key Env., 10-09-2015)
(b) Area B Groundwater Investigation Report (Sept 30, 2016)
(c) Former COA IM Supplemental Investigation Report (Aug 2, 2019)
(c) No. 10 Tank Area Report (Jan 6, 2020)
(d) COA 2019 Annual IM Report (Jan 31, 2020)
(e) Parcel B18 Phase II Report (August 3, 2020)
(f) CPA CMS Investigation Report (Rev 2, Feb 23, 2021)
(g) COA 2020 Annual IM Report (Feb 19, 2021)
(h) Parcel B10 COA Northeast Delineation Report (Dec 9, 2021)
(i) CPLF Fall 2021 GWMR (Mar 1, 2022)
(j) COA 2022 Annual IM Report (March 7, 2023)
(k) COA 2023 Annual IM Report (March 4, 2024)
(l) CPLF Fall 2024 GWMR (Jan 27, 2025)
(m) COA 2024 Annual IM Report (To be submitted)
(n) 2024 Supplemental Sampling (CPA CMS)
(o) 2025 Supplemental Sampling (CPA CMS)

APPENDIX B-2

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA A	CP05-PZM008	4/13/2023		X	X	X	
		10/11/2023		X	X	X	
		5/14/2024		X	X	X	
		10/2/2024		X	X	X	
GAA A	CP05-PZM019	4/13/2023		X	X	X	
		10/11/2023		X	X	X	
		5/14/2024		X	X	X	
		10/2/2024		X	X	X	
GAA A	CP05-PZM028	4/13/2023		X	X	X	
		10/11/2023		X	X	X	
		5/14/2024		X	X	X	
		10/2/2024		X	X	X	
GAA A	CP09-PZM010	4/13/2023		X	X	X	
		10/11/2023		X	X	X	
		5/13/2024		X	X	X	
		10/2/2024		X	X	X	
GAA A	CP09-PZM047	4/17/2023		X	X	X	
		10/19/2023		X	X	X	
		5/13/2024		X	X	X	
		10/2/2024		X	X	X	
GAA A	CP10-PZM008	10/28/2021		X	X	X	
GAA A	CP11-PZM010	4/18/2023		X	X	X	
		10/13/2023		X	X	X	
		5/20/2024		X	X	X	
		10/3/2024		X	X	X	
GAA A	CP15-PZM020	4/18/2023		X	X	X	
		10/12/2023		X	X	X	
		5/14/2024		X	X	X	
		10/3/2024		X	X	X	
GAA A	CP15-PZM042	4/18/2023		X	X	X	
		10/12/2023		X	X	X	
		5/14/2024		X	X	X	
		10/3/2024		X	X	X	
GAA A	CP24-MWI	2/28/2020		X	X	X	
GAA A	CP24-MWS	2/28/2020		X	X	X	
GAA A	CP25-MWI	3/16/2020		X	X	X	
GAA A	CP25-MWS	3/16/2020		X	X	X	
GAA B	CO02-PZM006	6/10/2015		X	X		
		12/17/2020		X			

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA B	CO02-PZM041	6/9/2015		X	X		
		3/9/2020		X			
		10/31/2024		X	X		X
		2/13/2025				X	
GAA B	CO03-PZM005	6/10/2015		X	X		
		3/9/2020		X			
GAA B	CO07-PZM008	6/10/2015		X	X		
		3/10/2020		X			
GAA B	CO07-PZM050	3/10/2020		X			
GAA B	CO08A-PZM	5/20/2021		X	X		
		9/17/2024	X				
GAA B	CO08B-PZM	5/19/2021		X	X		
GAA B	CO08C-PZM	5/19/2021		X	X		
GAA B	CO08D-PZM	5/19/2021		X	X		
GAA B	CO08-PZM005	6/10/2015		X	X		
GAA B	CO08-PZM036	6/11/2015		X	X		
GAA B	CO09-PZM007	6/10/2015		X	X		
GAA B	CO100-PZM	10/7/2019		X			
		9/17/2024	X				
GAA B	CO101-PZM	12/17/2020		X			
GAA B	CO102-PZM	12/17/2020		X			
GAA B	CO103-PZM	12/17/2020		X			
GAA B	CO104-PZM	12/16/2020		X			
GAA B	CO121-PZM	6/10/2015		X	X		
		10/8/2019		X			
		9/19/2024	X				
GAA B	CO152-PZM	4/10/2020	X				
		9/19/2024	X				
		10/31/2024		X	X		X
GAA B	CO159-PZM	4/10/2020		X			
		9/19/2024	X				
		2/13/2025				X	
GAA B	CO15-PZM005	6/9/2015		X	X		
GAA B	CO167-PZM	4/10/2020		X			
		9/19/2024	X				
GAA B	CO16-PZM006	6/9/2015		X	X		
		10/8/2019		X			
		2/14/2025				X	
GAA B	CO177-MWI	9/27/2019		X			
GAA B	CO177-MWS	9/27/2019		X			
GAA B	CO178-MWI	10/14/2019		X			
		2/11/2025			X	X	

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA B	CO178-MWS	10/11/2019		X			
		2/11/2025			X	X	
GAA B	CO179-MWI	10/2/2019		X			
GAA B	CO179-MWS	6/13/2023	X				
GAA B	CO180-MWI	5/23/2023	X				
		2/11/2025			X	X	
GAA B	CO180-MWS	5/23/2023	X				
		2/11/2025			X	X	
GAA B	CO181-MWI	5/24/2023	X				
GAA B	CO181-MWS	5/24/2023	X				
GAA B	CO182-MWI	8/9/2023	X				
		12/10/2024	X				
GAA B	CO183-MWI	9/27/2019		X			
GAA B	CO184-MWI	10/8/2019		X			
		11/1/2024		X	X		
GAA B	CO185-MWI	2/5/2020		X			
		11/1/2024		X	X		
GAA B	CO185-MWS	10/8/2019		X			
GAA B	CO186-MWS	6/13/2023	X				
		12/10/2024	X				
GAA B	CO187-MWS	10/7/2019		X			
		9/18/2024	X				
GAA B	CO188-MWI	10/8/2019		X			
		10/31/2024		X	X		X
GAA B	CO189-MWS	10/8/2019		X			
		9/17/2024	X				
		2/13/2025				X	
GAA B	CO18-PZM006	6/9/2015		X	X		
		12/28/2020		X			
		9/18/2024	X				
		11/4/2024		X	X		X
		2/14/2025				X	
GAA B	CO190-MWS	8/15/2023	X				
		11/28/2023	X				
		3/12/2024	X				
		6/20/2024	X				
		8/14/2024	X				
		12/17/2024	X				
GAA B	CO191-MWS	5/30/2023	X				
		6/7/2024	X				
GAA B	CO192-MWS	10/7/2019		X			

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA B	CO193-MWI	2/6/2020		X			
		11/1/2024		X	X		
		2/10/2025				X	
GAA B	CO193-MWS	10/1/2019		X			
		2/10/2025				X	
GAA B	CO194-MWS	5/30/2023	X				
		11/8/2023	X				
		6/6/2024	X				
		11/4/2024		X	X		X
		12/12/2024	X				
GAA B	CO195-MWS	8/11/2023	X				
		11/8/2023	X				
		3/8/2024	X				
		6/6/2024	X				
		8/12/2024	X				
		11/20/2024	X				
GAA B	CO196-MWS	5/31/2023	X				
		11/8/2023	X				
		6/6/2024	X				
		12/13/2024	X				
GAA B	CO197-MWS	10/1/2019		X			
		2/10/2025				X	
GAA B	CO198-MWS	5/19/2023	X				
		11/8/2023	X				
		6/6/2024	X				
		12/13/2024	X				
GAA B	CO199-MWS	9/30/2019		X			
GAA B	CO19-PZM004	6/10/2015		X	X		
		9/17/2024	X				
GAA B	CO200-MWS	9/30/2019		X			
GAA B	CO201-MWS	5/31/2023	X				
		11/8/2023	X				
		6/6/2024	X				
		12/13/2024	X				
GAA B	CO202-MWS	9/30/2019		X			
GAA B	CO209-MWI	6/2/2023	X				
		12/18/2024		X	X		X
		2/10/2025				X	
GAA B	CO209-MWS	6/2/2023	X				
		12/18/2024		X	X		X
		2/10/2025				X	

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA B	CO210-MWI	2/5/2020		X			
		12/20/2024		X	X		X
		2/10/2025				X	
GAA B	CO210-MWS	2/5/2020		X			
		12/18/2024		X	X		X
		2/10/2025				X	
GAA B	CO211-MWI	3/11/2020		X	X	X	
GAA B	CO211-MWS	3/11/2020		X	X	X	
GAA B	CO212-MWI	2/6/2020		X			
GAA B	CO212-MWS	2/6/2020		X			
		11/5/2024		X	X		X
GAA B	CO213-RIW	9/18/2024	X				
GAA B	CO214-RIW	9/18/2024	X				
GAA B	CO215-RIW	9/18/2024	X				
GAA B	CO27-PZM012	8/9/2023	X				
		11/13/2023	X				
		3/4/2024	X				
		8/13/2024	X				
		12/17/2024	X				
GAA B	CO27-PZM046	8/9/2023	X				
		11/14/2023	X				
		3/4/2024	X				
		8/13/2024	X				
		12/17/2024	X				
GAA B	CO28-PZM010	6/9/2015	X		X		
		5/24/2023	X				
		2/11/2025				X	
GAA B	CO28-PZM048	6/9/2015	X		X		
		5/24/2023	X				
		2/11/2025				X	
GAA B	CO29-PZM010	6/9/2015	X		X		
		12/19/2019		X			
		12/18/2024		X	X		X
GAA B	CO29-PZM051	6/9/2015	X		X		
		12/19/2019		X			
GAA B	CO30-PZM015	8/11/2023	X				
		11/8/2023	X				
		3/8/2024	X				
		6/6/2024	X				
		8/12/2024	X				
		11/20/2024	X				
		2/10/2025			X	X	

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA B	CO30-PZM060	5/19/2023	X				
		6/6/2024	X				
		2/10/2025			X	X	
GAA B	CO32-PZM004	6/11/2015	X		X		
		3/29/2020		X		X	
GAA B	CO32-PZM041	6/9/2015	X		X		
		3/16/2020		X	X	X	
GAA B	CO36-PZM008	8/10/2023	X				
		2/13/2025				X	
GAA B	CO36-PZM043	8/10/2023	X				
		2/13/2025				X	
GAA B	CO37-PZM003	8/8/2023	X				
		11/20/2023	X				
		3/12/2024	X				
		2/14/2025				X	
GAA B	CO37-PZM038	8/8/2023	X				
		11/20/2023	X				
		3/11/2024	X				
GAA B	CO38-PZM006	8/8/2023	X				
		2/11/2025				X	
GAA B	CO38-PZM043	8/8/2023	X				
		2/11/2025				X	
GAA B	CO39-PZM007	8/8/2023	X				
		2/14/2025				X	
GAA B	CO39-PZM042	8/8/2023	X				
		2/14/2025				X	
GAA B	CO40-PZM008	8/9/2023	X				
GAA B	CO41-PZM001	6/9/2015	X		X		
		8/2/2023	X				
		11/14/2023	X				
		3/4/2024	X				
		6/7/2024	X				
		8/13/2024	X				
		12/16/2024	X				
GAA B	CO41-PZM036	6/9/2015	X		X		
		8/2/2023	X				
		11/14/2023	X				
		3/4/2024	X				
		6/7/2024	X				
		8/13/2024	X				
		12/17/2024	X				

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA B	CO42-PZM004	6/9/2015	X		X		
		5/25/2023	X				
		11/20/2023	X				
		3/4/2024	X				
GAA B	CO43-PZM048	6/30/2022	X				
GAA B	CO44-PZM048	6/30/2022	X				
GAA B	CO45-PZM047	6/30/2022	X				
GAA B	CO46-PZM047	6/30/2022	X				
GAA B	CO47-PZM046	6/30/2022	X				
GAA B	CO48-PZM044	6/30/2022	X				
GAA B	CO79-PZM	6/9/2015		X	X		
GAA B	CO88-PZM	6/9/2015	X		X		
		10/8/2019		X			
		9/17/2024	X				
GAA B	CO93-PZM	6/9/2015	X		X		
		8/15/2023	X				
		11/27/2023	X				
		3/12/2024	X				
		6/18/2024	X				
		8/13/2024	X				
		12/10/2024	X				
GAA B	COA-MW-003	6/5/2024	X				
GAA B	COA-MWI-004	6/5/2024	X				
		2/14/2025				X	
GAA B	COA-MWI-006	11/12/2024	X				
GAA B	COA-MWI-0007	11/11/2024	X				
GAA B	COA-MWI-009	11/11/2024	X				
GAA B	COA-MWI-011	11/11/2024	X				
GAA B	COA-MWS-004	6/5/2024	X				
		2/14/2025				X	
GAA B	CP22-MWI	2/28/2020		X	X	X	
GAA B	CP22-MWS	2/28/2020			X	X	
		12/19/2024		X	X		X
GAA B	CP23-MWI	3/13/2020		X	X	X	
GAA B	CP23-MWS	3/13/2020		X	X	X	
		12/19/2024		X	X		X
GAA B	TS06-PPM008	6/11/2015		X	X		
GAA C	B18-007-PZ	12/13/2016		X	X	X	
GAA C	B18-044-PZ	11/30/2018		X	X		
GAA C	B18-046-PZ	11/29/2018		X	X		
GAA C	B18-061-PZ	12/13/2016		X	X	X	
GAA C	B18-070R-MWS	12/27/2024				X	

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA C	B18-077-PZ	11/29/2018		X	X		
GAA C	B18-078-PZ	11/30/2018		X	X		
GAA C	B18-079-PZ	11/29/2018		X	X		
GAA C	B18-080-PZ	11/28/2018		X	X		
GAA C	B18-081-PZ	11/28/2018		X	X		
GAA C	B18-082-PZ	11/29/2018		X	X		
GAA C	B18-083-PZ	11/28/2018		X	X		
GAA C	BA-81-7945	11/30/2018		X	X		
GAA C	BA-81-7946	11/29/2018		X	X		
GAA C	COA-MW-001	6/5/2024	X				
		2/14/2025				X	
GAA C	COA-MW-002	6/5/2024	X				
GAA C	SW-085-MWS	11/28/2018		X	X		
		2/17/2025				X	
GAA C	SW-086-MWS	11/28/2018		X	X		
GAA C	SW13-PZM003	3/28/2016		X	X	X	
GAA C	SW13-PZM025	2/19/2016		X	X	X	
GAA C	SW13-PZM111	12/9/2015		X	X	X	
GAA D	B18-070-PZ	12/14/2016		X	X	X	
GAA D	B18-071-PZ	12/14/2016		X	X	X	
GAA D	B18-072-PZ	12/14/2016		X	X	X	
GAA D	B18-074-PZ	12/14/2016		X	X	X	
GAA D	B18-075-PZ	12/14/2016		X	X	X	
GAA D	B18-076-PZ	12/13/2016		X	X	X	
GAA D	CO04-PZM048	6/10/2015			X		
		3/10/2020	X				
		2/13/2025				X	
GAA D	CO05A-PZM	5/19/2021			X		
		11/5/2024		X	X		X
		2/13/2025				X	
GAA D	CO05B-PZM	5/20/2021		X	X		
GAA D	CO05C-PZM	5/19/2021		X	X		
GAA D	CO05-PZM006	6/10/2015		X	X		
GAA D	CO10-PZM006	6/11/2015		X	X		
GAA D	CO20-PZM004	6/10/2015		X	X		
GAA D	CO212A-PZM	5/20/2021		X	X		
GAA D	CO216-MWS	4/10/2020		X			
GAA D	SW-030-MWS	2/1/2016		X	X	X	
GAA D	SW14-PZM004	3/31/2016		X	X	X	
GAA E	CO203-MWS	7/25/2023	X				
		2/10/2025			X	X	
GAA E	CO204-MWS	5/18/2023	X				

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA E	CO205-MWS	7/25/2023	X				
GAA E	CO206R-MWS	2/15/2024	X				
		6/7/2024	X				
		8/20/2024	X				
		11/4/2024		X	X		X
		2/11/2025				X	
GAA E	CO207-MWS	7/26/2023	X				
GAA E	CO208-MWS	10/10/2019		X			
GAA E	CO23-PZM008	6/10/2015			X		
		8/15/2023	X				
		11/15/2023	X				
		3/5/2024	X				
		6/7/2024	X				
		8/20/2024	X				
		11/19/2024	X				
GAA E	CO24-PZM007	6/10/2015			X		
		8/15/2023	X				
		11/15/2023	X				
		3/11/2024	X				
		6/7/2024	X				
		8/20/2024	X				
		11/19/2024	X				
		2/13/2025				X	
GAA E	CO25-PZM008	5/18/2023	X				
		11/28/2023	X				
		3/5/2024	X				
		6/7/2024	X				
		8/20/2024	X				
		11/19/2024	X				
GAA E	CO26-PZM007	6/10/2015			X		
		8/14/2023	X				
		11/15/2023	X				
		3/5/2024	X				
		6/7/2024	X				
		8/14/2024	X				
		11/20/2024	X				
		2/10/2025				X	
GAA E	CO26-PZM032	6/10/2015			X		
		8/3/2022	X				
		2/10/2025				X	
GAA E	CO34-PZM048	6/10/2015		X	X		
		2/13/2025				X	

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA E	CO35-PZM013	6/11/2015		X	X		
		7/26/2023	X				
GAA E	CO35-PZM056	6/11/2015			X		
		3/12/2020		X	X	X	
GAA E	CO55-PZM000	8/10/2023	X				
		11/16/2023	X				
		3/8/2024	X				
		6/7/2024	X				
		8/15/2024	X				
		11/20/2024	X				
GAA E	CO56-PZP001	8/10/2023	X				
		11/15/2023	X				
		3/5/2024	X				
		6/7/2024	X				
		8/14/2024	X				
		11/20/2024	X				
GAA E	CO57-PZP002	6/10/2015		X			
		8/14/2023	X				
		11/16/2023	X				
		3/8/2024	X				
		6/7/2024	X				
		8/19/2024	X				
		11/19/2024	X				
GAA E	CO58-PZM001	8/14/2023	X				
		11/14/2023	X				
		3/5/2024	X				
		6/7/2024	X				
		8/15/2024	X				
		11/20/2024	X				
		2/11/2025			X	X	
GAA E	CO59-PZP002	6/10/2015		X			
		8/10/2023	X				
		11/16/2023	x				
		3/11/2024	X				
		6/7/2024	X				
		8/19/2024	X				
		11/19/2024	X				
		2/11/2025				X	
GAA E	CO60-PZP001	5/12/2022	X				
GAA E	CO61-PZM007	6/22/2023	X				
GAA E	CO62-PZM007	6/22/2023	X				

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA E	CO63-PZM007	6/22/2023	X				
		10/17/2024	X				
GAA E	CO64-PZM006	6/22/2023	X				
		10/17/2024	X				
GAA E	CO65-PZM005	6/22/2023	X				
		10/17/2023	X				
GAA E	CO66-PZM005	6/22/2023	X				
		10/17/2024	X				
GAA E	CO67-PZM006	6/22/2023	X				
		10/17/2024	X				
GAA E	CO68-PZM005	6/22/2023	X				
		10/17/2024	X				
GAA E	CO69-PZM005	6/22/2023	X				
GAA E	CO70-PZM005	6/22/2023	X				
GAA E	CO71-PZM006	6/22/2023	X				
GAA E	CO72-PZM005	6/22/2023	X				
GAA E	CP17-MWI	3/13/2020		X	X	X	
GAA E	CP17-PZM013	3/16/2020		X	X	X	
GAA E	CP26-MWI	3/11/2020		X	X	X	
GAA E	CP26-MWS	3/11/2020		X	X	X	
GAA E	CT-037-GW-12.5	2/6/2024		X			
GAA E	CT-037-GW-41	2/6/2024		X			
GAA E	SW18-PZM008	3/19/2020		X	X	X	
GAA E	SW18-PZM053	3/12/2020		X	X	X	
GAA F	CP02-PZM007	4/19/2023		X	X	X	
		10/17/2023		X	X	X	
		5/16/2024		X	X	X	
		10/9/2024		X	X	X	
GAA F	CP02-PZM026	4/19/2023		X	X	X	
		10/17/2023		X	X	X	
		5/16/2024		X	X	X	
		10/9/2024		X	X	X	
GAA F	CP07-PZM006	4/24/2023		X	X	X	
		10/23/2023		X	X	X	
		5/20/2024		X	X	X	
		10/11/2024		X	X	X	
GAA F	CP08R-PZM008	4/25/2023		X	X	X	
		10/18/2023		X	X	X	
		5/22/2024		X	X	X	
		10/9/2024		X	X	X	

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA F	CP08R-PZM034	4/25/2023		X	X	X	
		10/18/2023		X	X	X	
		5/22/2024		X	X	X	
		10/9/2024		X	X	X	
GAA F	CP12-PZM012	4/17/2023		X	X	X	
		10/23/2023		X	X	X	
		5/22/2024		X	X	X	
		10/3/2024		X	X	X	
GAA F	CP12-PZM052	4/17/2023		X	X	X	
		10/23/2023		X	X	X	
		5/22/2024		X	X	X	
		10/4/2024		X	X	X	
GAA F	CP14-PZM009	4/18/2023		X	X	X	
		10/17/2023		X	X	X	
		5/16/2024		X	X	X	
		10/7/2024		X	X	X	
GAA F	CP14-PZM062	4/18/2023		X	X	X	
		10/17/2023		X	X	X	
		5/16/2024		X	X	X	
		10/7/2024		X	X	X	
GAA F	CP16-PZM008	4/19/2023		X	X	X	
		10/13/2023		X	X	X	
		5/16/2024		X	X	X	
		10/4/2024		X	X	X	
GAA F	CP16-PZM035	4/19/2023		X	X	X	
		10/13/2023		X	X	X	
		5/16/2024		X	X	X	
		10/7/2024		X	X	X	
GAA F	CP18R-PZM009	4/25/2023		X	X	X	
		10/19/2023		X	X	X	
		5/22/2024		X	X	X	
		10/7/2024		X	X	X	
GAA F	CP19R-PZM008	4/24/2023		X	X	X	
		10/17/2023		X	X	X	
		5/20/2024		X	X	X	
		10/11/2024		X	X	X	
GAA F	CP20-PZM011	4/24/2023		X	X	X	
		10/19/2023		X	X	X	
		5/22/2024		X	X	X	
		10/11/2024		X	X	X	
		11/4/2024		X	X		X

Appendix B-2 - Monitoring Well Sampling Dates
CPA Groundwater CMS
Sparrows Point, MD

GAA	Well ID	Sample Date	BTEX+N	VOCs	SVOCs	Metals	MNA
GAA F	CP21-PZM004	10/12/2022		X	X	X	
		10/18/2023		X	X	X	
		5/20/2024		X	X	X	
		10/11/2024		X	X	X	

Acronyms:
GAA: Groundwater Assessment Area
BTEX + N: Benzene, Toluene, Ethylbenzene, Xylenes + Naphthalene
VOCs: Volatile Organic Compounds
SVOCs: Semivolatile Organic Compounds (or PAHs [Polycyclic Aromatic Hydrocarbons])
MNA: Monitored Natural Attenuation

APPENDIX C

Appendix C - Groundwater COPC Screening Analysis
CPA Groundwater CMS

Parameter	CAS#	Location of Max Result	Max Detection (ug/L)	Final Flag	Min Detection (ug/L)	Average Detection (ug/L)	Total Samples	Frequency of Detection (%)	Cancer TR=1E-06 (ug/L)	Non-Cancer HQ=0.1 (ug/L)	Exceeds RSL?	MCL	Exceeds MCL?	COPC?	Reasoning
1,1,1-Trichloroethane	71-55-6	B18-083-PZ	5.3		5.3	5.30	146	0.68		800	no	200	no	no	<5% Detection Frequency
1,1-Biphenyl	92-52-4	B18-082-PZ	44.4	J	0.4	5.32	65	41.54	3.9	0.083	YES (C/NC)		no	YES	No MCL, exceeds RSL
1,1-Dichloroethane	75-34-3	B18-071-PZ	5.7		0.23	1.70	146	4.79	2.8	380	YES (C)		no	no	<5% Detection Frequency
1,1-Dichloroethene	75-35-4	B18-071-PZ	7		7.0	7.00	146	0.68		28	no	7	YES	no	<5% Detection Frequency
1,2,3-Trichlorobenzene	87-61-6	B18-080-PZ	0.59	J	0.59	0.59	80	1.25		0.7	no		no	no	<5% Detection Frequency
1,2,4-Trichlorobenzene	120-82-1	B18-080-PZ	0.51	J	0.51	0.51	114	0.88	1.2	0.4	YES (NC)	70	no	no	<5% Detection Frequency
1,2-Dichlorobenzene	95-50-1	CO101-PZM	4.7		0.5	2.70	163	2.45		30	no	600	no	no	<5% Detection Frequency
1,4-Dichlorobenzene	106-46-7	CP19R-PZM008	0.86	J	0.86	0.86	163	0.61	0.48	57	YES (C)	75	no	no	<5% Detection Frequency
1,4-Dioxane	123-91-1	B18-077-PZ	3.6		0.077	0.56	55	54.55	0.46	5.7	YES (C)		no	YES	No MCL, exceeds RSL
2,4,5-Trichlorophenol	95-95-4	CP21-PZM004	1.6	J	1.6	1.60	99	1.01		120	no		no	no	<5% Detection Frequency
2,4,6-Trichlorophenol	88-06-2	CO127-WS25	0.34	J	0.32	0.33	99	2.02	4.1	1.2	no		no	no	<5% Detection Frequency
2,4-Dimethylphenol	105-67-9	B18-082-PZ	277		0.36	16.9	99	47.47		36	YES (NC)		no	YES	No MCL, exceeds RSL
2,4-Dinitrophenol	51-28-5	CO127-WS25	2	J	0.56	1.28	99	2.02		3.9	no		no	no	<5% Detection Frequency
2,4-Dinitrotoluene	121-14-2	B18-044-PZ	23.4		0.22	8.21	99	3.03	0.24	3.8	YES (C/NC)		no	no	<5% Detection Frequency
2,6-Dinitrotoluene	606-20-2	CO128-W514.5	0.58	J	0.26	0.39	99	5.05	0.049	0.57	YES (C/NC)		no	YES	No MCL, exceeds RSL
2-Butanone (MEK)	78-93-3	TS06-PPM008	571		3.1	51.78	144	10.42		560	YES (NC)		no	YES	No MCL, exceeds RSL
2-Chloronaphthalene	91-58-7	SW-086-MWS	3.9		0.97	2.79	99	3.03		75	no		no	no	<5% Detection Frequency
2-Chlorophenol	95-57-8	SW-086-MWS	2		2.0	2.00	99	1.01		9.1	no		no	no	<5% Detection Frequency
2-Hexanone	591-78-6	B18-044-PZ	7.9	J	1.5	3.83	131	2.29		3.8	YES (NC)		no	no	<5% Detection Frequency
2-Methylnaphthalene	91-57-6	B18-044-PZ	582		0.028	45.9	107	79.44		3.6	YES (NC)		no	YES	No MCL, exceeds RSL
2-Methylphenol	95-48-7	B18-082-PZ	584		0.15	18.2	99	55.56		93	YES (NC)		no	YES	No MCL, exceeds RSL
3,3'-Dichlorobenzidine	91-94-1	B18-044-PZ	2.9	J	2.9	2.90	97	1.03	0.13		YES (C)		no	no	<5% Detection Frequency
4-Chloro-3-methylphenol	59-50-7	CO05-PZM006	1.3		1.3	1.30	20	5.00		140	no		no	no	No MCL, does not exceed RSL
4-Chloroaniline	106-47-8	B18-082-PZ	46.9	J	0.31	11.9	80	6.25	0.37	7.6	YES (C/NC)		no	YES	No MCL, exceeds RSL
4-Methyl-2-pentanone (MIBK)	108-10-1	B18-044-PZ	6.3	J	0.64	2.09	146	5.48		630	no		no	no	No MCL, does not exceed RSL
Acenaphthene	83-32-9	CO130-W525	125		0.017	6.67	107	80.37		53	YES (NC)		no	YES	No MCL, exceeds RSL
Acetone	67-64-1	TS06-PPM008	473		1.5	39.4	143	39.86		1,800	no		no	no	No MCL, does not exceed RSL
Acetophenone	98-86-2	B18-082-PZ	68.1		0.35	5.59	65	27.69		190	no		no	no	No MCL, does not exceed RSL
Aluminum	7429-90-5	SW14-PZM004	1,850		4.88	216	55	61.82		2,000	no		no	no	No MCL, does not exceed RSL
Anthracene	120-12-7	CO130-W525	122		0.011	4.64	107	76.64		180	no		no	no	No MCL, does not exceed RSL
Antimony	7440-36-0	CP08R-PZM034	25.96	J	0.16	10.2	56	5.36		0.78	YES (NC)	6	YES	YES	Exceeds MCL
Arsenic	7440-38-2	CP02-PZM007	27.58		0.7143	4.11	56	71.43	0.052	0.6	YES (C/NC)	10	YES	YES	Exceeds MCL
Available Cyanide	57-12-5A	SW-030-MWS	0.63	J	0.63	0.63	1	100.00		0.15	YES (NC)	200	no	no	Does not exceed MCL
Barium	7440-39-3	CP26-MWS	1350		8.286	245	56	100.00		380	YES (NC)	2,000	no	no	Does not exceed MCL
Benz[a]anthracene	56-55-3	CO130-W525	88.7		0.014	3.07	107	51.40	0.03		YES (C)		no	YES	No MCL, exceeds RSL
Benzaldehyde	100-52-7	B18-082-PZ	22.9	J	0.43	3.35	65	15.38	19	190	YES (C)		no	YES	No MCL, exceeds RSL
Benzene	71-43-2	CO18-PZM006 & CO23-PZM046	510,000		0.16	24,496	215	87.91	0.46	3.3	YES (C/NC)	5	YES	YES	Exceeds MCL
Benzo[a]pyrene	50-32-8	CO130-W525	71		0.0093	2.49	106	43.40	0.025	0.6	YES (C/NC)	0	YES	YES	Exceeds MCL
Benzo[b]fluoranthene	205-99-2	CO130-W525	101		0.01	3.14	106	43.40	0.25		YES (C)		no	YES	No MCL, exceeds RSL
Benzo[k]fluoranthene	207-08-9	CO130-W525	45		0.01	2.03	106	35.85	2.5		YES (C)		no	YES	No MCL, exceeds RSL
Beryllium	7440-41-7	B18-070-PZ	1.2		0.26	0.55	56	7.14		2.5	no	4	no	no	Does not exceed MCL
bis(2-chloroethoxy)methane	111-91-1	CO35-PZM056	0.38	J	0.38	0.38	84	1.19		5.9	no		no	no	<5% Detection Frequency
bis(2-Chloroethyl)ether	111-44-4	CP17-PZM013	3.2		0.87	2.04	99	2.02	0.014		YES (C)		no	no	<5% Detection Frequency
bis(2-Ethylhexyl)phthalate	117-81-7	CP19R-PZM008	18		0.2	1.27	99	21.21	5.6	40	YES (C)	6	YES	YES	Exceeds MCL
Bromodichloromethane	75-27-4	CP23-MWI	5.1		0.54	1.83	146	8.22	0.13	38	YES (C)	80	no	no	Does not exceed MCL
Bromomethane	74-83-9	CO104-PZM	2.1		0.81	1.46	146	1.37		0.75	YES (NC)		no	no	<5% Detection Frequency
Cadmium	7440-43-9	CP25-MWI	1.2	J	0.022	0.65	56	30.36		0.92	YES (NC)	5	no	no	Does not exceed MCL
Caprolactam	105-60-2	B18-044-PZ	21	J	0.23	3.49	65	10.77		990	no		no	no	No MCL, does not exceed RSL
Carbon disulfide	75-15-0	CP23-MWI	12.3		0.45	2.25	146	19.86		81	no		no	no	No MCL, does not exceed RSL
Chlorobenzene	108-90-7	CO212-MWS	10.7		1.5	4.80	146	2.05		7.8	YES (NC)	100	no	no	<5% Detection Frequency
Chloroform	67-66-3	CP23-MWI	17.7		0.33	4.17	146	23.29	0.22	0.4	YES (C/NC)	80	no	no	Does not exceed MCL
Chloromethane	74-87-3	CP14-PZM009	1.3	J	0.38	0.73	146	2.05		19	no		no	no	<5% Detection Frequency

Appendix C - Groundwater COPC Screening Analysis
CPA Groundwater CMS

Parameter	CAS#	Location of Max Result	Max Detection (ug/L)	Final Flag	Min Detection (ug/L)	Average Detection (ug/L)	Total Samples	Frequency of Detection (%)	Cancer TR=1E-06 (ug/L)	Non-Cancer HQ=0.1 (ug/L)	Exceeds RSL?	MCL	Exceeds MCL?	COPC?	Reasoning
Chromium	7440-47-3	CP09-PZM010	48.49		0.2018	4.32	54	72.22			no	100	no	no	Does not exceed MCL
Chromium VI	18540-29-9	CO32-PZM041	38.8		0.74	15.6	32	15.63	0.035	4.4	YES (C/NC)		no	YES	No MCL, exceeds RSL
Chrysene	218-01-9	CO130-W525	92		0.015	3.11	106	51.89	25		YES (C)		no	YES	No MCL, exceeds RSL
Cobalt	7440-48-4	B18-070-PZ	59.9		0.1664	10.2	56	19.64		0.6	YES (NC)		no	YES	No MCL, exceeds RSL
Copper	7440-50-8	B18-061-PZ	4.8	J	0.5096	1.83	56	26.79		80	no	1,300	no	no	Does not exceed MCL
Cyanide	57-12-5	SW18-PZM053	380		2.82	46.5	57	63.16		0.15	YES (NC)	200	YES	YES	Exceeds MCL
Cyclohexane	110-82-7	SW-085-MWS	3.8	J	0.3	1.57	80	11.25		1,300	no		no	no	No MCL, does not exceed RSL
Dibenz[a,h]anthracene	53-70-3	B18-044-PZ	2.9	J	0.02	0.45	107	12.15	0.025		YES (C)		no	YES	No MCL, exceeds RSL
Dibromochloromethane	124-48-1	CO127-WS25	2.6		1.9	2.21	146	5.48	0.87	38	YES (C)	80	no	no	Does not exceed MCL
Diethylphthalate	84-66-2	B18-074-PZ	1.4		0.24	0.58	99	9.09		1,500	no		no	no	No MCL, does not exceed RSL
Di-n-butylphthalate	84-74-2	CO126-WS35	0.74	J	0.10	0.48	99	8.08		90	no		no	no	No MCL, does not exceed RSL
Di-n-ocytlphthalate	117-84-0	CP26-MWI	0.84	J	0.67	0.76	84	2.38		20	no		no	no	<5% Detection Frequency
Ethylbenzene	100-41-4	CO93-PZM	1,500		0.17	100	217	74.19	1.5	81	YES (C/NC)	700	YES	YES	Exceeds MCL
Fluoranthene	206-44-0	CO130-W525	232		0.0096	6.04	107	84.11		80	YES (NC)		no	YES	No MCL, exceeds RSL
Fluorene	86-73-7	CO130-W525	133		0.018	10.9	107	84.11		29	YES (NC)		no	YES	No MCL, exceeds RSL
Hexachloroethane	67-72-1	B18-079-PZ	0.72	J	0.72	0.72	99	1.01	0.33	0.62	YES (C/NC)		no	no	<5% Detection Frequency
Indeno[1,2,3-c,d]pyrene	193-39-5	CO130-W525	18.3		0.012	1.39	107	21.50	0.25		YES (C)		no	YES	No MCL, exceeds RSL
Iron	7439-89-6	CP22-MWI	205,000		12.6	10,066	58	70.69		1,400	YES (NC)		no	YES	No MCL, exceeds RSL
Isophorone	78-59-1	B18-044-PZ	3.2	J	0.68	1.94	99	2.02	78	380	no		no	no	<5% Detection Frequency
Isopropylbenzene	98-82-8	CO08A-PZM	22.2		0.15	2.60	95	23.16		45	no		no	no	No MCL, does not exceed RSL
Lead	7439-92-1	CO35-PZM056	6		0.3442	1.79	59	15.25		1.5	YES (NC)	15	no	no	Does not exceed MCL
Manganese	7439-96-5	CP02-PZM026	4115		0.729	443	56	87.50		43	YES (NC)		no	YES	No MCL, exceeds RSL
Mercury	7439-97-6	CP10-PZM008	0.13	J	0.105	0.12	56	3.57		0.063	YES (NC)	2	no	no	<5% Detection Frequency
Methyl Acetate	79-20-9	B18-071-PZ	5.8		0.32	3.91	79	3.80		2,000	no		no	no	<5% Detection Frequency
Methyl tert-butyl ether (MTBE)	1634-04-4	B18-061-PZ	0.47	J	0.19	0.33	144	1.39	14	630	no		no	no	<5% Detection Frequency
Methylene Chloride	75-09-2	CO114-PZM002	10.5		1.2	5.05	146	9.59	11	11	no	5	YES	YES	Exceeds MCL
Naphthalene	91-20-3	CO127-WS25	177,000		0.043	4,741	232	85.78	0.12	0.61	YES (C/NC)		no	YES	No MCL, exceeds RSL
Nickel	7440-02-0	B18-070-PZ	65.7		0.5603	7.49	56	60.71		39	YES (NC)		no	YES	No MCL, exceeds RSL
Nitrobenzene	98-95-3	B18-078-PZ	0.24	J	0.24	0.24	99	1.01	0.14	1.3	YES (C)		no	no	<5% Detection Frequency
N-Nitroso-di-n-propylamine	621-64-7	CO128-W525	1.5	J	1.5	1.50	80	1.25	0.011		YES (C)		no	no	<5% Detection Frequency
N-Nitrosodiphenylamine	86-30-6	B18-044-PZ	35.7		0.22	12.3	65	4.62	12		YES (C)		no	no	<5% Detection Frequency
Pentachlorophenol	87-86-5	CO08-PZM005	1.9	J	0.05	0.75	99	17.17	0.041	2.3	YES (C)	1	YES	YES	Exceeds MCL
Phenol	108-95-2	B18-082-PZ	398		0.21	18.5	99	60.61		580	no		no	no	No MCL, does not exceed RSL
Pyrene	129-00-0	B18-044-PZ	266		0.017	7.21	107	81.31		12	YES (NC)		no	YES	No MCL, exceeds RSL
Pyridine	110-86-1	M-99-34	93.3		0.38	14.1	19	47.37		2	YES (NC)		no	YES	No MCL, exceeds RSL
Selenium	7782-49-2	B18-076-PZ	16.9		2.2	8.46	56	8.93		10	YES (NC)	50	no	no	Does not exceed MCL
Silver	7440-22-4	B18-070-PZ	0.88	J	0.30	0.59	56	3.57		9.4	no		no	no	<5% Detection Frequency
Styrene	100-42-5	CO112-PZM	1040		0.38	123	146	39.73		120	YES (NC)	100	YES	YES	Exceeds MCL
Thallium	7440-28-0	SW-030-MWS	4.8	J	0.057	2.99	56	5.36		0.02	YES (NC)	2	YES	YES	Exceeds MCL
Toluene	108-88-3	CO41-PZM036	94,000		0.21	3,632	217	79.26		110	YES (NC)	1000	YES	YES	Exceeds MCL
Trichloroethene	79-01-6	CT-037-GW-12.5	1	J	1.3	1.30	146	0.68	0.49	0.28	YES (C/NC)	5	no	no	<5% Detection Frequency
Vanadium	7440-62-2	SW18-PZM008	222		0.32	32.88	56	62.50		8.6	YES (NC)		no	YES	No MCL, exceeds RSL
Vinyl chloride	75-01-4	CO103-PZM	0.69	J	0.35	0.52	146	1.37	0	4.4	YES (C)	2	no	no	<5% Detection Frequency
Xylenes	1330-20-7	CO23-PZM046	20,700		0.43	1,232	217	74.65		19	YES (NC)	10000	YES	YES	Exceeds MCL
Zinc	7440-66-6	B18-075-PZ	245		0.64	46.4	56	21.43		600	no		no	no	No MCL, does not exceed RSL

J: The positive result reported for this analyte is a quantitative estimate.

COPC = Constituent of Potential Concern
TR = Target Risk
HQ = Hazard Quotient

C = Compound was identified as a cancer COPC
NC = Compound was identified as a non-cancer COPC

APPENDIX D


CO-057-PW
CO-064-PW
CO-063-PW
SW-01
CO-054-PW
SW-02
CO-066-PW
CO-051-PW
CO-067-PW
SW-03
CO-068-PW
CO-062-PW
CO-061-PW
CO-065-PW
CO-053-PW
CO-056-PW
CO-058-PW
CO-062-PW
CO-055-PW
CO-048-PW and CO-48-SW
CO-049-PW and CO-49-SW
CO-069-PW and CO-69-SW
SW-04
CO-47-SW
CO-070-PW and CO-70-SW
CO-72-SW
CP2025-01
CP2025-07
SW-05
CP2025-02
CP2025-03
SW-19
SW-21
SW-26-1
SW-27
SW-28
SW-22
SW-18
CO-020-PW and SW-20
SW-26
CP2025-08
CO-040-PW
CO-025-PW and SW-25
SW-26-1
SW-17
SW-15-2
CO-016-PW and SW-16
SW-06
CP2025-09
SW-15
SW-07
SW-23
SW-30
SW-08
SW-29
SW-31
SW-15-2
SW-14
SW-24
SW-33
SW-32
CP2025-04
CP2025-05
CP2025-06
SW-13
DU28-B
CO-099-SW
DU28-A
CO-073-PW and CO-073-SW
CO-074-PW and CO-074-SW
DU27-D
SW-12
CO-075-SW
CO-079-PW and CO-079-SW
CO-080-PW
CO-081-SW
CO-086-PW
DU27-B
CO-084-SW
SW-11
CO-087-SW
DU27-A
CO-090-SW
CO-093-SW
DU26-D
CO-095-PW
CO-098-PW and CO-098-SW
DU26-B
SW-10
SW-09
LEGEND
2025 Surface Water and Sediment Sample Location
2025 Surface Water Sample Location
2025 Sediment Sample Location
2024 Sediment Sample Location
2019 Pore Water and Surface Water Sample Location
2019 Pore Water Sample Location
2019 Surface Water Sample Location
2018 Surface Water Sample Location
Parcel Boundary
Coke Point Area CMS
Offshore Sampling Locations
March 14, 2025
Appendix
D
ARM Group LLC
Engineers and Scientists
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306
0
62.5
125
250

APPENDIX D-1


Parcel B4
Parcel B5
Parcel B18
Parcel B10
Parcel B11
Parcel B12
Parcel B13
CO36-PZM043
VOC
Benzene: 20,700
Toluene: 3,200
Xylenes: 826
CO27-PZM046
VOC
Benzene: 175,000
Ethylbenzene: 376
Toluene: 22,100
Xylenes: 4,420
SVOC
Naphthalene: 2,730 J
CO28-PZM048
VOC
Benzene: 183,000
Ethylbenzene: 373
Toluene: 17,700
Xylenes: 6,400
SVOC
Naphthalene: 2,600 J
Inorganic
Arsenic (T): 868
CO29-PZM010
CO30-PZM015
VOC
Benzene: 74,600
Ethylbenzene: 104
Toluene: 5,350
Xylenes: 1,470
CO26-PZM007
VOC
Toluene: 133
CO58-PZM001
VOC
Toluene: 108
CP05-PZM019
CP14-PZM009
CP12-PZM012
CP09-PZM047
Groundwater Sample Location
Coke Point Area
Parcel Boundary
Coke Point Area Groundwater
10x FCV/SCV Exceedances (ug/L)
August 9, 2018
Appendix
D-1
ARM Group Inc.
Earth Resource Engineers and Consultants
0 200 400 800 Feet
EnviroAnalytics Group
ARM Project 180386M-1
Sparrows Point Terminal
Baltimore County, MD
\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\180386M EAG Coke Point Groundwater to Surface Water Assessment\GIS\New PAL Exceedances.mxd



Total Toxic Units in Coke Point Groundwater Samples

July 23, 2018

Appendix D-1

ARM Group Inc.
Earth Resource Engineers and Consultants

EnviroAnalytics Group

ARM Project 180386M-1

Sparrows Point Terminal

Baltimore County, MD

\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\180386M EAG Coke Point Groundwater to Surface Water Assessment\GIS\New PAL Exceedances.mxd



\\COLUMBIADC01\CorpData\Projects\EnviroAnalytics Group\170194M EAG Groundwater Conditions Summary Report\GIS\Proposed GWPWSW.mxd

Total Toxic Units in
Coke Point Sediment Samples
April 20, 2018

Appendix
D-1

ARM Group Inc.
Earth Resource Engineers and Consultants

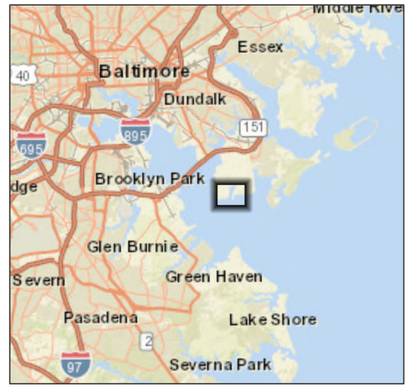
EnviroAnalytics Group

ARM Project 170194M

Sparrows Point Terminal

Baltimore County, MD





Legend

- Remaining Sampling Locations
- Proposed Channel Footprint
- Dredging Unit
- Deepening
- Widening
- Terminal Revetment Area
- Brewerton Channel

Note: Environmental samples were only collected from locations DU26, DU27, and DU28.

0 300 600
Feet

Data Sources: ESRI, Maryland MD iMap
Coordinate System: NAD83 State Plane MD

Sonic Drilling Locations for Widening of West Channel within North Channel Segment (Sediment Surface to -52 ft MLLW)

Appendix D-1

Appendix D-1, Table A1
April / May 2024 Sediment Sampling Results
CPA GW CMS, Sparrows Point, Maryland

ANALYTE	UNITS	EPA Region III BTAG - Marine Sediment	Table 2A - non-narcotic		Table 2b - narcotic		DU-26		DU-27			DU-28	
			EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	SPCT24-DU26-B-WW-BOT-SED	SPCT24-DU26-D-WW-BOT-SED	SPCT24-DU27-A-WW-BOT-SED	SPCT24-DU27-B-WW-BOT-SED	SPCT24-DU27-D-WW-BOT-SED	SPCT24-DU28-A-WW-BOT-SED	SPCT24-DU28-B-WW-BOT-SED
							-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-49.6 to -51.6 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW
VOCs													
1,1,1-TRICHLOROETHANE	µg/kg	856			--	367	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,1,2,2-TETRACHLOROETHANE	µg/kg	202			13	2320	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,1,2-TRICHLOROETHANE	µg/kg	570			--	1545	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,1-DICHLOROETHANE	µg/kg	--			--	1666	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,1-DICHLOROETHENE	µg/kg	2780			2	753	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,2,4-TRICHLOROBENZENE	µg/kg	473			75	485	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,2-DIBROMO-3-CHLOROPROPANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,2-DIBROMOETHANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,2-DICHLOROBENZENE	µg/kg	989			173	477	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,2-DICHLOROETHANE	µg/kg	--			--	1131	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,2-DICHLOROPROPANE	µg/kg	--			--	876	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,3-DICHLOROBENZENE	µg/kg	842			--	468	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
1,4-DICHLOROBENZENE	µg/kg	460			--	468	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
2-BUTANONE (MEK)	µg/kg	--			--	22707	32 U	**8.4 J**	29 U	28 U	33 U	31 U	**16 J**
2-HEXANONE	µg/kg	--			--	7598	32 U	37 U	29 U	28 U	33 U	31 U	35 U
4-METHYL-2-PENTANONE (MIBK)	µg/kg	--			--	8165	32 U	37 U	**2.3 J**	**2 J**	33 U	31 U	35 U
ACETONE	µg/kg	--			--	38133	32 U	**53**	29 U	28 U	33 U	31 U	**140**
BENZENE	µg/kg	137			111	2185	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
DICHLOROBROMOMETHANE	µg/kg	--	2172	--			6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
BROMOFORM	µg/kg	1310	223	--			6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
BROMOMETHANE	µg/kg	--	108	--			6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CARBON DISULFIDE	µg/kg	--			131	1580	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CARBON TETRACHLORIDE	µg/kg	7,240			3.3	706	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CHLOROBENZENE	µg/kg	162			66	939	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CHLOROETHANE	µg/kg	--			--	1178	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CHLOROFORM	µg/kg	--			--	75	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CHLOROMETHANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CIS-1,2-DICHLOROETHENE	µg/kg	--			--	1135	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CIS-1,3-DICHLOROPROPENE	µg/kg	--	34.7	75			6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CYCLOHEXANE	µg/kg	--	--	278			6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
CHLORODIBROMOMETHANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
DICHLORODIFLUOROMETHANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
ETHYLBENZENE	µg/kg	305			119	1467	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U

Appendix D-1, Table A1
April / May 2024 Sediment Sampling Results
CPA GW CMS, Sparrows Point, Maryland

ANALYTE	UNITS	EPA Region III BTAG - Marine Sediment	Table 2A - non-narcotic		Table 2b - narcotic		DU-26		DU-27			DU-28	
			EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	SPCT24-DU26-B-WW-BOT-SED	SPCT24-DU26-D-WW-BOT-SED	SPCT24-DU27-A-WW-BOT-SED	SPCT24-DU27-B-WW-BOT-SED	SPCT24-DU27-D-WW-BOT-SED	SPCT24-DU28-A-WW-BOT-SED	SPCT24-DU28-B-WW-BOT-SED
							-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-49.6 to -51.6 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW
ISOPROPYLBENZENE	µg/kg	--			--	713	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
METHYL ACETATE	µg/kg	--	--	--	--	--	32 U	37 U	29 U	28 U	33 U	31 U	35 U
METHYL TERT-BUTYL ETHER	µg/kg	--			2081	4433	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
METHYLCYCLOHEXANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
METHYLENE CHLORIDE	µg/kg	--			667	2404	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
STYRENE	µg/kg	7070			--	1621	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
TETRACHLOROETHENE	µg/kg	190			11	415	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
TOLUENE	µg/kg	1090			568	2074	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
TRANS-1,2-DICHLOROETHENE	µg/kg	--			--	1135	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
TRANS-1,3-DICHLOROPROPENE	µg/kg	--	34.7	75			6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
TRICHLOROETHENE	µg/kg	8950			73	692	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
TRICHLOROFLUOROMETHANE	µg/kg	--	--	--	--	--	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
VINYL CHLORIDE	µg/kg	--			--	1178	6.5 U	7.4 U	5.8 U	5.5 U	6.5 U	6.1 U	7.1 U
XYLENES, TOTAL	µg/kg	--			--	1074	13 U	15 U	12 U	11 U	13 U	12 U	14 U
SVOCs													
1,2,4-TRICHLOROBENZENE	µg/kg	473			75	485	23 U	26 U	20 U	19 U	23 U	20 U	25 U
1,2-DICHLOROBENZENE	µg/kg	989			173	477	23 U	26 U	20 U	19 U	23 U	20 U	25 U
1,2-DIPHENYLHYDRAZINE(AS AZOBENZENE	µg/kg	--	--	106			23 U	26 U	20 U	19 U	23 U	20 U	25 U
1,3-DICHLOROBENZENE	µg/kg	842			--	468	23 U	26 U	20 U	19 U	23 U	20 U	25 U
1,4-DICHLOROBENZENE	µg/kg	460			--	468	23 U	26 U	20 U	19 U	23 U	20 U	25 U
2,2'-OXYBIS[1-CHLOROPROPANE]	µg/kg		--	--	--	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
2,4,6-TRICHLOROPHENOL	µg/kg	2,650	117	1,964			23 U	26 U	20 U	19 U	23 U	20 U	25 U
2,4-DICHLOROPHENOL	µg/kg	--			--	1,886	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
2,4-DIMETHYLPHENOL	µg/kg	--	29	504			23 U	26 U	20 U	19 U	23 U	20 U	25 U
2,4-DINITROPHENOL	µg/kg	--	45	2,961			230 U	260 U	200 U	190 U	230 U	200 U	250 U
2,4-DINITROTOLUENE	µg/kg	--	29	114			23 U	26 U	20 U	19 U	23 U	20 U	25 U
2,6-DINITROTOLUENE	µg/kg	--	--	131			23 U	26 U	20 U	19 U	23 U	20 U	25 U
2-CHLORONAPHTHALENE	µg/kg	--	--	--	--	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
2-CHLOROPHENOL	µg/kg	344	885	2,302			23 U	26 U	20 U	19 U	23 U	20 U	25 U
2-METHYLPHENOL	µg/kg	--	63	1,773			23 U	26 U	20 U	19 U	23 U	20 U	25 U
2-NITROPHENOL	µg/kg	--	2,070	3,589			23 U	26 U	20 U	19 U	23 U	20 U	25 U
3,3'-DICHLOROBENZIDINE	µg/kg	2,060	--	90			23 U	26 U	20 U	19 U	23 U	20 U	25 U
4,6-DINITRO-2-METHYLPHENOL	µg/kg	--	1,477	2,304			120 U	130 U	100 U	99 U	120 U	100 U	130 U
4-BROMOPHENYL PHENYL ETHER	µg/kg	--			--	62	23 U	26 U	20 U	19 U	23 U	20 U	25 U
4-CHLORO-3-METHYLPHENOL	µg/kg	--	1,257	2,035			23 U	26 U	20 U	19 U	23 U	20 U	25 U

Appendix D-1, Table A1
April / May 2024 Sediment Sampling Results
CPA GW CMS, Sparrows Point, Maryland

ANALYTE	UNITS	EPA Region III BTAG - Marine Sediment	Table 2A - non-narcotic		Table 2b - narcotic		DU-26		DU-27			DU-28	
			EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	SPCT24-DU26-B-WW-BOT-SED	SPCT24-DU26-D-WW-BOT-SED	SPCT24-DU27-A-WW-BOT-SED	SPCT24-DU27-B-WW-BOT-SED	SPCT24-DU27-D-WW-BOT-SED	SPCT24-DU28-A-WW-BOT-SED	SPCT24-DU28-B-WW-BOT-SED
							-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-49.6 to -51.6 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW
4-CHLOROPHENYL PHENYL ETHER	µg/kg	--					23 U	26 U	20 U	19 U	23 U	20 U	25 U
4-NITROPHENOL	µg/kg	--	1,579	4,105			120 U	130 U	100 U	99 U	120 U	100 U	130 U
BENZIDINE	µg/kg	--	--	17			460 U	520 U	410 U	390 U	460 U	410 U	500 U
BENZOIC ACID	µg/kg	--			--	2,000	120 U	130 U	100 U	99 U	120 U	100 U	130 U
BENZYL ALCOHOL	µg/kg	--			522	6,729	110 U	130 U	100 U	98 U	120 U	100 U	130 U
BIS(2-CHLOROETHOXY)METHANE	µg/kg	--	--	--	--	--	23 U	26 U	20 U	19 U	23 U	20 U	25 U
BIS(2-CHLOROETHYL)ETHER	µg/kg	--	--	8163			4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
BIS(2-ETHYLHEXYL) PHTHALATE	µg/kg	182			182	2,647	230 U	260 U	200 U	190 U	230 U	200 U	250 U
BUTYL BENZYL PHTHALATE	µg/kg	16,800			--	481	110 U	130 U	100 U	98 U	120 U	100 U	130 U
DIBENZOFURAN	µg/kg	7,300			--	2,313	23 U	26 U	20 U	19 U	23 U	20 U	25 U
DIETHYL PHTHALATE	µg/kg	218			80	1,105	23 U	26 U	20 U	19 U	23 U	20 U	25 U
DIMETHYL PHTHALATE	µg/kg	--			530	2,031	46 U	52 U	41 U	39 U	46 U	41 U	50 U
DI-N-BUTYL PHTHALATE	µg/kg	1,160			--	319	230 U	260 U	200 U	190 U	230 U	200 U	250 U
DI-N-OCTYL PHTHALATE	µg/kg	--			580	45,000	23 U	26 U	20 U	19 U	23 U	20 U	25 U
HEXACHLOROBENZENE	µg/kg	--	10	23			4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
HEXACHLOROBUTADIENE	µg/kg	--	--	--	--	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
HEXACHLOROCYCLOPENTADIENE	µg/kg	139	1	130			23 U	26 U	20 U	19 U	23 U	20 U	25 U
HEXACHLOROETHANE	µg/kg	804			--	75	23 U	26 U	20 U	19 U	23 U	20 U	25 U
ISOPHORONE	µg/kg	--			--	948	23 U	26 U	20 U	19 U	23 U	20 U	25 U
METHYLPHENOL, 3 & 4	µg/kg	--	670	714			23 U	26 U	20 U	19 U	23 U	20 U	**15 J**
NITROBENZENE	µg/kg	--			1,853	9,007	45 U	52 U	41 U	39 U	46 U	41 U	50 U
N-NITROSODIMETHYLAMINE	µg/kg	--	--	--	--	--	23 U	26 U	20 U	19 U	23 U	20 U	25 U
N-NITROSODI-N-PROPYLAMINE	µg/kg	--	--	--	--	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
N-NITROSODIPHENYLAMINE	µg/kg	422,000			211	370	23 U	26 U	20 U	19 U	23 U	20 U	25 U
PENTACHLOROPHENOL	µg/kg	7,970	360	394			120 U	130 U	100 U	99 U	120 U	100 U	130 U
PHENOL	µg/kg	--	63	420			23 U	26 U	20 U	19 U	**13 J**	20 U	**16 J**
LOW MOLECULAR WEIGHT PAHs (LPAH)													
1-METHYLNAPHTHALENE	µg/kg	--			--	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
2-METHYLNAPHTHALENE	µg/kg	20.2			20.2	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
ACENAPHTHENE	µg/kg	6.71			6.70	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
ACENAPHTHYLENE	µg/kg	5.87			5.90	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
ANTHRACENE	µg/kg	46.9			47.0	--	**3.4 J**	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
FLUORENE	µg/kg	21.2			21.0	--	4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
NAPHTHALENE	µg/kg	34.6			35.0	--	4.6 U	**1.2 J**	4.1 U	3.9 U	4.6 U	4.1 U	5 U
PHENANTHRENE	µg/kg	86.7			87.0	--	**2.4 J**	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U

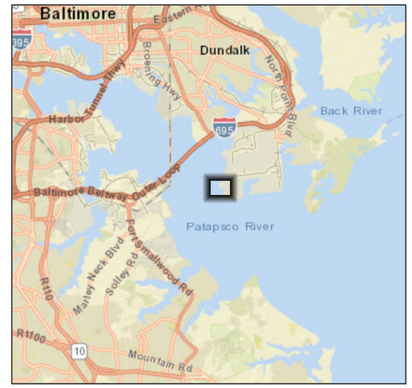
Appendix D-1, Table A1
April / May 2024 Sediment Sampling Results
CPA GW CMS, Sparrows Point, Maryland

ANALYTE	UNITS	EPA Region III BTAG - Marine Sediment	Table 2A - non-narcotic		Table 2b - narcotic		DU-26		DU-27			DU-28	
			EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	SPCT24-DU26-B-WW-BOT-SED	SPCT24-DU26-D-WW-BOT-SED	SPCT24-DU27-A-WW-BOT-SED	SPCT24-DU27-B-WW-BOT-SED	SPCT24-DU27-D-WW-BOT-SED	SPCT24-DU28-A-WW-BOT-SED	SPCT24-DU28-B-WW-BOT-SED
							-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-49.6 to -51.6 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW	-50 to -52 ft MLLW
TOTAL LPAHs (ND=0)	µg/kg				312.0		**5.8**	**1.2**	0	0	0	0	0
TOTAL LPAHs (ND=1/2RL)	µg/kg				312.0		**19.6**	**19.4**	**16.8**	**16**	**18.4**	**16.8**	**20**
TOTAL LPAHs (ND=RL)	µg/kg				312.0		**33.4**	**37.6**	**32.8**	**31.2**	**36.8**	**32.8**	**40**
HIGH MOLECULAR WEIGHT PAHs (HPAH)													
BENZO(A)ANTHRACENE	µg/kg	74.8			75		4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
BENZO(A)PYRENE	µg/kg	88.8			89		4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
BENZO(B)FLUORANTHENE	µg/kg	--			--		4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
BENZO(GHI)PERYLENE	µg/kg	--			310		4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
BENZO(K)FLUORANTHENE	µg/kg	--			--		4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
CHRYSENE	µg/kg	108			108		**2.8 J**	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
DIBENZO(A,H)ANTHRACENE	µg/kg	6.22			6.2		4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
FLUORANTHENE	µg/kg	113			113		**3.4 J**	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
INDENO(1,2,3-CD)PYRENE	µg/kg	--			340		4.6 U	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
PYRENE	µg/kg	153			153		**2.3 J**	5.2 U	4.1 U	3.9 U	4.6 U	4.1 U	5 U
TOTAL HPAHs (ND=0)	µg/kg				655.0		**8.5**	0	0	0	0	0	0
TOTAL HPAHs (ND=1/2RL)	µg/kg				655.0		**24.6**	**26**	**21**	**20**	**23**	**21**	**25**
TOTAL HPAHs (ND=RL)	µg/kg				655		**40.7**	**52**	**41**	**39**	**46**	**41**	**50**
TOTAL PAHs													
TOTAL PAHs (ND=0)	µg/kg				1684		**14.3**	**1.2**	0	0	0	0	0
TOTAL PAHs (ND=1/2RL)	µg/kg				1684		**44.2**	**45.4**	**37.8**	**36**	**41.4**	**37.8**	**45**
TOTAL PAHs (ND=RL)	µg/kg				1684		**74.1**	**89.6**	**73.8**	**70.2**	**82.8**	**73.8**	**90**

Bold values represent detected concentrations.
Red bold values represent exceedances of applicable screening levels.

References:
EPA Region III - Marine = EPA Region III BTAG Marine
EPA Region IV = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018.
Table 2a, Region 4 Sediment Screening Values for Hazardous Waste Sites, Non-narcotic, Marine
Table 2b, Region 4 Sediment Screening Values for Hazardous Waste Sites, Narcotic, Marine





Legend

- Sediment Sample Location
- Surface Water Sample Location
- Well Location
- ARM 2018 Surface Water Sample Locations
- SubSurface Sediment; 2009-2010 Site Assessment
- Surface Sediment; 2003 Recon Study
- Surface Sediment; 2009-2010 Site Assessment
- Sparrows Point

Note: In 2025, pore water samples were attempted at all surface water locations, but no samples were able to be collected.

0 150 300
Feet

Data Sources: ESRI
Coordinate System: NAD83 State Plane MD

Coke Point Actual Sample Locations

Appendix D-1

Appendix D-1, Table A2
February 2025 Sediment Sampling Results
CPA GW CMS, Sparrows Point, Maryland

ANALYTE	UNITS	EPA Region III BTAG - Marine Sediment	Table 2A - non-narcotic		Table 2b - narcotic		CP2025-04-SD	CP2025-07-SD
			EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	2/12/2025	2/10/2025
VOCs								
1,1,1-TRICHLOROETHANE	µg/kg	856			--	367	1 U	0.8 U
1,1,2,2-TETRACHLOROETHANE	µg/kg	202			13	2320	1 U	0.8 U
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	µg/kg	--	--	--	--	--	8 U	6.0 U
1,1,2-TRICHLOROETHANE	µg/kg	570			--	1545	2 U	1.5 U
1,1-DICHLOROETHANE	µg/kg	--			--	1666	2 U	1.5 U
1,1-DICHLOROETHENE	µg/kg	2780			2	753	2 U	1.5 U
1,2,3-TRICHLOROBENZENE	µg/kg	--			71	495	4 U	3.0 U
1,2,4-TRICHLOROBENZENE	µg/kg	473			75	485	4 U	3.0 U
1,2-DIBROMO-3-CHLOROPROPANE	µg/kg	--	--	--	--	--	4 U	4.5 U
1,2-DIBROMOETHANE	µg/kg	--	--	--	--	--	1 U	0.8 U
1,2-DICHLOROBENZENE	µg/kg	989			173	477	4 U	3.0 U
1,2-DICHLOROETHANE	µg/kg	--			--	1131	2 U	1.5 U
1,2-DICHLOROPROPANE	µg/kg	--			--	876	2 U	1.5 U
1,3-DICHLOROBENZENE	µg/kg	842			--	468	4 U	3.0 U
1,3-DICHLOROPROPENE, TOTAL	µg/kg	7.31	34.7	75			1 U	0.8 U
1,4-DICHLOROBENZENE	µg/kg	460			--	468	4 U	3.0 U
2-BUTANONE (MEK)	µg/kg	--			--	22707	**15 J**	15 U
2-HEXANONE	µg/kg	--			--	7598	20 U	15 U
4-METHYL-2-PENTANONE (MIBK)	µg/kg	--			--	8165	20 U	15 U
ACETONE	µg/kg	--			--	38133	**67**	37 U
BENZENE	µg/kg	137			111	2185	1 U	0.8 U
DICHLOROBROMOMETHANE	µg/kg	--	2172	--			1 U	0.8 U
BROMOFORM	µg/kg	1310	223	--			8 U	6.0 U
BROMOMETHANE	µg/kg	--	108	--			4 U	3.0 U
CARBON DISULFIDE	µg/kg	--			131	1580	20 U	15 U
CARBON TETRACHLORIDE	µg/kg	7,240			3.3	706	2 U	1.5 U
CHLOROBENZENE	µg/kg	162			66	939	1 U	0.8 U
CHLOROETHANE	µg/kg	--			--	1178	4 U	3.0 U
CHLOROFORM	µg/kg	--			--	75	3 U	2.2 U
CHLOROMETHANE	µg/kg	--	--	--	--	--	8 U	6.0 U
CIS-1,2-DICHLOROETHENE	µg/kg	--			--	1135	2 U	1.5 U
CIS-1,3-DICHLOROPROPENE	µg/kg	--	34.7	75			1 U	0.8 U
CYCLOHEXANE	µg/kg	--	--	278			20 U	15 U
CHLORODIBROMOMETHANE	µg/kg	--	--	--	--	--	2 U	1.5 U
DICHLORODIFLUOROMETHANE	µg/kg	--	--	--	--	--	20 U	15 U
ETHYLBENZENE	µg/kg	305			119	1467	2 U	**0.23 J**
ISOPROPYLBENZENE	µg/kg	--			--	713	2 U	1.5 U
METHYL ACETATE	µg/kg	--	--	--	--	--	8 U	6.0 U

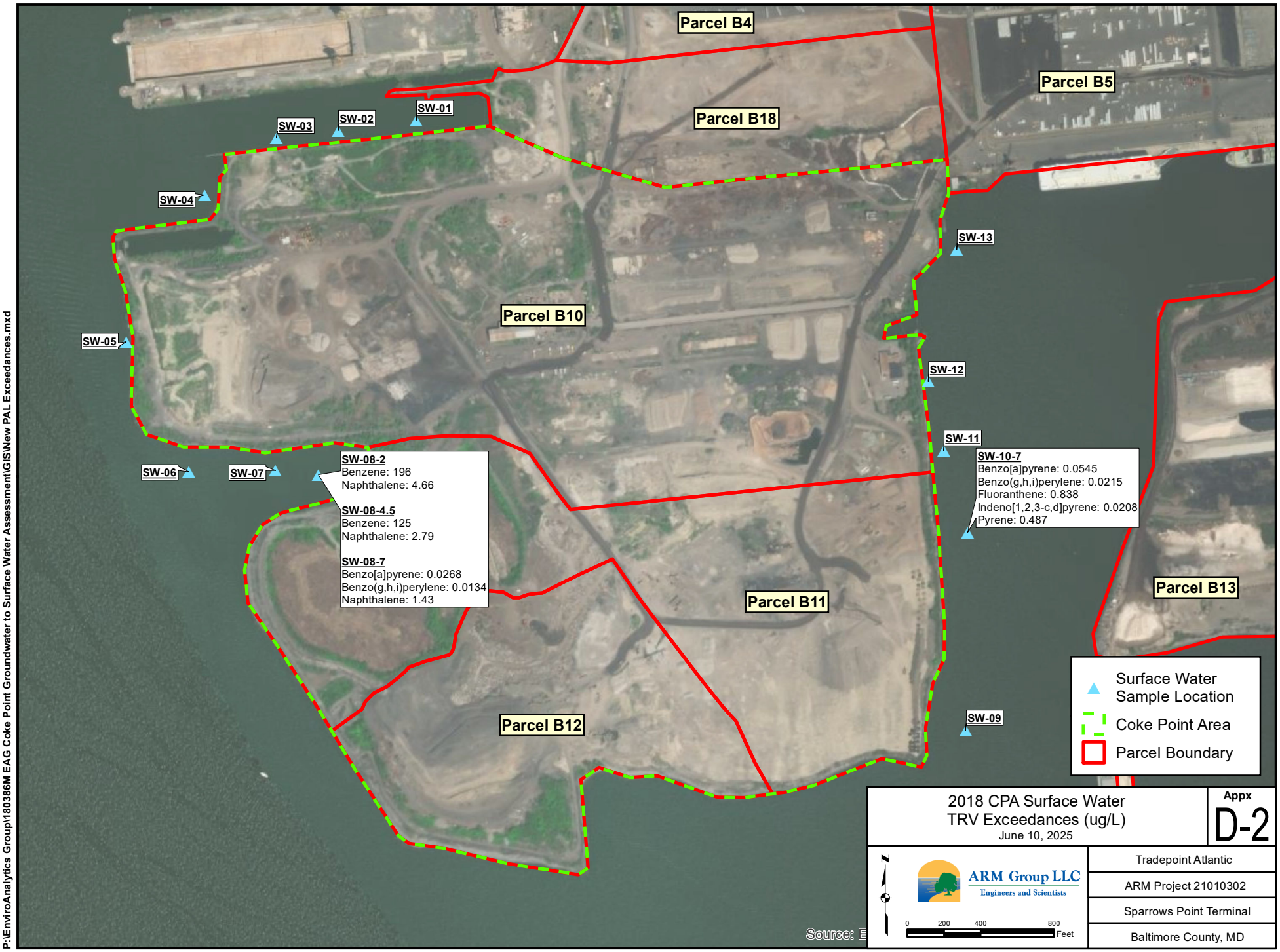
Appendix D-1, Table A2
February 2025 Sediment Sampling Results
CPA GW CMS, Sparrows Point, Maryland

ANALYTE	UNITS	EPA Region III BTAG - Marine Sediment	Table 2A - non-narcotic		Table 2b - narcotic		CP2025-04-SD	CP2025-07-SD
			EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	EPA Region IV - Marine Sediment ESV	EPA Region IV - Marine Sediment RSV	2/12/2025	2/10/2025
METHYL TERT-BUTYL ETHER	µg/kg	--			2081	4433	4 U	3.0 U
METHYLENE CHLORIDE	µg/kg	--			667	2404	10 U	7.5 U
STYRENE	µg/kg	7070			--	1621	2 U	1.5 U
TETRACHLOROETHENE	µg/kg	190			11	415	1 U	0.8 U
TOLUENE	µg/kg	1090			568	2074	2 U	1.5 U
TRANS-1,2-DICHLOROETHENE	µg/kg	--			--	1135	3 U	2.2 U
TRANS-1,3-DICHLOROPROPENE	µg/kg	--	34.7	75			2 U	1.5 U
TRICHLOROETHENE	µg/kg	8950			73	692	1 U	0.8 U
TRICHLOROFLUOROMETHANE	µg/kg	--	--	--	--	--	8 U	6.0 U
VINYL CHLORIDE	µg/kg	--			--	1178	2 U	1.5 U
XYLENES, TOTAL	µg/kg	--			--	1074	2 U	1.5 U
PAHs								
2-METHYLNAPHTHALENE	µg/kg	20.2			20.2	--	**9,950**	**6,910**
ACENAPHTHENE	µg/kg	6.71			6.70	--	**29,700**	**985**
ACENAPHTHYLENE	µg/kg	5.87			5.90	--	**62,700**	**1,660**
ANTHRACENE	µg/kg	46.9			47.0	--	**121,000**	**2,540**
BENZO(A)ANTHRACENE	µg/kg	74.8			75		**235,000**	**5,440**
BENZO(A)PYRENE	µg/kg	88.8			89		**268,000**	**7,200**
BENZO(B)FLUORANTHENE	µg/kg	--			--		**267,000**	**6,190**
BENZO(GHI)PERYLENE	µg/kg	--			310		**152,000**	**4,210**
BENZO(K)FLUORANTHENE	µg/kg	--			--		**178,000**	**5,160**
CHRYSENE	µg/kg	108			108		**249,000**	**5,370**
DIBENZO(A,H)ANTHRACENE	µg/kg	6.22			6.2		**41,400**	**1,020**
FLUORANTHENE	µg/kg	113			113		**559,000**	**9,270**
FLUORENE	µg/kg	21.2			21.0	--	**12,000**	**1,220**
INDENO(1,2,3-CD)PYRENE	µg/kg	--			340		**171,000**	**4,470**
NAPHTHALENE	µg/kg	34.6			35.0	--	**181,000**	**190,000 E**
PHENANTHRENE	µg/kg	86.7			87.0	--	**77,400**	**5,320**
PYRENE	µg/kg	153			153		**363,000**	**7,190**

Bold values represent detected concentrations.
Red bold values represent exceedances of applicable screening levels.

References:
EPA Region III - Marine = EPA Region III BTAG Marine
EPA Region IV = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018.
Table 2a, Region 4 Sediment Screening Values for Hazardous Waste Sites, Non-narcotic, Marine
Table 2b, Region 4 Sediment Screening Values for Hazardous Waste Sites, Narcotic, Marine

APPENDIX D-2


Parcel B4
Parcel B5
Parcel B18
Parcel B10
Parcel B11
Parcel B12
Parcel B13
SW-01
SW-02
SW-03
SW-04
SW-05
SW-06
SW-07
SW-08-2
Benzene: 196
Naphthalene: 4.66
SW-08-4.5
Benzene: 125
Naphthalene: 2.79
SW-08-7
Benzo[a]pyrene: 0.0268
Benzo(g,h,i)perylene: 0.0134
Naphthalene: 1.43
SW-09
SW-10-7
Benzo[a]pyrene: 0.0545
Benzo(g,h,i)perylene: 0.0215
Fluoranthene: 0.838
Indeno[1,2,3-c,d]pyrene: 0.0208
Pyrene: 0.487
SW-11
SW-12
SW-13
Surface Water Sample Location
Coke Point Area
Parcel Boundary
2018 CPA Surface Water TRV Exceedances (ug/L)
June 10, 2025
Appx D-2
ARM Group LLC
Engineers and Scientists
0 200 400 800 Feet
Tradepoint Atlantic
ARM Project 21010302
Sparrows Point Terminal
Baltimore County, MD
P:\EnviroAnalytics Group\180386M EAG Coke Point Groundwater to Surface Water Assessment\GIS\New PAL Exceedances.mxd

Appendix D-2, Table A1
May 2018 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	SW-01-2	SW-01-9.5	SW-01-19	SW-02-2	SW-02-12	SW-02-22	SW-03-2	SW-03-12.5	SW-03-23	SW-04-2
				5/22/18	5/22/18	5/22/18	5/22/18	5/22/18	5/22/18	5/22/18	5/22/18	5/22/18	5/22/18
Volatile Organic Compounds													
2-Butanone (MEK)	µg/L	65,695	EPA Region IV - SW	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	µg/L	117,629	EPA Region IV - SW	**3.8 J**	**3.5 J**	**3.1 J**	**4.4 J**	**4.4 J**	**3.7 J**	**4.8 J**	**6.1 J**	**9.6 J**	**2.9 J**
Benzene	µg/L	110	EPA Region IV - SW	**13.1**	**2.4**	1 U	**15.7**	**14.4**	1 U	**11**	**11.1**	1 U	**6.6**
Bromodichloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	**1**	1 U	1 U	1 U
Bromomethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	471	EPA Region IV - SW	1 U	**0.43 J**	1 U	**1.7**	**0.89 J**	1 U	**2.1**	1 U	1 U	1 U
Chloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	µg/L	25	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	412	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	215	EPA Region IV - SW	**4.4**	**0.47 J**	1 U	**3.3**	**2.2**	1 U	**2.2**	**2**	1 U	**1.1**
Trichloroethene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes	µg/L	260	EPA Region IV - SW	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Semi-Volatile Organic Compounds													
Acenaphthene	µg/L	15	EPA Region IV - SW	**0.0191**	**0.0167**	**0.00371 J**	**0.0183**	**0.0158**	**0.00285 J**	**0.0146**	**0.0141**	**0.00281 J**	**0.0119**
Acenaphthylene	µg/L	28	EPA Region IV - SW	**0.0264**	**0.0157**	**0.00536 J**	**0.0325**	**0.022**	**0.00302 J**	**0.0172**	**0.0222**	**0.00281 J**	**0.0148**
Anthracene	µg/L	0.43	EPA Region IV - SW	**0.00844 J**	**0.00782 J**	**0.00691 J**	**0.00839 J**	**0.00598 J**	**0.00358 J**	**0.00622 J**	**0.00641 J**	**0.00317 J**	**0.0062 J**
Benz[a]anthracene	µg/L	0.35	EPA Region IV - SW	**0.00383 J**	**0.0046 J**	**0.00868 J**	**0.00346 J**	**0.00272 J**	**0.0062 J**	**0.00358 J**	**0.00321 J**	**0.0064 J**	**0.00215 J**
Benzo[a]pyrene	µg/L	0.02	EPA Region IV - SW	**0.00479 J**	**0.006 J**	**0.0138**	**0.00405 J**	**0.00346 J**	**0.00867 J**	**0.00301 J**	**0.00518 J**	**0.0088 J**	**0.00304 J**
Benzo[b]fluoranthene	µg/L	0.06	EPA Region IV - SW	**0.00548 J**	**0.00617 J**	**0.0135**	**0.00438 J**	**0.00383 J**	**0.00778 J**	**0.00402 J**	**0.00516 J**	**0.00831 J**	**0.00358 J**
Benzo[g,h,i]perylene	µg/L	0.012	EPA Region IV - SW	**0.0036 J**	**0.00408 J**	**0.00941 J**	**0.00267 J**	0.01 U	**0.00586 J**	0.01 U	**0.0033 J**	**0.00543 J**	0.01 U
Chrysene	µg/L	0.35	EPA Region IV - SW	**0.00559 J**	**0.00628 J**	**0.0119**	**0.00464 J**	**0.00401 J**	**0.00754 J**	**0.00461 J**	**0.00485 J**	**0.0069 J**	**0.00355 J**
Fluoranthene	µg/L	0.82	EPA Region IV - SW	**0.0254**	**0.0336**	**0.0317**	**0.0236**	**0.0209**	**0.0211**	**0.0233**	**0.0224**	**0.0192**	**0.0175**
Fluorene	µg/L	24	EPA Region IV - SW	**0.0284**	**0.0223**	**0.00458 J**	**0.0278**	**0.0221**	**0.00336 J**	**0.0205**	**0.0202**	**0.00307 J**	**0.0162**
Indeno[1,2,3-c,d]pyrene	µg/L	0.012	EPA Region IV - SW	**0.00366 J**	**0.00371 J**	**0.00794 J**	**0.00304 J**	**0.0025 J**	**0.00494 J**	**0.00262 J**	**0.00334 J**	**0.00476 J**	**0.00258 J**
Naphthalene	µg/L	1.40	EPA Region III - Marine	**0.238**	**0.0331**	**0.0444**	**0.597**	**0.12**	**0.0233**	**0.13**	**0.156**	**0.0216**	**0.538**
Phenanthrene	µg/L	4.6	EPA Region IV - SW	**0.0383**	**0.0209**	**0.0122**	**0.0402**	**0.0297**	**0.00904 J**	**0.0276**	**0.0263**	**0.00852 J**	**0.0239**
Pyrene	µg/L	0.11	EPA Region IV - SW	**0.0168**	**0.0236**	**0.0257**	**0.0174**	**0.014**	**0.0187**	**0.0182**	**0.0153**	**0.0176**	**0.0121**
Other													
Available Cyanide	µg/L	1.00	NRWQC	2 U	2 U	2 U	0.55 B	2 U	2 U	2 U	2 U	2 U	2 U
Total Cyanide	µg/L	1.00	NRWQC	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.

Source References:
NRWQC = USEPA National Recommended Water Quality Criteria (2014)
EPA Region IV SW = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018. Table 1a, Region 4 Surface Water Screening Values for Hazardous Waste Sites, Saltwater, Chronic

EPA Region III - Marine = EPA Region III BTAG Marine Screening

Appendix D-2, Table A1
May 2018 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	SW-04-5.5	SW-04-9	SW-05-2	SW-05-7	SW-05-12	SW-06-2	SW-06-6.5	SW-06-11	SW-07-2	SW-07-6
				5/22/18	5/22/18	5/22/18	5/22/18	5/22/18	5/23/18	5/23/18	5/23/18	5/23/18	5/23/18
Volatile Organic Compounds													
2-Butanone (MEK)	µg/L	65,695	EPA Region IV - SW	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	µg/L	117,629	EPA Region IV - SW	**4 J**	**5.4 J**	**4.4 J**	**5.8 J**	**7.2 J**	7 B	4.1 B	4.4 B	4.7 B	5.3 B
Benzene	µg/L	110	EPA Region IV - SW	**2.5**	**4.8**	1 U	1 U	1 U	**2.5**	**1.9**	**1.4**	**18.2**	**3.1**
Bromodichloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	0.8 B	1 UJ	1 UJ	1 UJ	1 UJ
Carbon disulfide	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	471	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	**1.1**	1 U	1 U	1 U
Cyclohexane	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	µg/L	25	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	412	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	215	EPA Region IV - SW	1 U	**0.83 J**	1 U	1 U	1 U	1 U	1 U	1 U	**1.6**	1 U
Trichloroethene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes	µg/L	260	EPA Region IV - SW	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Semi-Volatile Organic Compounds													
Acenaphthene	µg/L	15	EPA Region IV - SW	**0.00472 J**	**0.00907 J**	**0.00439 J**	**0.00444 J**	**0.00515 J**	**0.0172**	**0.0181**	**0.00943 J**	**0.0271**	**0.0333**
Acenaphthylene	µg/L	28	EPA Region IV - SW	**0.00428 J**	**0.00782 J**	**0.00362 J**	**0.00396 J**	**0.00624 J**	0.00695 B	0.0072 B	0.00518 B	**0.0302**	**0.01**
Anthracene	µg/L	0.43	EPA Region IV - SW	**0.00252 J**	**0.00565 J**	**0.00235 J**	**0.00244 J**	**0.0077 J**	**0.00613 J**	**0.00775 J**	**0.00748 J**	**0.011**	**0.0109**
Benz[a]anthracene	µg/L	0.35	EPA Region IV - SW	**0.00153 J**	**0.00562 J**	**0.0023 J**	**0.00191 J**	**0.0124**	**0.004 J**	**0.00709 J**	**0.012**	**0.00452 J**	**0.0093 J**
Benzo[a]pyrene	µg/L	0.02	EPA Region IV - SW	**0.00268 J**	**0.00678 J**	**0.00311 J**	**0.00302 J**	**0.0189**	**0.0046 J**	**0.00827 J**	**0.0194**	**0.0045 J**	**0.011**
Benzo[b]fluoranthene	µg/L	0.06	EPA Region IV - SW	**0.00259 J**	**0.00642 J**	**0.00317 J**	**0.00359 J**	**0.0177**	**0.00478 J**	**0.00773 J**	**0.0149**	**0.00462 J**	**0.00941 J**
Benzo[g,h,i]perylene	µg/L	0.012	EPA Region IV - SW	0.01 U	**0.0044 J**	0.01 U	0.01 U	**0.0104**	**0.00327 J**	**0.00507 J**	**0.0112**	**0.00285 J**	**0.00607 J**
Chrysene	µg/L	0.35	EPA Region IV - SW	**0.00299 J**	**0.00586 J**	**0.0033 J**	**0.00293 J**	**0.0145**	**0.00538 J**	**0.00807 J**	**0.014**	**0.00496 J**	**0.0109**
Fluoranthene	µg/L	0.82	EPA Region IV - SW	**0.0108**	**0.026**	**0.013**	**0.012**	**0.0406**	**0.0233**	**0.0333**	**0.0434**	**0.0264**	**0.0447**
Fluorene	µg/L	24	EPA Region IV - SW	**0.00539 J**	**0.00952 J**	**0.00576 J**	**0.00595 J**	**0.00536 J**	**0.0172**	**0.0155**	**0.00684 J**	**0.0403**	**0.0209**
Indeno[1,2,3-c,d]pyrene	µg/L	0.012	EPA Region IV - SW	0.01 U	**0.0037 J**	0.01 U	0.01 U	**0.00972 J**	**0.00309 J**	**0.0041 J**	**0.00908 J**	0.01 U	**0.00497 J**
Naphthalene	µg/L	1.40	EPA Region III - Marine	**0.118**	**0.167**	**0.0871**	**0.104**	**0.13**	**0.14**	**0.112**	**0.0649**	**0.776**	**0.236**
Phenanthrene	µg/L	4.6	EPA Region IV - SW	**0.00952 J**	**0.0154**	**0.00911 J**	**0.00943 J**	**0.016**	**0.0315**	**0.0245**	**0.0147**	**0.0616**	**0.0385**
Pyrene	µg/L	0.11	EPA Region IV - SW	**0.00762 J**	**0.0178**	**0.00948 J**	**0.00894 J**	**0.0364**	**0.0152**	**0.0221**	**0.0318**	**0.0156**	**0.0288**
Other													
Available Cyanide	µg/L	1.00	NRWQC	2 U	**0.33 J**	2 U	2 U	2 U	2 U	**0.42 J**	2 U	2 U	2 U
Total Cyanide	µg/L	1.00	NRWQC	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Appendix D-2, Table A1
May 2018 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	SW-07-10	SW-08-2	SW-08-4.5	SW-08-7	SW-09-2	SW-09-7.5	SW-09-13	SW-10-2	SW-10-7	SW-10-12
				5/23/18	5/23/18	5/23/18	5/23/18	5/23/18	5/23/18	5/23/18	5/23/18	5/23/18	5/23/18
Volatile Organic Compounds													
2-Butanone (MEK)	µg/L	65,695	EPA Region IV - SW	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	µg/L	117,629	EPA Region IV - SW	3.8 B	5.8 B	5.4 B	4.3 B	5.7 B	5.3 B	**32.6**	7.4 B	5.5 B	**44**
Benzene	µg/L	110	EPA Region IV - SW	**6**	**196**	**125**	**47.2**	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	--		1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 UJ
Carbon disulfide	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	471	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	µg/L	25	EPA Region IV - SW	1 U	**0.34 J**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	412	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	215	EPA Region IV - SW	**0.51 J**	**14.6**	**9.2**	**3.6**	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes	µg/L	260	EPA Region IV - SW	3 U	**3.9**	**2.7 J**	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Semi-Volatile Organic Compounds													
Acenaphthene	µg/L	15	EPA Region IV - SW	**0.0201**	**0.0848**	**0.0497**	**0.0721**	**0.15**	**0.00325 J**	**0.0193**	**0.178**	**1.04**	**0.0573**
Acenaphthylene	µg/L	28	EPA Region IV - SW	**0.0105**	**0.188**	**0.104**	**0.0792**	**0.019**	0.01 U	**0.0131**	**0.0324**	**0.0677**	**0.01**
Anthracene	µg/L	0.43	EPA Region IV - SW	**0.0109**	**0.0615**	**0.0299**	**0.0358**	**0.0296**	**0.00196 J**	**0.00875 J**	**0.0299**	**0.232**	**0.0163**
Benz[a]anthracene	µg/L	0.35	EPA Region IV - SW	**0.0127**	**0.00927 J**	**0.00901 J**	**0.0199**	**0.0111**	**0.00117 J**	**0.0136**	**0.0125**	**0.121**	**0.0155**
Benzo[a]pyrene	µg/L	0.02	EPA Region IV - SW	**0.018**	**0.0108**	**0.011**	**0.0268**	**0.00564 J**	**0.00278 J**	**0.0161**	**0.00687 J**	**0.0545**	**0.012**
Benzo[b]fluoranthene	µg/L	0.06	EPA Region IV - SW	**0.0166**	**0.00895 J**	**0.00794 J**	**0.0198**	**0.00653 J**	**0.00314 J**	**0.016**	**0.00735 J**	**0.0498**	**0.0157**
Benzo[g,h,i]perylene	µg/L	0.012	EPA Region IV - SW	**0.00931 J**	**0.00558 J**	**0.00606 J**	**0.0134**	0.01 U	0.01 U	**0.00974 J**	**0.00437 J**	**0.0215**	**0.00702 J**
Chrysene	µg/L	0.35	EPA Region IV - SW	**0.0162**	**0.0112**	**0.0112**	**0.0276**	**0.0163**	**0.00336 J**	**0.014**	**0.0143**	**0.118**	**0.0153**
Fluoranthene	µg/L	0.82	EPA Region IV - SW	**0.0526**	**0.0695**	**0.0475**	**0.0897**	**0.148**	**0.00896 J**	**0.0692**	**0.162**	**0.838**	**0.0801**
Fluorene	µg/L	24	EPA Region IV - SW	**0.0145**	**0.231**	**0.109**	**0.1**	**0.134**	**0.00363 J**	**0.0142**	**0.139**	**0.635**	**0.0374**
Indeno[1,2,3-c,d]pyrene	µg/L	0.012	EPA Region IV - SW	**0.00726 J**	**0.00444 J**	**0.005 J**	**0.00981 J**	0.01 U	0.01 U	**0.0091 J**	**0.00369 J**	**0.0208**	**0.006 J**
Naphthalene	µg/L	1.40	EPA Region III - Marine	**0.275**	**4.66**	**2.79**	**1.43**	**0.0203**	**0.0111**	**0.0625**	**0.0481**	**0.039**	**0.0662**
Phenanthrene	µg/L	4.6	EPA Region IV - SW	**0.0283**	**0.319**	**0.14**	**0.129**	**0.267**	0.00812 B	**0.024**	**0.25**	**1.37**	**0.0649**
Pyrene	µg/L	0.11	EPA Region IV - SW	**0.0352**	**0.0371**	**0.0279**	**0.0523**	**0.0665**	**0.00704 J**	**0.0446**	**0.0749**	**0.487**	**0.051**
Other													
Available Cyanide	µg/L	1.00	NRWQC	2 U	2 U	2 U	2 U	2 U	2 U	2 U	0.65 B	0.6 B	0.36 B
Total Cyanide	µg/L	1.00	NRWQC	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U

Appendix D-2, Table A1
May 2018 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	SW-11-2	SW-11-11	SW-11-20	SW-12-2	SW-12-7.5	SW-12-13	SW-13-2	SW-13-11	SW-13-20
				5/24/18	5/24/18	5/24/18	5/24/18	5/24/18	5/24/18	5/24/18	5/24/18	5/24/18
Volatile Organic Compounds												
2-Butanone (MEK)	µg/L	65,695	EPA Region IV - SW	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-pentanone	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	µg/L	117,629	EPA Region IV - SW	10.8 B	5.7 B	7 B	6.6 B	7.4 B	4.8 B	7.9 B	7.9 B	7.2 B
Benzene	µg/L	110	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon disulfide	µg/L	--		1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
Chlorobenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	µg/L	471	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	µg/L	--		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Ethylbenzene	µg/L	25	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	µg/L	412	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	µg/L	215	EPA Region IV - SW	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	µg/L	--		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes	µg/L	260	EPA Region IV - SW	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Semi-Volatile Organic Compounds												
Acenaphthene	µg/L	15	EPA Region IV - SW	**0.0339**	**0.0875**	**0.0135**	**0.0635**	**0.0775**	**0.0617**	**0.0692**	**0.124**	**0.0446**
Acenaphthylene	µg/L	28	EPA Region IV - SW	**0.0154**	**0.00858 J**	0.00952 U	**0.0705**	**0.0384**	**0.0066 J**	**0.0194**	**0.0107**	**0.0042 J**
Anthracene	µg/L	0.43	EPA Region IV - SW	**0.00725 J**	**0.0174**	**0.0038 J**	**0.0139**	**0.0158**	**0.0107**	**0.0122**	**0.0177**	**0.0095 J**
Benz[a]anthracene	µg/L	0.35	EPA Region IV - SW	**0.00358 J**	**0.00913 J**	**0.00516 J**	**0.00463 J**	**0.00623 J**	**0.00969 J**	**0.00514 J**	**0.0115 J**	**0.011 J**
Benzo[a]pyrene	µg/L	0.02	EPA Region IV - SW	**0.00285 J**	**0.00526 J**	**0.0041 J**	**0.00249 J**	**0.00322 J**	**0.00816 J**	**0.00311 J**	**0.00652 J**	**0.00784 J**
Benzo[b]fluoranthene	µg/L	0.06	EPA Region IV - SW	**0.00364 J**	**0.00994 J**	**0.00556 J**	**0.00528 J**	**0.00586 J**	**0.0111 J**	**0.00534 J**	**0.0118 J**	**0.0117 J**
Benzo[g,h,i]perylene	µg/L	0.012	EPA Region IV - SW	0.00952 U	**0.00344 J**	**0.00307 J**	0.00952 U	0.00952 U	**0.00375 J**	0.00952 U	**0.00376 J**	**0.00527 J**
Chrysene	µg/L	0.35	EPA Region IV - SW	**0.00404 J**	**0.0104**	**0.00563 J**	**0.00526 J**	**0.00709 J**	**0.0123**	**0.00593 J**	**0.014**	**0.0132**
Fluoranthene	µg/L	0.82	EPA Region IV - SW	**0.0364**	**0.0827**	**0.025**	**0.0605**	**0.0784**	**0.0681**	**0.0665**	**0.103**	**0.0603**
Fluorene	µg/L	24	EPA Region IV - SW	**0.0285**	**0.0499**	**0.00985**	**0.0695**	**0.0681**	**0.0366**	**0.0526**	**0.0723**	**0.0238**
Indeno[1,2,3-c,d]pyrene	µg/L	0.012	EPA Region IV - SW	0.00952 UJ	**0.00313 J**	0.00952 UJ	0.00952 UJ	0.00952 UJ	**0.00375 J**	0.00952 UJ	**0.00354 J**	**0.00415 J**
Naphthalene	µg/L	1.40	EPA Region III - Marine	**0.0497**	0.0156 B	0.0125 B	**0.0582**	0.0147 B	**0.0211**	0.0151 B	**0.022**	**0.0275**
Phenanthrene	µg/L	4.6	EPA Region IV - SW	**0.0406**	**0.051**	**0.0108**	**0.0916**	**0.0913**	**0.0273**	**0.0623**	**0.077**	**0.0178**
Pyrene	µg/L	0.11	EPA Region IV - SW	**0.019**	**0.0509**	**0.019**	**0.0296**	**0.0415**	**0.0431**	**0.0337**	**0.0584**	**0.0403**
Other												
Available Cyanide	µg/L	1.00	NRWQC	0.69 B	0.44 B	0.45 B	1.2 B	2 U	2 U	**0.53 J**	**0.33 J**	2 U
Total Cyanide	µg/L	1.00	NRWQC	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U



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1 inch = 80 feet

0 40 80 Feet

2019 Cell 2
Surface Water Sample Locations
Benzene and Naphthalene Results

Appx
D-2

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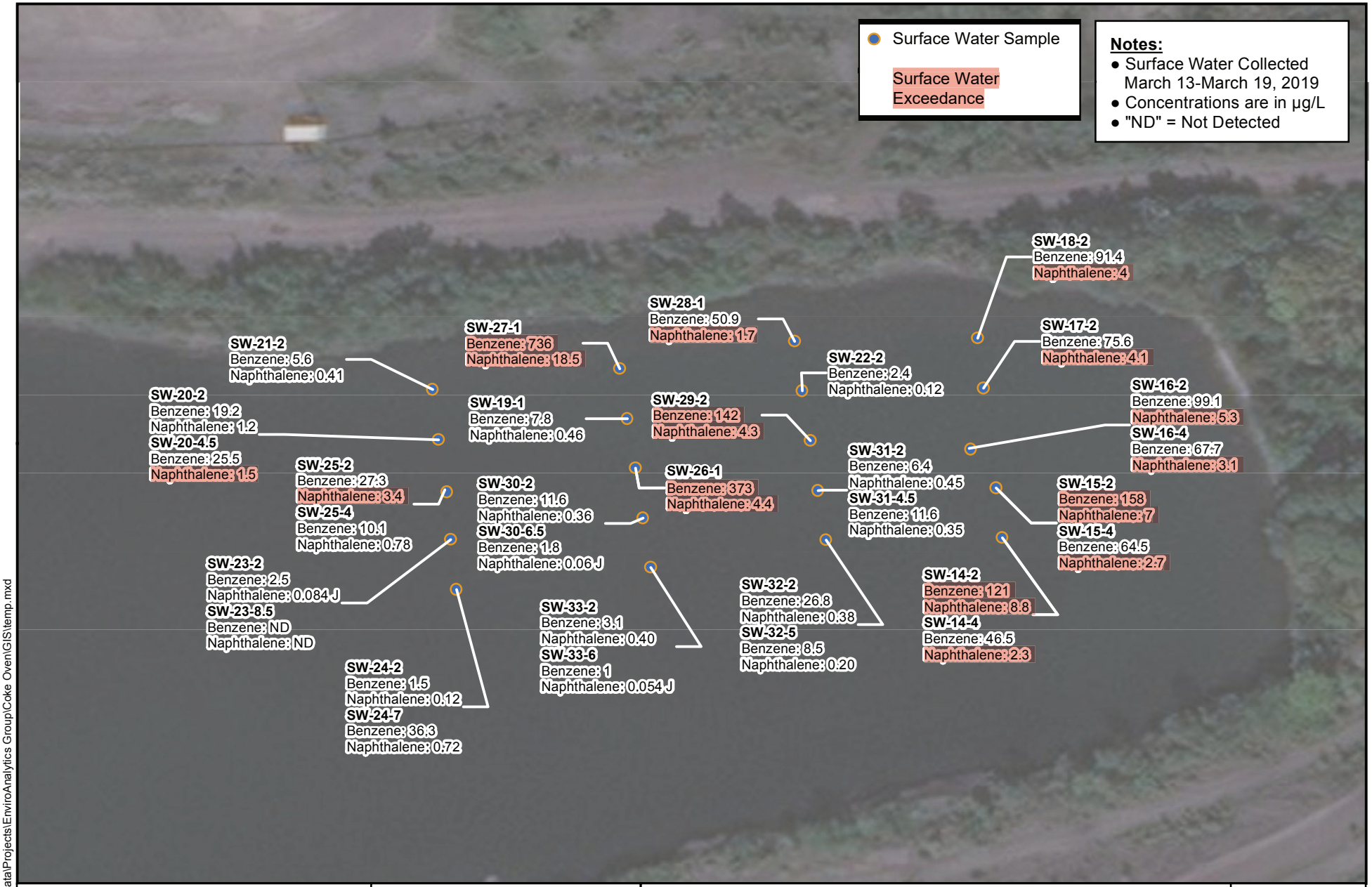
Appendix D-2, Table A2
July 2019 Surface Water Sampling Results - Cell 2
CPA CMS, Sparrows Point, Maryland

Parameter	Benzene	Ethylbenzene	Toluene	Xylene	Naphthalene~
Units	µg/L	µg/L	µg/L	µg/L	µg/L
Surface Water Screening Level	110	25	215	260	1.40
Source	EPA Region IV - Saltwater	EPA Region IV - Saltwater	EPA Region IV - Saltwater	EPA Region IV - Saltwater	EPA Region III - Marine
Sample ID					
CO-047-SW-2	**1.2**	1 U	**0.41 J**	3 U	**0.19**
CO-048-SW-2	**2.8**	1 U	**0.86 J**	3 U	**0.56**
CO-048-SW-8	**1.0**	1 U	1 U	3 U	**1.5**
CO-049-SW-2	1 U	1 U	1 U	3 U	**0.18**
CO-049-SW-6	**1.1**	1 U	1 U	3 U	**0.32**
CO-069-SW-2	1 U	1 U	1 U	3 U	**0.34 J**
CO-069-SW-6	**0.34 J**	1 U	1 U	3 U	**0.24**
CO-070-SW-2	1 U	1 U	1 U	3 U	**0.064 J**
CO-070-SW-7.5	1 U	1 U	1 U	3 U	**0.055 J**
CO-072-SW-2	1 U	1 U	1 U	3 U	**0.099 J**

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.

References:
EPA Region III - Marine = EPA Region III BTAG Marine Screening Benchmarks (2006)
EPA Region IV = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018. Table 1a, Region 4 Surface Water Screening Values for Hazardous Waste Sites, Saltwater, Chronic

Surface water samples collected on July 16, 2019.



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1 inch = 80 feet

0 40 80 Feet

2019 Cell 3
Surface Water Sample Locations
Benzene and Naphthalene Results

Appendix
D-2

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Appendix D-2, Table A3
March 2019 Surface Water Sampling Results - Cell 3
CPA CMS, Sparrows Point, Maryland

Parameter	Benzene	Ethylbenzene	Toluene	Xylene	Naphthalene
Units	µg/L	µg/L	µg/L	µg/L	µg/L
Surface Water Screening Level	110	25	215	260	1.40
Source	EPA Region IV - Saltwater	EPA Region IV - Saltwater	EPA Region IV - Saltwater	EPA Region IV - Saltwater	EPA Region III - Marine
Sample ID					
SW-14-2	**121**	1 U	**9.5**	**3.3**	**8.8**
SW-14-4	**46.5**	1 U	**3.8**	**0.94 J**	**2.3**
SW-15-2	**158**	1 U	**12.3**	**4.4**	**7.0**
SW-15-4	**64.5**	1 U	**5.1**	**1.8 J**	**2.7**
SW-16-2	**99.1**	1 U	**7.8**	**2.6 J**	**5.3**
SW-16-4	**67.7**	1 U	**5.4**	**1.9 J**	**3.1**
SW-17-2	**75.6**	1 U	**6**	**2.1 J**	**4.1**
SW-18-2	**91.4**	1 U	**7.2**	**2.4 J**	**4.0**
SW-19-1	**7.8**	1 U	**0.70 J**	3 U	**0.46**
SW-20-2	**19.2**	1 U	**1.6**	3 U	**1.2**
SW-20-4.5	**25.5**	1 U	**2.1**	3 U	**1.5**
SW-21-2	**5.6**	1 U	**0.57 J**	3 U	**0.41**
SW-22-2	**2.4**	1 U	1 U	3 U	**0.12**
SW-23-2	**2.5**	1 U	1 U	3 U	**0.084 J**
SW-23-8.5	1 U	1 U	1 U	3 U	0.10 U
SW-24-2	**1.5**	1 U	1 U	3 U	**0.12**
SW-24-7	**36.3**	1 U	**2.9**	3 U	**0.72**
SW-25-2	**27.3**	1 U	**2.4**	**0.81 J**	**3.4**
SW-25-4	**10.1**	1 U	**0.99 J**	3 U	**0.78**
SW-26-1	**373**	**0.74 J**	**27.7**	**8.6**	**4.4**
SW-27-1	**736**	**1.5**	**67.2**	**21.4**	**18.5**
SW-28-1	**50.9**	1 U	**4.1**	**1.1 J**	**1.7**
SW-29-2	**142**	1 U	**10.7**	**3.8**	**4.3**
SW-30-2	**11.6**	1 U	**1.0**	3 U	**0.36**
SW-30-6.5	**1.8**	1 U	1 U	3 U	**0.060 J**
SW-31-2	**6.4**	1 U	**0.64 J**	3 U	**0.45**
SW-31-4.5	**11.6**	1 U	**1.0**	3 U	**0.35**
SW-32-2	**26.8**	1 U	**2.0**	3 U	**0.38**
SW-32-5	**8.5**	1 U	**0.78 J**	3 U	**0.2**
SW-33-2	**3.1**	1 U	**0.34 J**	3 U	**0.4**
SW-33-6	**1.0**	1 U	1 U	3 U	**0.054 J**

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.
J: The positive result reported for this analyte is a quantitative estimate.

Source References:
EPA Region III - Marine = EPA Region III BTAG Marine Screening Benchmarks (2006)
EPA Region IV = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018. Table 1a, Region 4 Surface Water Screening Values for Hazardous Waste Sites, Saltwater, Chronic

Surface water samples collected between March 13-19, 2019.



Notes:

- Surface Water Collected July 9-16, 2019
- Concentrations are in µg /L
- 'ND' = Not Detected
- There were no surface water exceedances.

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1 inch = 170 feet

0 85 170 Feet

2019 Cell 5
Surface Water Sample Locations
Benzene and Naphthalene Results

Appendix

D-2

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Appendix D-2, Table A4
July 2019 Surface Water Sampling Results - Cell 5
CPA CMS, Sparrows Point, Maryland

Parameter		Naphthalene
Units		µg/L
Surface Water Screening Level		1.40
Source		EPA Region III - Marine
Sample ID	Date	
CO-073-SW-2	10-Jul-19	**0.5**
CO-073-SW-5	10-Jul-19	**1.1**
CO-074-SW-2	9-Jul-19	**0.051 J**
CO-074-SW-9	9-Jul-19	**0.058 J**
CO-075-SW-2	10-Jul-19	**0.45**
CO-075-SW-5	10-Jul-19	**0.67**
CO-079-SW-2	9-Jul-19	0.1 U
CO-079-SW-8.5	9-Jul-19	**0.064 J**
CO-081-SW-2	10-Jul-19	**0.3**
CO-084-SW-2	10-Jul-19	**0.59**
CO-087-SW-2	10-Jul-19	**0.25**
CO-090-SW-2	10-Jul-19	**0.31**
CO-093-SW-2	10-Jul-19	**0.045 J**
CO-098-SW-2	16-Jul-19	0.1 U
CO-098-SW-4	16-Jul-19	**0.11**
CO-099-SW-1	9-Jul-19	**0.065 J**

Source References:

EPA Region III - Marine = EPA Region III BTAG Marine Screening Benchmarks (2006)

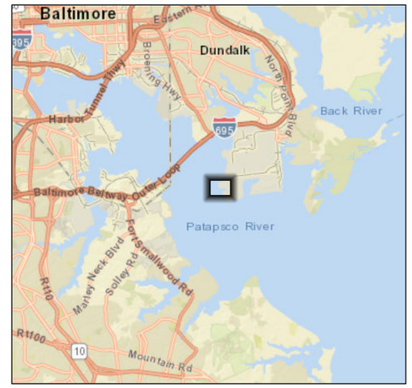
Detections in bold

Values in red indicate an exceedance of the Water Quality Criteria

U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.

J: The positive result reported for this analyte is a quantitative estimate.





Legend

- Sediment Sample Location
- Surface Water Sample Location
- Well Location
- ARM 2018 Surface Water Sample Locations
- SubSurface Sediment; 2009-2010 Site Assessment
- Surface Sediment; 2003 Recon Study
- Surface Sediment; 2009-2010 Site Assessment
- Sparrows Point

Note: In 2025, pore water samples were attempted at all surface water locations, but no samples were able to be collected.

0 150 300
Feet

Data Sources: ESRI
Coordinate System: NAD83 State Plane MD

Coke Point Actual Sample Locations

Appendix D-2

Appendix D-2, Table A5
February 2025 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	CP2025-01-SW-A			CP2025-01-SW-B			CP2025-02-SW-A			CP2025-02-SW-B			CP2025-07-SW-A			CP2025-07-SW-B			CP2025-03-SW-A			CP2025-03-SW-B		
				2/10/2025			2/10/2025			2/10/2025			2/10/2025			2/10/2025			2/10/2025			2/12/2025			2/12/2025		
				Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL
Volatile Organic Compounds																											
Dichlorodifluoromethane	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Chloromethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Vinyl chloride	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromomethane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Chloroethane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Trichlorofluoromethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,1-Dichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Carbon disulfide	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Methylene chloride	µg/L	1,580	EPA Region IV - SW	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Acetone	µg/L	117,629	EPA Region IV - SW	ND		5	ND		5	ND		5	ND		5	ND		5	**1.5**	**J**	5	**1.7**	**J**	5	ND		5
trans-1,2-Dichloroethene	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Methyl Acetate	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2
Methyl tert butyl ether	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
1,1-Dichloroethane	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
cis-1,2-Dichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Cyclohexane	µg/L	--		ND		10	ND		10	ND		10	ND		10	ND		10	ND		10	ND		10	ND		10
Chloroform	µg/L	471	EPA Region IV - SW	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Carbon tetrachloride	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,1,1-Trichloroethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
2-Butanone	µg/L	65,695	EPA Region IV - SW	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Benzene	µg/L	110	EPA Region IV - SW	**0.44**	**J**	0.5	**0.39**	**J**	0.5	**0.2**	**J**	0.5	**0.22**	**J**	0.5	ND		0.5	**0.22**	**J**	0.5	ND		0.5	ND		0.5
1,2-Dichloroethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Trichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,2-Dichloropropane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromodichloromethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
cis-1,3-Dichloropropene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Toluene	µg/L	215	EPA Region IV - SW	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Tetrachloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
4-Methyl-2-pentanone	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
trans-1,3-Dichloropropene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,3-Dichloropropene, Total	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,1,2-Trichloroethane	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Dibromochloromethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,2-Dibromoethane	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2
2-Hexanone	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Chlorobenzene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Ethylbenzene	µg/L	25	EPA Region IV - SW	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
p/m-Xylene	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
o-Xylene	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Xylenes, Total	µg/L	260	EPA Region IV - SW	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Styrene	µg/L	412	EPA Region IV - SW	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromoform	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2

Appendix D-2, Table A5
February 2025 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	CP2025-01-SW-A			CP2025-01-SW-B			CP2025-02-SW-A			CP2025-02-SW-B			CP2025-07-SW-A			CP2025-07-SW-B			CP2025-03-SW-A			CP2025-03-SW-B		
				2/10/2025			2/10/2025			2/10/2025			2/10/2025			2/10/2025			2/10/2025			2/12/2025			2/12/2025		
				Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL
Isopropylbenzene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,3-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,4-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2-Dibromo-3-chloropropane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2,4-Trichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2,3-Trichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
VOLATILE ORGANICS BY GC/MS-SIM																											
1,1,2,2-Tetrachloroethane	µg/L	--		ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
SEMIVOLATILE ORGANICS BY GC/MS-SIM																											
Naphthalene	µg/L	1.40	EPA Region III	**0.1**		0.1	**0.08**	**J**	0.1	**0.06**	**J**	0.1	**0.06**	**J**	0.1	**0.07**	**J**	0.1	**0.08**	**J**	0.1	**0.23**		0.1	ND		0.1
2-Methylnaphthalene	µg/L	52	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.04**	**J**	0.1	ND		0.1	**0.07**	**J**	0.1	ND		0.1
Acenaphthylene	µg/L	28	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.04**	**J**	0.1	ND		0.1
Acenaphthene	µg/L	15	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Fluorene	µg/L	24	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.04**	**J**	0.1	ND		0.1
Phenanthrene	µg/L	4.6	EPA Region IV - SW	**0.05**		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	**0.08**		0.05	ND		0.05
Anthracene	µg/L	0.43	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Fluoranthene	µg/L	0.82	EPA Region IV - SW	**0.04**	**J**	0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.09**	**J**	0.1	ND		0.1
Pyrene	µg/L	0.11	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.08**	**J**	0.1	ND		0.1
Benzo(a)anthracene	µg/L	0.35	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	**0.06**		0.05	ND		0.05
Chrysene	µg/L	0.35	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.09**	**J**	0.1	ND		0.1
Benzo(b)fluoranthene	µg/L	0.06	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	**0.17**		0.05	ND		0.05
Benzo(k)fluoranthene	µg/L	0.06	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.05**	**J**	0.1	ND		0.1
Benzo(a)pyrene	µg/L	0.02	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.03**	**J**	0.1	ND		0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.012	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.09**	**J**	0.1	ND		0.1
Dibenzo(a,h)anthracene	µg/L	0.01	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Benzo(ghi)perylene	µg/L	0.012	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
ND: The analyte was not detected in the sample.
J: The positive result reported for this analyte is a quantitative estimate.

Source References:
NRWQC = USEPA National Recommended Water Quality Criteria (2014)
EPA Region IV SW = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018. Table 1a, Region 4 Surface Water Screening Values for Hazardous Waste Sites, Saltwater, Chronic

EPA Region III = EPA Region III BTAG Marine Screening Benchmarks (2006)

Appendix D-2, Table A5
February 2025 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	CP2025-04-SW-A			CP2025-04-SW-B			CP2025-05-SW-A			CP2025-05-SW-B			CP2025-06-SW-A			CP2025-06-SW-B			CP2025-08-SW-A			CP2025-08-SW-B		
				2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025		
				Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL
Volatile Organic Compounds																											
Dichlorodifluoromethane	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Chloromethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Vinyl chloride	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromomethane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Chloroethane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Trichlorofluoromethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,1-Dichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Carbon disulfide	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Methylene chloride	µg/L	1,580	EPA Region IV - SW	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Acetone	µg/L	117,629	EPA Region IV - SW	ND		5	ND		5	ND		5	ND		5	**6.3**		5	ND		5	ND		5	**2.7**	**J**	5
trans-1,2-Dichloroethene	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Methyl Acetate	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2
Methyl tert butyl ether	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
1,1-Dichloroethane	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
cis-1,2-Dichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Cyclohexane	µg/L	--		ND		10	ND		10	ND		10	ND		10	ND		10	ND		10	ND		10	ND		10
Chloroform	µg/L	471	EPA Region IV - SW	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Carbon tetrachloride	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,1,1-Trichloroethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
2-Butanone	µg/L	65,695	EPA Region IV - SW	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Benzene	µg/L	110	EPA Region IV - SW	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,2-Dichloroethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Trichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,2-Dichloropropane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromodichloromethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
cis-1,3-Dichloropropene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Toluene	µg/L	215	EPA Region IV - SW	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Tetrachloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
4-Methyl-2-pentanone	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
trans-1,3-Dichloropropene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,3-Dichloropropene, Total	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,1,2-Trichloroethane	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Dibromochloromethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,2-Dibromoethane	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2
2-Hexanone	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Chlorobenzene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Ethylbenzene	µg/L	25	EPA Region IV - SW	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
p/m-Xylene	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
o-Xylene	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Xylenes, Total	µg/L	260	EPA Region IV - SW	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Styrene	µg/L	412	EPA Region IV - SW	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromoform	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2	ND		2

Appendix D-2, Table A5
February 2025 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	CP2025-04-SW-A			CP2025-04-SW-B			CP2025-05-SW-A			CP2025-05-SW-B			CP2025-06-SW-A			CP2025-06-SW-B			CP2025-08-SW-A			CP2025-08-SW-B		
				2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025		
				Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL
Isopropylbenzene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,3-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,4-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2-Dibromo-3-chloropropane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2,4-Trichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2,3-Trichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
VOLATILE ORGANICS BY GC/MS-SIM																										
1,1,2,2-Tetrachloroethane	µg/L	--		ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
SEMIVOLATILE ORGANICS BY GC/MS-SIM																										
Naphthalene	µg/L	1.40	EPA Region III	**0.08**	**J**	0.1	**0.07**	**J**	0.1	**0.05**	**J**	0.1	**0.06**	**J**	0.1	**0.04**	**J**	0.1	**0.05**	**J**	0.1	**0.04**	**J**	0.1	**0.04**	**J**	0.1
2-Methylnaphthalene	µg/L	52	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Acenaphthylene	µg/L	28	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Acenaphthene	µg/L	15	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Fluorene	µg/L	24	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Phenanthrene	µg/L	4.6	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Anthracene	µg/L	0.43	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Fluoranthene	µg/L	0.82	EPA Region IV - SW	ND		0.1	ND		0.1	**0.04**	**J**	0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Pyrene	µg/L	0.11	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Benzo(a)anthracene	µg/L	0.35	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Chrysene	µg/L	0.35	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	**0.04**	**J**	0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Benzo(b)fluoranthene	µg/L	0.06	EPA Region IV - SW	ND		0.05	ND		0.05	**0.03**	**J**	0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Benzo(k)fluoranthene	µg/L	0.06	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Benzo(a)pyrene	µg/L	0.02	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.012	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Dibenzo(a,h)anthracene	µg/L	0.01	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Benzo(ghi)perylene	µg/L	0.012	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
ND: The analyte was not detected in the sample.
J: The positive result reported for this analyte is a quantitative estimate.

Source References:
NRWQC = USEPA National Recommended Water Quality Criteria (2014)
EPA Region IV SW = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018. Table 1a, Region 4 Surface Water Screening Values for Hazardous Waste Sites, Saltwater, Chronic

EPA Region III = EPA Region III BTAG Marine Screening Benchmarks (2006)

Appendix D-2, Table A5
February 2025 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	CP2025-09-SW-A			CP2025-09-SW-B			CP2025-SW-26-1-A			CP2025-SW-26-1-B			CP2025-SW-15-2-A			CP2025-SW-15-2-B		
				2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025		
				Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL
Volatile Organic Compounds																					
Dichlorodifluoromethane	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Chloromethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Vinyl chloride	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromomethane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Chloroethane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Trichlorofluoromethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,1-Dichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Carbon disulfide	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Methylene chloride	µg/L	1,580	EPA Region IV - SW	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
Acetone	µg/L	117,629	EPA Region IV - SW	**1.5**	**J**	5	**1.7**	**J**	5	ND		5	ND		5	ND		5	ND		5
trans-1,2-Dichloroethene	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Methyl Acetate	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2
Methyl tert butyl ether	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
1,1-Dichloroethane	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
cis-1,2-Dichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Cyclohexane	µg/L	--		ND		10	ND		10	ND		10	ND		10	ND		10	ND		10
Chloroform	µg/L	471	EPA Region IV - SW	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Carbon tetrachloride	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,1,1-Trichloroethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
2-Butanone	µg/L	65,695	EPA Region IV - SW	ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Benzene	µg/L	110	EPA Region IV - SW	0.64		0.5	ND		0.5	**2.1**		0.5	**12**		0.5	**5.4**		0.5	**4.3**		0.5
1,2-Dichloroethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Trichloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,2-Dichloropropane	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromodichloromethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
cis-1,3-Dichloropropene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Toluene	µg/L	215	EPA Region IV - SW	ND		0.75	ND		0.75	**0.22**	**J**	0.75	**1.0**		0.75	**0.87**		0.75	**0.56**	**J**	0.75
Tetrachloroethene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
4-Methyl-2-pentanone	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
trans-1,3-Dichloropropene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,3-Dichloropropene, Total	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,1,2-Trichloroethane	µg/L	--		ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75	ND		0.75
Dibromochloromethane	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,2-Dibromoethane	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2
2-Hexanone	µg/L	--		ND		5	ND		5	ND		5	ND		5	ND		5	ND		5
Chlorobenzene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
Ethylbenzene	µg/L	25	EPA Region IV - SW	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
p/m-Xylene	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
o-Xylene	µg/L	--		ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Xylenes, Total	µg/L	260	EPA Region IV - SW	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Styrene	µg/L	412	EPA Region IV - SW	ND		1	ND		1	ND		1	ND		1	ND		1	ND		1
Bromoform	µg/L	--		ND		2	ND		2	ND		2	ND		2	ND		2	ND		2

Appendix D-2, Table A5
February 2025 Surface Water Sampling Results
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Surface Water Screening Level	Source	CP2025-09-SW-A			CP2025-09-SW-B			CP2025-SW-26-1-A			CP2025-SW-26-1-B			CP2025-SW-15-2-A			CP2025-SW-15-2-B		
				2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025			2/12/2025		
				Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL	Conc	Q	RL
Isopropylbenzene	µg/L	--		ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5	ND		0.5
1,3-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,4-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2-Dichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2-Dibromo-3-chloropropane	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2,4-Trichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
1,2,3-Trichlorobenzene	µg/L	--		ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5	ND		2.5
VOLATILE ORGANICS BY GC/MS-SIM																					
1,1,2,2-Tetrachloroethane	µg/L	--		ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
SEMIVOLATILE ORGANICS BY GC/MS-SIM																					
Naphthalene	µg/L	1.40	EPA Region III	**0.1**		0.1	**0.07**	**J**	0.1	**0.23**		0.1	**0.95**		0.1	**0.46**		0.1	**0.39**		0.1
2-Methylnaphthalene	µg/L	52	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	**0.06**	**J**	0.1	**0.04**	**J**	0.1	**0.03**	**J**	0.1
Acenaphthylene	µg/L	28	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	**0.04**	**J**	0.1	ND		0.1	ND		0.1
Acenaphthene	µg/L	15	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Fluorene	µg/L	24	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	**0.03**	**J**	0.1	ND		0.1	**0.03**	**J**	0.1
Phenanthrene	µg/L	4.6	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	**0.04**	**J**	0.05	ND		0.05	**0.04**	**J**	0.05
Anthracene	µg/L	0.43	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Fluoranthene	µg/L	0.82	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	**0.04**	**J**	0.1
Pyrene	µg/L	0.11	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Benzo(a)anthracene	µg/L	0.35	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Chrysene	µg/L	0.35	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Benzo(b)fluoranthene	µg/L	0.06	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Benzo(k)fluoranthene	µg/L	0.06	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Benzo(a)pyrene	µg/L	0.02	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Indeno(1,2,3-cd)pyrene	µg/L	0.012	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1
Dibenzo(a,h)anthracene	µg/L	0.01	EPA Region IV - SW	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05	ND		0.05
Benzo(ghi)perylene	µg/L	0.012	EPA Region IV - SW	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1	ND		0.1

Detections in bold
Values in red indicate an exceedance of the Water Quality Criteria
ND: The analyte was not detected in the sample.
J: The positive result reported for this analyte is a quantitative estimate.

Source References:
NRWQC = USEPA National Recommended Water Quality Criteria (2014)
EPA Region IV SW = Region 4 Ecological Risk Assessment Supplemental Guidance, March 2018. Table 1a, Region 4 Surface Water Screening Values for Hazardous Waste Sites, Saltwater, Chronic

EPA Region III = EPA Region III BTAG Marine Screening Benchmarks (2006)

APPENDIX D-3



N

ARM Group Inc.
Engineers and Scientists

1 inch = 80 feet

0 40 80
Feet

Former Coke Oven Area - Cell 2
Pore Water Sample Locations
Benzene Results

Appendix
D-3



N

ARM Group Inc.
Engineers and Scientists

1 inch = 80 feet

0 40 80
Feet

Former Coke Oven Area - Cell 2
Pore Water Sample Locations
Naphthalene Results

Appendix
D-3

Appendix D-3, Table A1
April/May 2019 Pore Water Sampling Results - Cell 2
CPA CMS, Sparrows Point, Maryland

Parameter		Benzene	Ethylbenzene	Toluene	Xylene	Naphthalene
Units		µg/L	µg/L	µg/L	µg/L	µg/L
Pore Water TRV		130	7.3	9.8	67	193.50
Sample ID	Date					
CO-048-PW-1	4/26/2019	1 U	1 U	1 U	3 U	**2.9**
CO-048-PW-3	4/26/2019	1 U	1 U	1 U	3 U	**6,380**
CO-049-PW-1	4/26/2019	**149**	**1.6**	**34.9**	**25.4**	**500**
CO-049-PW-3	4/26/2019	**19,100**	**34.2**	**631**	**382**	**72,000**
CO-051-PW-1	5/7/2019	1 U	1 U	1 U	3 U	**1.7 J**
CO-052-PW-1	5/6/2019	1 U	1 U	1 U	3 U	**2.0**
CO-052-PW-2	5/6/2019	1 U	1 U	1 U	3 U	**0.096 J**
CO-053-PW-2	4/29/2019	1 U	1 U	1 U	3 U	**11.5**
CO-054-PW-1	5/8/2019	1 U	1 U	1 U	3 U	0.45 B
CO-054-PW-3	5/8/2019	1 U	1 U	1 U	3 U	0.42 B
CO-055-PW-1	5/6/2019	1 U	1 U	1 U	3 U	**8.4**
CO-055-PW-2	5/6/2019	1 U	1 U	1 U	3 U	**0.33**
CO-056-PW-2	4/29/2019	1 U	1 U	1 U	3 U	**0.35**
CO-057-PW-1	5/8/2019	1 U	1 U	1 U	3 U	**1.5 J**
CO-058-PW-1	5/3/2019	**0.80 J**	1 U	1 U	3 U	**6.2**
CO-058-PW-2	5/3/2019	1 U	1 U	1 U	3 U	**0.59**
CO-061-PW-1	5/3/2019	1 U	1 U	1 U	3 U	0.14 B
CO-062-PW-1	4/30/2019	1 U	1 U	1 U	3 U	**6.4**
CO-063-PW-1	5/9/2019	**3.4**	1 U	**1**	3 U	**63.9 J**
CO-063-PW-2	5/8/2019	1 U	1 U	1 U	3 U	1.2 B
CO-064-PW-3	5/2/2019	1 U	1 U	1 U	3 U	**0.29**
CO-065-PW-1	4/30/2019	1 U	1 U	1 U	3 U	0.10 B
CO-065-PW-2	4/30/2019	1 U	1 U	1 U	3 U	0.15 B
CO-066-PW-1	5/9/2019	**0.78 J**	1 U	1 U	3 U	0.31 B
CO-066-PW-2	5/9/2019	**0.62 J**	1 U	1 U	3 U	0.44 B
CO-067-PW-1	5/3/2019	1 U	1 U	1 U	3 U	0.045 B
CO-067-PW-2	5/3/2019	1 U	1 U	1 U	3 U	**0.33**
CO-068-PW-1	5/2/2019	1 U	1 U	1 U	3 U	NS
CO-068-PW-2	5/2/2019	1 U	1 U	1 U	3 U	0.099 U
CO-069-PW-1	4/25/2019	**0.99 J**	1 U	1 U	3 U	**3.6**
CO-069-PW-2	4/25/2019	**104**	**0.53 J**	1 U	**2.5 J**	**192**
CO-070-PW-1	4/25/2019	**17,200**	**41**	**1,910**	**511**	**52,000**
CO-070-PW-2	4/25/2019	**9,470**	**127**	**128**	**421**	**63,200**

References:

Pore Water TRV = Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic Contaminants (2017)

Detections in bold

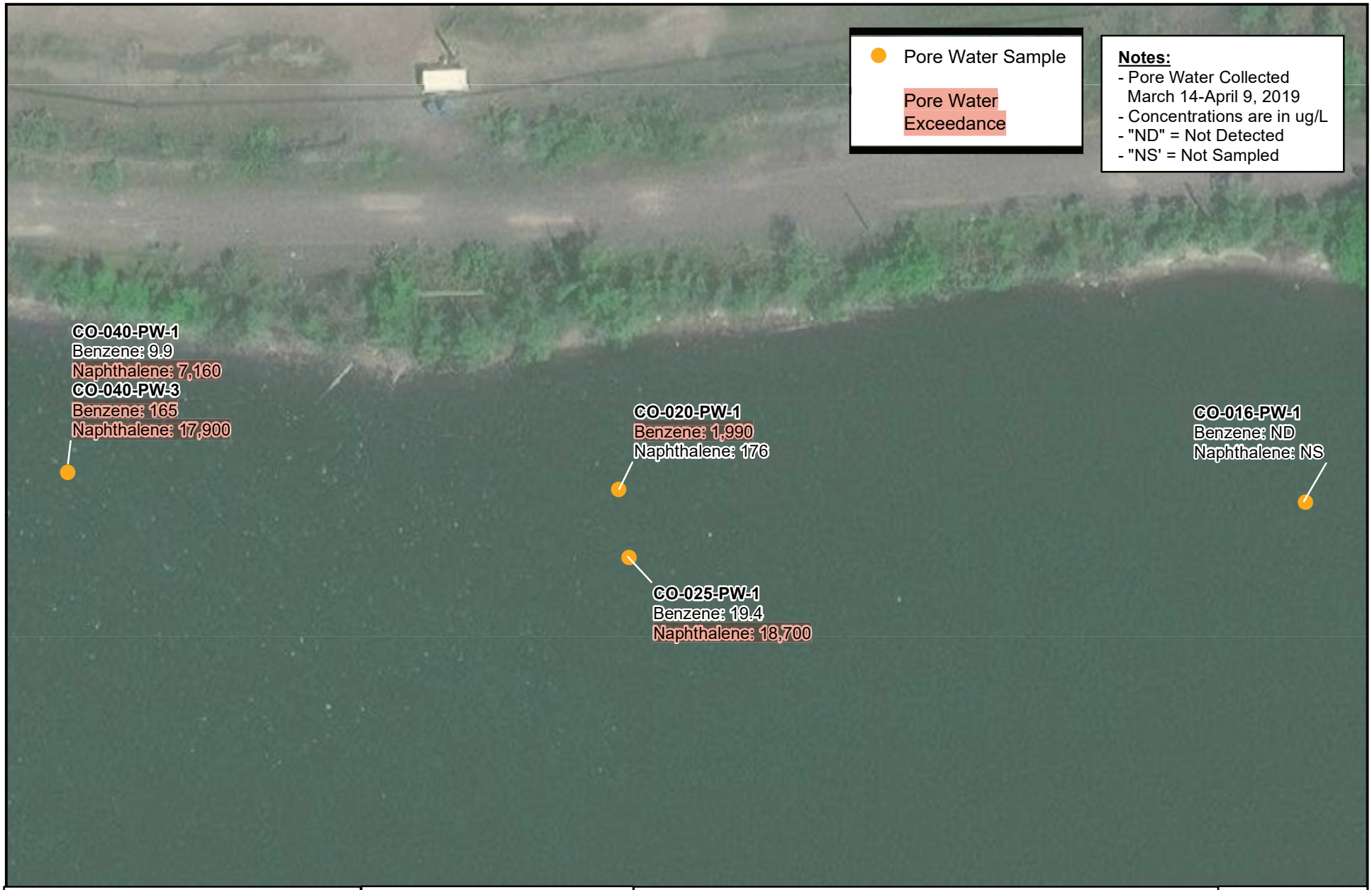
Values in red indicate an exceedance of the Water Quality Criteria

U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.

J: The positive result reported for this analyte is a quantitative estimate.

B: This analyte was not detected substantially above the level of the associated method blank/preparation or field blank.

NS: Not Sampled



N

ARM Group LLC
Engineers and Scientists

1.5 inch = 100 feet

0 25 50 100
Feet

Former Coke Oven Area - Cell 3
Pore Water Sample Locations
Benzene and Naphthalene Results

Appendix

D-3

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Appendix D-3, Table A2
April 2019 Pore Water Sampling Results - Cell 3
CPA CMS, Sparrows Point, Maryland

Parameter	Units	Pore Water TRV	CO-016-PW-1	CO-020-PW-1	CO-025-PW-1	CO-040-PW-1	CO-040-PW-3
			4/4/2019	4/4/2019	4/4/2019	4/9/2019	4/9/2019
Benzene	µg/L	130	1 U	**1,990**	**19.4**	**9.9**	**165**
Ethylbenzene	µg/L	7.3	1 U	**2.9**	**1.4**	**1.6**	**14.4**
Toluene	µg/L	9.8	1 U	**141**	**8.6**	**3.6**	**110**
Xylene	µg/L	67	3 U	**45.4**	**17.8**	**7.5**	**332**
Naphthalene	µg/L	193.5	NS	**176**	**18,700**	**7,160**	**17,900**

References:

Pore Water TRV = Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic Contaminants (2017)

Detections in bold

Values in red indicate an exceedance of the Water Quality Criteria

U: The analyte was not detected in the sample. The numeric value represents the sample quantitative/detection limit.

J: The positive result reported for this analyte is a quantitative estimate.

NS: Not Sampled



N

ARM Group Inc.
Engineers and Scientists

1 inch = 170 feet

0 85 170 Feet

Former Coke Oven Area - Cell 5
Pore Water Sample Locations
Naphthalene Results

Appendix
D-3

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Appendix D-3, Table A3
April 2019 Pore Water Sampling Results - Cell 5
CPA CMS, Sparrows Point, Maryland

Parameter		Naphthalene
Units		µg/L
Pore Water TRV		193.5
Sample ID	Date	
CO-073-PW-1	11-Apr-19	**1,530**
CO-074-PW-1	16-Apr-19	**9,230**
CO-074-PW-2	16-Apr-19	**8,880**
CO-079-PW-1	10-Apr-19	**3,680**
CO-080-PW-1	17-Apr-19	**0.41**
CO-086-PW-1	17-Apr-19	**0.33**
CO-095-PW-1	23-Apr-19	**0.14**
CO-095-PW-2	23-Apr-19	**30.4**
CO-098-PW-1	23-Apr-19	**352**

References:

Pore Water TRV Source: Developing Sediment Remediation Goals at Superfund Sites Based on Pore Water for the Protection of Benthic Organisms from Direct Toxicity to Non-ionic Organic Contaminants (USEPA, 2017)

Detections in bold

Values in red indicate an exceedance of the Water Quality Criteria

APPENDIX D-4

ARM Group LLC
Engineers and Scientists

February 4, 2025

Ms. Jennifer Sohns
Land Restoration Program
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

Ms. Christine Kimak
US EPA Mid-Atlantic Region
1650 Arch Street
Philadelphia, PA 19103

Re: Coke Point Area Corrective Measures Study
Tradepoint Atlantic,
Sparrows Point, MD 21219

Dear Ms. Sohns and Ms. Kimak:

ARM Group LLC (ARM), on behalf of Tradepoint Atlantic (TPA), has prepared this letter report summarizing the groundwater results for monitoring wells along the Coke Point Area (CPA) southern and southwestern shoreline. The *Proposed Sampling Plan for Supplemental Sampling of Coke Point Area Sediment, Surface Water, and Pore Water* (EA, January 28, 2025) focuses on the western shoreline of the CPA. Based on the January 23, 2025 comments from the Agencies, groundwater results from along the southern and southwestern perimeter wells were evaluated (specifically for polycyclic aromatic hydrocarbons [PAHs]) to determine if additional pore water, surface water, and sediment samples will be required in these areas.

There were no exceedances for the southern and southwestern shoreline monitoring wells of the Groundwater Target Values for Ecological Receptors (based on the CPA Corrective Measures Study [CMS] calculations). Refer to **Figure 1** for the locations of the monitoring wells being evaluated. This letter report focuses on the Groundwater Target Values for the Off-Site Recreational User, which consists of a recreational user consuming fish and crab. First the perimeter well data (including data from multiple rounds for most wells) were screened against the groundwater target values for this receptor (at the 1e-6 risk level). There were several exceedances for benz[a]pyrene and dibenz[a,h]anthracene, and one exceedance for benz[a]anthracene.

Cumulative cancer risk was calculated for each of the perimeter wells based on the most recent sampling results (refer to **Attachment 1**). To ensure accurate risk calculations, all carcinogenic

volatile organic compound (VOC) and semivolatile organic compound (SVOC) contaminants of potential concern (COPCs) were included if there were any detections. There were no detections above the reporting limit for 4-Chloroaniline, Benzaldehyde, and Methylene Chloride; these are not included in the risk calculations. The cumulative risk for each sample from each well was estimated separately, as has been done previously for the vapor intrusion risk analysis as part of Response and Development Work Plans. Each well represents a segment of the shoreline to identify if any segment might present a risk greater than 1e-5 to the off-site recreational user. None of the individual wells presents a cumulative risk greater than 1e-5 (refer to **Attachment 1**). Based on a well by well evaluation, there are no unacceptable risks to the recreational user or ecological receptor based on the current perimeter well concentrations.

As a secondary assessment, 95% upper confidence limits (UCLs) were considered as the UCLs may be more representative of the perimeter wells as a group, since the fish and the recreational user are mobile and may move along the shoreline. 95% UCLs were calculated for each COPC identified in southern shoreline monitoring wells (half the reporting limit was utilized for non-detect values, if a well had multiple rounds of results, then the maximum concentration was used for the UCL calculations). The cumulative risk was calculated for the southern shoreline wells (refer to **Attachment 2**). The cumulative cancer risk for southern shoreline wells was 7E-6, below the Target Risk of 1E-5. Based on evaluation of the southern shoreline as a whole, there are no unacceptable risks to the recreational user or ecological receptor based on the current perimeter well concentrations.

As the current perimeter well concentrations do not present an unacceptable risk to the recreational user or ecological receptor, off-shore sampling along the southern and southwestern shore of the CPA is not warranted.

Calculations for the revised Groundwater Target Values for the Off-Site Recreational User will be submitted to the Agencies separately for review.

If you have questions regarding any information covered in this document, please feel free to contact Peter Haid at Tradepoint Atlantic: 443-649-5055.

Respectfully Submitted,
ARM Group LLC

Kaye Guille, P.E., PMP
Senior Engineer

Neil Peters, P.E.
Principal Engineer

Attachments:

Figure 1 – Southern Shoreline Monitoring Wells

Attachment 1 – Shoreline Groundwater Results and Risk Calculations
Attachment 2 – Shoreline Groundwater Risk Calculations

FIGURES

Parcel B11

Parcel B12

CP24-MWI
CP24-MWS

CP05-PZM028
CP05-PZM008
CP05-PZM019

CP26-MWS
CP26-MWI

CP12-PZM052
CP12-PZM012

CP16-PZM008
CP16-PZM035

CP14-PZM009
CP14-PZM062

CP09-PZM047
CP09-PZM010

CP15-PZM042
CP15-PZM020

CP11-PZM010

LEGEND

- Intermediate Well
- Shallow Well
- Parcel Boundary

Coke Point Area CMS
Southern Shoreline Monitoring Wells
January 29, 2025

Figure 1

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

1 inch = 400 feet

ATTACHMENT 1

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP05-PZM008								CP05-PZM019							
				4/13/2023		10/11/2023		5/14/2024		10/2/2024		4/13/2023		10/11/2023		5/14/2024		10/2/2024	
Cancer Risk					Risk		Risk		Risk		Risk		Risk		Risk		Risk		Risk
1,1-Biphenyl	µg/L	Carcinogen	370	0.58 J	1.6E-09	2 U	2.7E-09	2 U	2.7E-09	0.3 J	8.1E-10	1.2 J	3.2E-09	1.1 J	3.0E-09	1.1 J	3.0E-09	0.61 J	1.6E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.5 U	6.4E-09	0.5 U	6.4E-09	8.3	2.1E-07	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.07	4.5E-07	0.05 U	1.6E-07	0.03 J	1.9E-07	0.04 J	2.5E-07	0.05	3.2E-07	0.05 U	1.6E-07	0.04 J	2.5E-07	0.04 J	2.5E-07
Benzene	µg/L	Carcinogen	6,171	10	1.6E-09	5.2	8.4E-10	4.9	7.9E-10	5.6	9.1E-10	45	7.3E-09	39	6.3E-09	44	7.1E-09	1.6	2.6E-10
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	**0.04 J**	2.5E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	**0.03 J**	1.9E-06	**0.03 J**	1.9E-06	0.1 U	3.2E-06	0.1 U	3.2E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.02 J	1.3E-07	0.05 U	1.6E-07	0.02 J	1.3E-07	0.05 U	1.6E-07	0.02 J	1.3E-07	0.04 J	2.5E-07	0.02 J	1.3E-07	0.05 U	1.6E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.03 J	1.9E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.03 J	1.9E-08	0.01 J	6.4E-09	0.1 U	3.2E-08	0.1 U	3.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	1.7 J	3.8E-08	3 U	3.4E-08
Chrysene	µg/L	Carcinogen	2.18	0.04 J	1.8E-08	0.1 U	2.3E-08	0.06 J	2.8E-08	0.1 U	2.3E-08	0.02 J	9.2E-09	0.1 U	2.3E-08	0.03 J	1.4E-08	0.1 U	2.3E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	**0.02 J**	1.3E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.32 J	1.3E-12	0.32 J	1.3E-12	0.29 J	1.1E-12	0.37 J	1.5E-12	0.71	2.8E-12	0.89	3.5E-12	0.85	3.3E-12	0.5 U	9.8E-13
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.04 J	2.5E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.03 J	1.9E-07	0.02 J	1.3E-07	0.1 U	3.2E-07	0.1 U	3.2E-07
Naphthalene	µg/L	Carcinogen	127	16	1.3E-07	9.0	7.1E-08	8.0	6.3E-08	8.6	6.7E-08	81	6.4E-07	50	3.9E-07	58	4.6E-07	28	2.2E-07
Pentachlorophenol	µg/L	Carcinogen	363	0.18	5.0E-10	0.1 U	1.4E-10	10.0 U	1.4E-08	10 U	1.4E-08	0.11	3.0E-10	0.1 J	2.8E-10	10 U	1.4E-08	10 U	1.4E-08
Cumulative Cancer Risk					5E-06		6E-06		6E-06		6E-06		5E-06		5E-06		6E-06		6E-06

U: Not detected above the reporting limit
J: Detected above the method detection limit but below the reporting limit
NS: Not Sampled

Notes:
1. Cumulative cancer risks are rounded to one significant figure, and compared to a Target Risk of 1E-05.
2. All results were not detected above the reporting limit for 4-Chloroaniline, Benzaldehyde, and Methylene Chloride; these are not included in the above tables.
3. For non-detect results, one half of the reporting limit was used for risk calculations.

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP05-PZM28								CP09-PZM010							
				4/13/2023		10/11/2023		5/14/2024		10/2/2024		4/13/2023		10/11/2023		5/13/2024		10/2/2024	
Cancer Risk					Risk		Risk		Risk		Risk		Risk		Risk		Risk		Risk
1,1-Biphenyl	µg/L	Carcinogen	370	0.93 J	2.5E-09	0.66 J	1.8E-09	0.89 J	2.4E-09	0.54 J	1.5E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.09	5.7E-07	0.02 J	1.3E-07	0.03 J	1.9E-07	0.05	3.2E-07	0.05 U	1.6E-07	0.02 J	1.3E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzene	µg/L	Carcinogen	6,171	27	4.4E-09	29	4.7E-09	31	5.0E-09	34	5.5E-09	0.5 U	4.1E-11	0.5 U	4.1E-11	0.5 U	4.1E-11	0.5 U	4.1E-11
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	**0.07 J**	4.5E-06	**0.02 J**	1.3E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.03 J	1.9E-07	0.02 J	1.3E-07	0.02 J	1.3E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.02 J	1.3E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.05 J	3.2E-08	0.01 J	6.4E-09	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08
Chrysene	µg/L	Carcinogen	2.18	0.05 J	2.3E-08	0.02 J	9.2E-09	0.02 J	9.2E-09	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	**0.02 J**	1.3E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.66	2.6E-12	0.71	2.8E-12	0.79	3.1E-12	0.74	2.9E-12	0.5 U	9.8E-13	0.5 U	9.8E-13	0.5 U	9.8E-13	0.5 U	9.8E-13
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.06 J	3.8E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07
Naphthalene	µg/L	Carcinogen	127	46	3.6E-07	36	2.8E-07	37	2.9E-07	34	2.7E-07	0.1 U	3.9E-10	0.28	2.2E-09	0.1 U	3.9E-10	0.19	1.5E-09
Pentachlorophenol	µg/L	Carcinogen	363	0.16	4.4E-10	0.09 J	2.5E-10	10 U	1.4E-08	10 U	1.4E-08	0.1 U	1.4E-10	0.1 U	1.4E-10	10 U	1.4E-08	10 U	1.4E-08
Cumulative Cancer Risk					7E-06		4E-06		6E-06		6E-06		6E-06		5E-06		6E-06		6E-06

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP09-PZM047									CP11-PZM010								
				4/13/2023			10/19/2023			5/13/2024			10/2/2024			4/18/2023			10/13/2023			5/20/2024			10/3/2024		
Cancer Risk						Risk			Risk			Risk			Risk			Risk			Risk			Risk			Risk
1,1-Biphenyl	µg/L	Carcinogen	370	2	U	2.7E-09	2	U	2.7E-09	2	U	2.7E-09	2	U	2.7E-09	2.5		6.8E-09	2.3		6.2E-09	2.2		6.0E-09	2	U	2.7E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	NS		N/A	3.0	U	5.8E-11	3.0	U	5.8E-11	3.0	U	5.8E-11	NS		N/A	3.0	U	5.8E-11	3.0	U	5.8E-11	3.0	U	5.8E-11
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.13		8.3E-07	0.05	J	3.2E-07	0.02	J	1.3E-07	0.05	U	1.6E-07	0.08		5.1E-07	**0.18**		1.1E-06	0.08		5.1E-07	0.05	J	3.2E-07
Benzene	µg/L	Carcinogen	6,171	0.5	U	4.1E-11	0.5	U	4.1E-11	0.5	U	4.1E-11	0.5	U	4.1E-11	12		1.9E-09	7.8		1.3E-09	9.6		1.6E-09	5.5		8.9E-10
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	**0.02**	**J**	1.3E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	**0.03**	**J**	1.9E-06	**0.02**	**J**	1.3E-06	0.1	U	3.2E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.05	U	1.6E-07	0.02	J	1.3E-07	0.02	J	1.3E-07	0.05	U	1.6E-07	0.05	U	1.6E-07	0.06		3.8E-07	0.04	J	2.5E-07	0.05	U	1.6E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.1	U	3.2E-08	0.1	U	3.2E-08	0.01	J	6.4E-09	0.1	U	3.2E-08	0.1	U	3.2E-08	0.02	J	1.3E-08	0.01	J	6.4E-09	0.1	U	3.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08
Chrysene	µg/L	Carcinogen	2.18	0.1		4.6E-08	0.03	J	1.4E-08	0.01	J	4.6E-09	0.1	U	2.3E-08	0.07	J	3.2E-08	0.17		7.8E-08	0.05	J	2.3E-08	0.1	U	2.3E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.5	U	9.8E-13	0.5	U	9.8E-13	0.5	U	9.8E-13	0.5	U	9.8E-13	0.7		2.8E-12	0.54		2.1E-12	0.54		2.1E-12	0.51		2.0E-12
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07
Naphthalene	µg/L	Carcinogen	127	0.1	U	3.9E-10	0.08	J	6.3E-10	0.13		1.0E-09	0.15		1.2E-09	32		2.5E-07	30		2.4E-07	38		3.0E-07	13		1.0E-07
Pentachlorophenol	µg/L	Carcinogen	363	0.1	U	1.4E-10	10	U	1.4E-08	10	U	1.4E-08	10	U	1.4E-08	0.1	U	1.4E-10	10	U	1.4E-08	10	U	1.4E-08	10	U	1.4E-08
Cumulative Cancer Risk						4E-06			6E-06			5E-06			6E-06			6E-06			6E-06			4E-06			6E-06

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP12-PZM012								CP12-PZM052							
				4/17/2023		10/23/2023		5/22/2024		10/3/2024		4/17/2023		10/23/2023		5/22/2024		10/4/2024	
Cancer Risk					Risk		Risk		Risk		Risk		Risk		Risk		Risk		Risk
1,1-Biphenyl	µg/L	Carcinogen	370	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.05 U	1.6E-07	0.02 J	1.3E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.03 J	1.9E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzene	µg/L	Carcinogen	6,171	2.4	3.9E-10	17	2.8E-09	12	1.9E-09	0.5 U	4.1E-11	0.5 U	4.1E-11	0.5 U	4.1E-11	0.5 U	4.1E-11	6.5	1.1E-09
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	**0.03 J**	1.9E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.05 U	1.6E-07	0.02 J	1.3E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.02 J	1.3E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.1 U	3.2E-08	0.01 J	6.4E-09	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.01 J	6.4E-09	0.1 U	3.2E-08	0.1 U	3.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08
Chrysene	µg/L	Carcinogen	2.18	0.1 U	2.3E-08	0.01 J	4.6E-09	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.5 U	9.8E-13	0.3 J	1.2E-12	0.26 J	1.0E-12	0.5 U	9.8E-13	0.5 U	9.8E-13	0.5 U	9.8E-13	0.5 U	9.8E-13	0.2 J	7.9E-13
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.1 U	3.2E-07	0.01 J	6.4E-08	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07
Naphthalene	µg/L	Carcinogen	127	3	2.4E-08	8.9	7.0E-08	2.6	2.0E-08	0.1 U	3.9E-10	0.1 U	3.9E-10	0.07 J	5.5E-10	0.09 J	7.1E-10	9.5	7.5E-08
Pentachlorophenol	µg/L	Carcinogen	363	0.1 U	1.4E-10	10 U	1.4E-08	0.1 U	1.4E-10	10 U	1.4E-08	0.1 U	1.4E-10	10 U	1.4E-08	0.1 U	1.4E-10	10 U	1.4E-08
Cumulative Cancer Risk					4E-06		5E-06		6E-06		6E-06		6E-06		5E-06		6E-06		6E-06

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP14-PZM009								CP14-PZM062							
				4/18/2023		10/17/2023		5/16/2024		10/7/2024		4/18/2023		10/17/2023		5/16/2024		10/7/2024	
Cancer Risk					Risk		Risk		Risk		Risk		Risk		Risk		Risk		Risk
1,1-Biphenyl	µg/L	Carcinogen	370	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	0.37 J	1.0E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	NS	N/A	6.0 U	1.2E-10	3.0 U	5.8E-11	3.0 U	5.8E-11	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzene	µg/L	Carcinogen	6,171	45	7.3E-09	62	1.0E-08	64	1.0E-08	50	8.1E-09	0.5 U	4.1E-11	0.5 U	4.1E-11	0.5 U	4.1E-11	0.5 U	4.1E-11
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08
Chrysene	µg/L	Carcinogen	2.18	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.56	2.2E-12	0.77 J	3.0E-12	0.75	3.0E-12	0.67	2.6E-12	0.5 U	9.8E-13	0.5 U	9.8E-13	0.5 U	9.8E-13	0.5 U	9.8E-13
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07
Naphthalene	µg/L	Carcinogen	127	13	1.0E-07	16	1.3E-07	20	1.6E-07	23	1.8E-07	0.2	1.6E-09	0.11	8.6E-10	0.07 J	5.5E-10	0.17	1.3E-09
Pentachlorophenol	µg/L	Carcinogen	363	0.1 U	1.4E-10	10 U	1.4E-08	10 U	1.4E-08	10 U	1.4E-08	0.1 U	1.4E-10	10 U	1.4E-08	10 U	1.4E-08	10 U	1.4E-08
Cumulative Cancer Risk					6E-06		6E-06		6E-06		6E-06		6E-06		6E-06		6E-06		6E-06

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP15-PZM020									CP15-PZM042								
				4/18/2023			10/12/2023			5/14/2024			10/3/2024			4/18/2023			10/12/2023			5/14/2024			10/3/2024		
Cancer Risk						Risk			Risk			Risk			Risk			Risk			Risk			Risk			Risk
1,1-Biphenyl	µg/L	Carcinogen	370	1.6	J	4.3E-09	1.7	J	4.6E-09	2.3		6.2E-09	2	U	2.7E-09	2	U	2.7E-09	2	U	2.7E-09	2	U	2.7E-09	2	U	2.7E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	NS		N/A	1.20	J	4.6E-11	3.0	U	5.8E-11	3.0	U	5.8E-11	NS		N/A	3.0	U	5.8E-11	3.0	U	5.8E-11	3.0	U	5.8E-11
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09	0.5	U	6.4E-09
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.07		4.5E-07	0.06		3.8E-07	0.07		4.5E-07	0.05	U	1.6E-07	0.05	U	1.6E-07	0.03	J	1.9E-07	0.05	U	1.6E-07	0.05	U	1.6E-07
Benzene	µg/L	Carcinogen	6,171	6.8		1.1E-09	6.6		1.1E-09	6.2		1.0E-09	5.3		8.6E-10	0.43	J	7.0E-11	1.8		2.9E-10	1.1		1.8E-10	4.2		6.8E-10
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06	0.1	U	3.2E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.05	U	1.6E-07	0.03	J	1.9E-07	0.02	J	1.3E-07	0.05	U	1.6E-07	0.05	U	1.6E-07	0.05	U	1.6E-07	0.05	U	1.6E-07	0.05	U	1.6E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.1	U	3.2E-08	0.1	U	3.2E-08	0.1	U	3.2E-08	0.1	U	3.2E-08	0.1	U	3.2E-08	0.1	U	3.2E-08	0.1	U	3.2E-08	0.1	U	3.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08	3	U	3.4E-08
Chrysene	µg/L	Carcinogen	2.18	0.08	J	3.7E-08	0.15		6.9E-08	0.07	J	3.2E-08	0.1	U	2.3E-08	0.02	J	9.2E-09	0.04	J	1.8E-08	0.1	U	2.3E-08	0.1	U	2.3E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06	0.05	U	1.6E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.89		3.5E-12	0.85		3.3E-12	0.78		3.1E-12	0.8		3.1E-12	0.5	U	9.8E-13	0.22	J	8.7E-13	0.23	J	9.1E-13	0.45	J	1.8E-12
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07	0.1	U	3.2E-07
Naphthalene	µg/L	Carcinogen	127	48		3.8E-07	70		5.5E-07	52		4.1E-07	32		2.5E-07	1.5		1.2E-08	5.2		4.1E-08	3.4		2.7E-08	8.7		6.8E-08
Pentachlorophenol	µg/L	Carcinogen	363	0.1	U	1.4E-10	0.1	U	1.4E-10	10	U	1.4E-08	10	U	1.4E-08	0.1	U	1.4E-10	0.1	U	1.4E-10	10	U	1.4E-08	10	U	1.4E-08
Cumulative Cancer Risk						6E-06			6E-06			6E-06			6E-06			5E-06			6E-06			6E-06			6E-06

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP16-PZM008								CP16-PZM035							
				4/19/2023		10/13/2023		5/16/2024		10/4/2024		4/19/2023		10/13/2023		5/16/2024		10/7/2024	
Cancer Risk					Risk		Risk		Risk		Risk		Risk		Risk		Risk		Risk
1,1-Biphenyl	µg/L	Carcinogen	370	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	2 U	2.7E-09	0.46 J	1.2E-09	0.5 J	1.4E-09	2 U	2.7E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11	NS	N/A	3.0 U	5.8E-11	3.0 U	5.8E-11	3.0 U	5.8E-11
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09	0.5 U	6.4E-09
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.05 J	3.2E-07	0.05 J	3.2E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.06	3.8E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzene	µg/L	Carcinogen	6,171	77	1.2E-08	98	1.6E-08	57	9.2E-09	82	1.3E-08	170	2.8E-08	170	2.8E-08	180	2.9E-08	110	1.8E-08
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06	0.1 U	3.2E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.03 J	1.9E-07	0.03 J	1.9E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07	0.05 U	1.6E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.02 J	1.3E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08	0.1 U	3.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	3 U	3.4E-08	1.6 J	3.6E-08	3 U	3.4E-08	3 U	3.4E-08
Chrysene	µg/L	Carcinogen	2.18	0.05 J	2.3E-08	0.07 J	3.2E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.1 U	2.3E-08	0.02 J	9.2E-09	0.1 U	2.3E-08	0.1 U	2.3E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06	0.05 U	1.6E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.56	2.2E-12	0.64	2.5E-12	0.46 J	1.8E-12	0.59	2.3E-12	0.83	3.3E-12	0.86	3.4E-12	0.85	3.3E-12	0.67	2.6E-12
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07	0.1 U	3.2E-07
Naphthalene	µg/L	Carcinogen	127	8.6	6.7E-08	13	1.0E-07	7.6	6.0E-08	8.6	6.7E-08	70	5.5E-07	84	6.6E-07	63	4.9E-07	21	1.6E-07
Pentachlorophenol	µg/L	Carcinogen	363	0.07 J	1.9E-10	10 U	1.4E-08	10 U	1.4E-08	10 U	1.4E-08	0.1 U	1.4E-10	10 U	1.4E-08	10 U	1.4E-08	10 U	1.4E-08
Cumulative Cancer Risk					6E-06		6E-06		6E-06		6E-06		6E-06		6E-06		6E-06		6E-06

Attachment 1 - Shoreline Groundwater Results and Risk Calculations
Coke Point Area Groundwater CMS

	Units	Organ System	Human Health (Off-Site Recreational User)	CP24-MWS			CP24-MWI			CP26-MWS			CP26-MWI		
				2/28/2020			2/28/2020			3/11/2020			3/11/2020		
Cancer Risk						Risk			Risk			Risk			Risk
1,1-Biphenyl	µg/L	Carcinogen	370	0.46	J	1.2E-09	0.82	J	2.2E-09	0.4	J	1.1E-09	0.97	U	1.3E-09
1,4-Dioxane	µg/L	Carcinogen	25,847	3.0	U	5.8E-11	0.098	U	1.9E-12	0.099	U	1.9E-12	0.17		6.6E-12
2,6-Dinitrotoluene	µg/L	Carcinogen	39.2	0.98	U	1.3E-08	0.99	U	1.3E-08	0.98	U	1.3E-08	0.97	U	1.2E-08
Benz[a]anthracene	µg/L	Carcinogen	0.157	0.072	J	4.6E-07	0.075	J	4.8E-07	0.069	J	4.4E-07	0.057	J	3.6E-07
Benzene	µg/L	Carcinogen	6,171	3.4		5.5E-10	1.2		1.9E-10	59.9		9.7E-09	0.83	J	1.3E-10
Benzo[a]pyrene	µg/L	Carcinogen	0.0157	**0.02**	**J**	1.3E-06	0.099	U	3.1E-06	**0.11**		7.0E-06	**0.074**	**J**	4.7E-06
Benzo[b]fluoranthene	µg/L	Carcinogen	0.157	0.035	J	2.2E-07	0.099	U	3.1E-07	0.13		8.3E-07	0.087	J	5.5E-07
Benzo[k]fluoranthene	µg/L	Carcinogen	1.57	0.03	J	1.9E-08	0.099	U	3.1E-08	0.044	J	2.8E-08	0.035	J	2.2E-08
Bis(2-Ethylhexyl)phthalate	µg/L	Carcinogen	44.77	0.98	U	1.1E-08	0.99	U	1.1E-08	0.98	U	1.1E-08	0.97	U	1.1E-08
Chrysene	µg/L	Carcinogen	2.18	0.064	J	2.9E-08	0.099	U	2.3E-08	0.077	J	3.5E-08	0.054	J	2.5E-08
Dibenz[a,h]anthracene	µg/L	Carcinogen	0.0157	0.098	U	3.1E-06	0.099	U	3.1E-06	0.098	U	3.1E-06	0.097	U	3.1E-06
Ethylbenzene	µg/L	Carcinogen	254,100	0.73	J	2.9E-12	0.51	J	2.0E-12	0.72	J	2.8E-12	1	U	2.0E-12
Indeno[1,2,3-c,d]pyrene	µg/L	Carcinogen	0.157	0.098	U	3.1E-07	0.099	U	3.1E-07	0.061	J	3.9E-07	0.045	J	2.9E-07
Naphthalene	µg/L	Carcinogen	127	48.3		3.8E-07	41.6		3.3E-07	70.5		5.5E-07	2.1		1.6E-08
Pentachlorophenol	µg/L	Carcinogen	363	2.5	U	3.4E-09	2.5	U	3.4E-09	2.4	U	3.3E-09	2.4	U	3.3E-09
Cumulative Cancer Risk						6E-06			8E-06			1E-05			9E-06

ATTACHMENT 2

Attachment 2 - Shoreline Groundwater Risk Calculations
Coke Point Area Groundwater CMS

	Units	Human Health (Off-Site Recreational User)	EPCs		
			EPC Type	EPC (µg/L)	Risk
1,1-Biphenyl	µg/L	370	Maximum Value	2.2	6.0E-09
1,4-Dioxane	µg/L	25,847	Maximum Value	0.17	6.6E-12
2,6-Dinitrotoluene	µg/L	39.2	Maximum Value	8.3	2.1E-07
Benz[a]anthracene	µg/L	0.157	95% KM Adjusted Gamma UCL	0.086	5.5E-07
Benzene	µg/L	6,171	Gamma Adjusted KM-UCL	68.0	1.1E-08
Benzo[a]pyrene	µg/L	0.0157	95% KM (t) UCL	0.06	3.8E-06
Benzo[b]fluoranthene	µg/L	0.157	95% KM Adjusted Gamma UCL	0.06	3.8E-07
Benzo[k]fluoranthene	µg/L	1.57	95% KM (t) UCL	0.04	2.5E-08
Bis(2-Ethylhexyl)phthalate	µg/L	44.77	Maximum Value	1.7	3.8E-08
Chrysene	µg/L	2.18	95% KM (t) UCL	0.08	3.7E-08
Dibenz[a,h]anthracene	µg/L	0.0157	Maximum Value	0.02	1.3E-06
Ethylbenzene	µg/L	254,100	95% KM (t) UCL	0.68	2.7E-12
Indeno[1,2,3-c,d]pyrene	µg/L	0.157	95% KM (t) UCL	0.05	3.2E-07
Naphthalene	µg/L	127	95% Student's-t UCL	43.3	3.4E-07
Pentachlorophenol	µg/L	363	95% KM (t) UCL	0.17	4.7E-10
Cumulative Cancer Risk					7.0E-06

EPC = exposure point concentration
UCL = upper confidence limit

Notes:
1. For non-detect results, one half of the reporting limit was used for UCL calculations.
2. For COPCs with a large number of non-detect concentrations, then UCL calculations are generally not recommended. In those cases, the maximum value was utilized as the EPC.

APPENDIX E

APPENDIX E-1

Appendix E-1 - Target Organs
CPA Groundwater CMS, Sparrows Point

Chemical	CAS	Parameter Group	Target Organs based on RfD for Oral	Target Organs based on RfC for inhalation	Source
Cyanide	57-12-5	CN	Reproductive	Thyroid	IRIS Assessments for RfD, RSL Calculator Metadata (El Ghawabit et al. 1975) for RfC
Antimony	7440-36-0	Metal	Hematologic	Respiratory	IRIS Assessments for RfD, RSL Calculator Metadata (Newton et al. 1994) for RfC
Arsenic	7440-38-2	Metal	Cardiovascular, Dermal	N/A	IRIS Assessments
Chromium VI	18540-29-9	Metal	Gastrointestinal	Respiratory	IRIS Assessments
Cobalt	7440-48-4	Metal	Thyroid	Respiratory	RSL Calculator Metadata (Roche and Layrisse 1956) and (Nemery et al. 1992)
Iron	7439-89-6	Metal	Gastrointestinal	None	RSL Calculator Metadata (Frykman et al. 1994)
Manganese	7439-96-5	Metal	Nervous	Nervous	IRIS Assessments
Nickel	7440-02-0	Metal	Body weight	Respiratory	IRIS Assessments for RfD, RSL Calculator Metadata (NTP 1996c) for RfC
Thallium	7440-28-0	Metal	Dermal	N/A	RSL Calculator Metadata (MRI 1988)
Vanadium	7440-62-2	Metal	Dermal	Respiratory	RSL Calculator Metadata (Stokinger et al. 1953) and (NTP 2002)
PCBs (total)	1336-36-3	PCB	Immune, Dermal, Ocular	N/A	IRIS Assessments
1,1-Biphenyl	92-52-4	SVOC	Urinary	Hepatic, Urinary	IRIS Assessments for RfD, RSL Calculator Metadata (Cannon Laboratories Inc. 1977) for RfC
2,4-Dimethylphenol	105-67-9	SVOC	Nervous, Hematologic	N/A	IRIS Assessments
2,6-Dinitrotoluene	606-20-2	SVOC	Immune (Spleen)	N/A	RfD from RSL Calculator Metadata (Lee et al. 1976c)
2-Butanone (MEK)	78-93-3	SVOC	Developmental, Musculoskeletal	Developmental	IRIS Assessments (RfD), RfC from RSL Calculator Metadata (Schwetz et al. 1991)
2-Methylnaphthalene	91-57-6	SVOC	Respiratory	N/A	IRIS Assessments
2-Methylphenol	95-48-7	SVOC	Nervous, Body Weight	N/A	IRIS Assessments
Acenaphthene	83-32-9	SVOC	Hepatic	N/A	IRIS Assessment (RfD)
Benz[a]anthracene	56-55-3	SVOC	N/A	N/A	IRIS Assessments
Benzo[a]pyrene	50-32-8	SVOC	Developmental	Developmental	IRIS Assessments
Benzo[b]fluoranthene	205-99-2	SVOC	N/A	N/A	IRIS Assessments

Appendix E-1 - Target Organs
CPA Groundwater CMS, Sparrows Point

Chemical	CAS	Parameter Group	Target Organs based on RfD for Oral	Target Organs based on RfC for inhalation	Source
Benzo[k]fluoranthene	207-08-9	SVOC	N/A	N/A	IRIS Assessments
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	Hepatic	N/A	IRIS Assessments
Chrysene	218-01-9	SVOC	N/A	N/A	IRIS Assessments
Dibenz[a,h]anthracene	53-70-3	SVOC	N/A	N/A	IRIS Assessments
Fluoranthene	206-44-0	SVOC	Hepatic, Urinary	N/A	IRIS Assessments
Fluorene	86-73-7	SVOC	Hematologic	N/A	IRIS Assessments
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	N/A	N/A	IRIS Assessments
Naphthalene	91-20-3	SVOC	Body weight	Respiratory	IRIS Assessments
Pentachlorophenol	87-86-5	SVOC	Hepatic	N/A	IRIS Assessments
Pyrene	129-00-0	SVOC	Urinary	N/A	IRIS Assessments
Pyridine	110-86-1	SVOC	Hepatic	N/A	IRIS Assessments
Styrene	100-42-5	SVOC	Hematologic, Hepatic	Nervous	RSL Calculator Metadata (Quast et al. 1979) and (Mutti et al. 1984)
4-Chloroaniline	106-47-8	VOC	Immune	N/A	IRIS Assessments
Benzaldehyde	100-52-7	VOC	Gastrointestinal, Urinary	N/A	IRIS Assessments
Benzene	71-43-2	VOC	Immune	Immune	IRIS Assessments
Ethylbenzene	100-41-4	VOC	Hepatic	Developmental	RSL Calculator Metadata (Mellert et al. 2007) and (Andrew et al. 1981, Hardin et al. 1981)
Methylene Chloride	75-09-2	VOC	Hepatic	Hepatic	RSL Calculator Metadata (Soreta et al. 1986) and (Nitschke et al. 1988)
Toluene	108-88-3	VOC	Urinary	Nervous	IRIS Assessments
Xylenes	1330-20-7	VOC	Other (Body weight)	Nervous	RSL Calculator Metadata (NTP 1986) and (Korsak et al. 1994)
1,4-Dioxane	123-91-1	VOC/SVOC	Hepatic, Urinary	Respiratory	IRIS Assessments

Notes:

1. Equations for recreational user (fish/crab ingestion) utilize RfD only, so only those target organs will be assessed.
2. IRIS Assessments: https://iris.epa.gov/AtoZ/?list_type=alpha
3. For PCBs, target organs were selected based on Aroclor 1254.

APPENDIX E-2

Appendix E-2, Table A1
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
On-Site Utility Worker, Exposure Assumptions

Description	Variable	Value
Target cancer risk (unitless)	TR	1.00E-06
Target hazard quotient (unitless)	THQ	1
Averaging time - noncancer (days) - Utility Worker	ATnc,uw	365
Averaging time - cancer (days)	ATc	25550
Lifetime (yr)	LTc	70
Exposure duration (yr) - Utility Worker	EDuw	1
Exposure frequency (events/yr) - Utility Worker	EFuw	20
Hours worked per day - Utility Worker	ETuw	4
Body weight (kg) - Utility Worker	BWuw	80
Skin surface area (cm2) - Utility Worker	SAuw	2550
Hourly Air Exchange Rate (Utility Worker)	ACHuw	46
Area of Trench (m2)	A	2.44
Volume of Trench (m3)	V	5.95
Fraction of floor contaminant can enter (unitless)	F	1
Molecular weight of O2 (g/mol)	MWo2	32
Molecular weight of H2O (g/mol)	MWh2o	18
Groundwater temp (degree K)	Tgw	284
Liquid phase transfer coeff of O2 (cm/sec)	kLO2	0.002
Gas phase transfer coeff of H2O (cm/sec)	kGH2O	0.833
Ideal Gas Constant	R	8.20E-05

Appendix E-2, Table A2
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
On-Site Utility Worker, Carcinogenic Calculations

			Parameter Specific Data													Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
																DA (ug/cm^2 * event)	RBSL (ug/L)	VF (L/m^3)	Utility RBSL (ug/L)	Utility RBSL (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo (mg/kg*day)$^{-1}$	FA (unitless)	kL (cm/sec)	kG (cm/sec)	HLC (atm*m^3/mole)	K (cm/sec)	IUR (ug/m^3)$^{-1}$	Cancer	Cancer	Utility	Cancer	Cancer
Cyanide	57-12-5	CN	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1		0.01	2.1E-03	7.0E-01	1.0E-04	1.2E-03		-	-	--	-	-
Antimony	7440-36-0	Metal	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15		1 *	9.8E-04	4.2E-01				-	-	-	-	-
Arsenic	7440-38-2	Metal	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1.5E+00	1 *	1.2E-03	4.9E-01			4.3E-03	2.67E-02	6.68E+03	-	-	6.68E+03
Chromium VI	18540-29-9	Metal	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	5.0E-01	1 *	1.5E-03	5.6E-01			8.4E-02	2.00E-03	2.50E+02	-	-	2.50E+02
Cobalt	7440-48-4	Metal	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1		1 *	1.4E-03	5.3E-01			9.0E-03	-	-	-	-	-
Iron	7439-89-6	Metal	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1		1 *	1.4E-03	5.4E-01				-	-	-	-	-
Manganese	7439-96-5	Metal	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04		1 *	1.5E-03	5.5E-01				-	-	-	-	-
Nickel	7440-02-0	Metal	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04		1 *	1.4E-03	5.3E-01			2.6E-04	-	-	-	-	-
Thallium	7440-28-0	Metal	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1		1 *	7.6E-04	3.5E-01				-	-	-	-	-
Vanadium	7440-62-2	Metal	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026		1 *	1.5E-03	5.6E-01				-	-	-	-	-
PCBs (total) ˜	1336-36-3	PCB	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E+00	0.5	5.9E-04	3.0E-01	2.8E-04	5.1E-04	5.7E-04	2.00E-02	3.63E+00	1.64E-01	8.20E+01	3.47E+00
1,1-Biphenyl	92-52-4	SVOC	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	8.0E-03	1 *	8.8E-04	3.9E-01	3.1E-04	7.5E-04		5.01E+00	1.08E+04	--	-	1.08E+04
2,4-Dimethylphenol	105-67-9	SVOC	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1		1	9.8E-04	4.2E-01	9.5E-07	1.7E-05		-	-	-	-	-
2,6-Dinitrotoluene	606-20-2	SVOC	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1.5E+00	1	8.0E-04	3.7E-01	7.5E-07	1.2E-05		2.67E-02	1.17E+03	-	-	1.17E+03
2-Butanone (MEK)	78-93-3	SVOC	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1		1	1.3E-03	5.0E-01	5.7E-05	6.2E-04		-	-	--	-	-
2-Methylnaphthalene	91-57-6	SVOC	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1		1 *	9.1E-04	4.0E-01	5.2E-04	8.3E-04		-	-	--	-	-
2-Methylphenol	95-48-7	SVOC	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1		1	1.0E-03	4.3E-01	1.2E-06	2.2E-05		-	-	-	-	-
Acenaphthene	83-32-9	SVOC	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1		1 *	8.7E-04	3.9E-01	1.8E-04	6.8E-04		-	-	--	-	-
Benz[a]anthracene	56-55-3	SVOC	2.0E+00	3.2E+00	8.5E+00	5.5E-01	2.3E+02	1	1.0E-01	1	7.1E-04	3.4E-01	1.2E-05	1.4E-04	6.0E-05	4.01E-01	9.32E+01	4.49E-02	2.85E+03	9.03E+01
Benzo[a]pyrene	50-32-8	SVOC	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1.0E+00	1	6.8E-04	3.3E-01	4.6E-07	6.4E-06	6.0E-04	4.01E-02	6.21E+00	-	-	6.21E+00
Benzo[b]fluoranthene	205-99-2	SVOC	2.7E+00	2.5E+00	1.1E+01	4.2E-01	2.5E+02	1	1.0E-01	1	6.8E-04	3.3E-01	6.6E-07	9.1E-06	6.0E-05	4.01E-01	1.05E+02	-	-	1.05E+02
Benzo[k]fluoranthene	207-08-9	SVOC	2.7E+00	4.2E+00	1.2E+01	6.9E-01	2.5E+02	1	1.0E-02	1 *	6.8E-04	3.3E-01	5.8E-07	8.1E-06	6.0E-06	4.01E+00	6.39E+02	-	-	6.39E+02
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	1.4E-02	0.8	5.5E-04	2.8E-01	2.7E-07		2.4E-06	2.86E+00	1.42E+02	-	-	1.42E+02
Chrysene	218-01-9	SVOC	2.0E+00	3.5E+00	8.5E+00	6.0E-01	2.3E+02	1	1.0E-03	1	7.1E-04	3.4E-01	5.2E-06	6.9E-05	6.0E-07	4.01E+01	8.54E+03	-	-	8.54E+03
Dibenz[a,h]anthracene	53-70-3	SVOC	3.8E+00	6.1E+00	1.7E+01	9.5E-01	2.8E+02	1	1.0E+00	0.6	6.5E-04	3.2E-01	1.4E-07	1.9E-06	6.0E-04	4.01E-02	6.50E+00	-	-	6.50E+00
Fluoranthene	206-44-0	SVOC	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1		1	7.6E-04	3.5E-01	8.9E-06	1.1E-04		-	-	-	-	-
Fluorene	86-73-7	SVOC	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1		1 *	8.3E-04	3.7E-01	9.6E-05	5.4E-04		-	-	--	-	-
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7E+00	7.9E+00	1.7E+01	1.2E+00	2.8E+02	1	1.0E-01	0.6	6.4E-04	3.2E-01	3.5E-07	4.7E-06	6.0E-05	4.01E-01	5.23E+01	-	-	5.23E+01
Naphthalene	91-20-3	SVOC	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1.2E-01	1	9.5E-04	4.1E-01	4.4E-04	8.4E-04	3.4E-05	3.34E-01	1.53E+03	2.70E-01	8.34E+02	5.40E+02
Pentachlorophenol	87-86-5	SVOC	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	4.0E-01	0.9	6.6E-04	3.2E-01	2.5E-08	3.4E-07	5.1E-06	1.00E-01	8.53E+01	-	-	8.53E+01
Pyrene	129-00-0	SVOC	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1		1 *	7.6E-04	3.5E-01	1.2E-05	1.5E-04		-	-	--	-	-
Pyridine	110-86-1	SVOC	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1		1 *	1.2E-03	4.8E-01	1.1E-05	1.9E-04		-	-	--	-	-
Styrene	100-42-5	SVOC	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1		1	1.1E-03	4.4E-01	2.8E-03	1.0E-03		-	-	--	-	-
4-Chloroaniline	106-47-8	VOC	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	2.0E-01	1 *	9.5E-04	4.1E-01	1.2E-06	2.0E-05		2.00E-01	8.03E+03	-	-	8.03E+03
Benzaldehyde	100-52-7	VOC	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	4.0E-03	1 *	1.0E-03	4.4E-01	2.7E-05	3.4E-04		1.00E+01	5.47E+05	--	-	5.47E+05
Benzene	71-43-2	VOC	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	5.5E-02	1	1.2E-03	4.9E-01	5.6E-03	1.2E-03	7.8E-06	7.29E-01	1.10E+04	3.88E-01	2.53E+03	2.06E+03
Ethylbenzene	100-41-4	VOC	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1.1E-02	1	1.0E-03	4.4E-01	7.9E-03	1.0E-03	2.5E-06	3.64E+00	1.71E+04	3.33E-01	9.19E+03	5.98E+03
Methylene Chloride	75-09-2	VOC	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	2.0E-03	1	1.2E-03	4.7E-01	3.3E-03	1.1E-03	1.0E-08	2.00E+01	1.23E+06	3.69E-01	2.08E+06	7.74E+05
Toluene	108-88-3	VOC	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1		1	1.1E-03	4.6E-01	6.6E-03	1.1E-03		-	-	--	-	-
Xylenes	1330-20-7	VOC	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1		1	1.0E-03	4.4E-01	6.6E-03	1.0E-03		-	-	--	-	-
1,4-Dioxane	123-91-1	VOC / SVOC	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1.0E-01	1	1.1E-03	4.7E-01	4.8E-06	8.9E-05	5.0E-06	4.01E-01	2.61E+05	-	-	2.61E+05
Sources			EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAGSE	CALC	CALC	EPA CS	CALC	RTAP RSL	CALC	CALC	CALC	CALC	CALC

Notes:
* FA <1 applies to a limited number of organic compounds. An FA of 1 was utilized for inorganics and for organic analytes not listed on RAGSE Exhibit B-3.
˜PCBs (total) using Aroclor 1254 values
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)
XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.

Appendix E-2, Table A3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
On-Site Utility Worker, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data												
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	kL (cm/sec)	kG (cm/sec)	HLC (atm*m3/mole)	K (cm/sec)	RfC (mg/m^3)
Body weight																	
2-Methylphenol	95-48-7	SVOC	25%	0.25	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.0E-03	4.3E-01	1.2E-06	2.2E-05	6.0E-01
Naphthalene	91-20-3	SVOC	25%	0.25	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	9.5E-04	4.1E-01	4.4E-04	8.4E-04	3.0E-03
Nickel	7440-02-0	Metal	25%	0.25	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02	1.4E-03	5.3E-01			1.0E-05
Xylenes	1330-20-7	VOC	25%	0.25	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	1.0E-03	4.4E-01	6.6E-03	1.0E-03	1.0E-01
Cardiovascular																	
Arsenic	7440-38-2	Metal	100%	1	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04	1.2E-03	4.9E-01			1.5E-05
Dermal																	
Arsenic	7440-38-2	Metal	25%	0.25	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04	1.2E-03	4.9E-01			1.5E-05
Thallium	7440-28-0	Metal	25%	0.25	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1	1	1.0E-05	7.6E-04	3.5E-01			
Vanadium	7440-62-2	Metal	25%	0.25	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03	1.5E-03	5.6E-01			1.0E-04
PCBs (total) ˜	1336-36-3	PCB	25%	0.25	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	5.9E-04	3.0E-01	2.8E-04	5.1E-04	
Developmental																	
2-Butanone (MEK)	78-93-3	SVOC	33%	0.33	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	1.3E-03	5.0E-01	5.7E-05	6.2E-04	5.0E+00
Benzo[a]pyrene	50-32-8	SVOC	33%	0.33	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1	3.0E-04	6.8E-04	3.3E-01	4.6E-07	6.4E-06	2.0E-06
Ethylbenzene	100-41-4	VOC	33%	0.33	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	1.0E-03	4.4E-01	7.9E-03	1.0E-03	1.0E+00
Gastrointestinal																	
Benzaldehyde	100-52-7	VOC	33%	0.33	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	1.0E-03	4.4E-01	2.7E-05	3.4E-04	
Chromium VI	18540-29-9	Metal	33%	0.33	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03	1.5E-03	5.6E-01			1.0E-04
Iron	7439-89-6	Metal	33%	0.33	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1	1	7.0E-01	1.4E-03	5.4E-01			
Hematologic																	
Antimony	7440-36-0	Metal	25%	0.25	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04	9.8E-04	4.2E-01			3.0E-04
2,4-Dimethylphenol	105-67-9	SVOC	25%	0.25	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.8E-04	4.2E-01	9.5E-07	1.7E-05	
Fluorene	86-73-7	SVOC	25%	0.25	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1	1	4.0E-02	8.3E-04	3.7E-01	9.6E-05	5.4E-04	
Styrene	100-42-5	SVOC	25%	0.25	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	1.1E-03	4.4E-01	2.8E-03	1.0E-03	1.0E+00
Hepatic																	
Acenaphthene	83-32-9	SVOC	10%	0.10	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1	1	6.0E-02	8.7E-04	3.9E-01	1.8E-04	6.8E-04	
1,1-Biphenyl	92-52-4	SVOC	10%	0.10	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	8.8E-04	3.9E-01	3.1E-04	7.5E-04	4.0E-04
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	10%	0.10	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	0.8	2.0E-02	5.5E-04	2.8E-01	2.7E-07	3.3E-06	
Ethylbenzene	100-41-4	VOC	10%	0.10	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	1.0E-03	4.4E-01	7.9E-03	1.0E-03	1.0E+00
Fluoranthene	206-44-0	SVOC	10%	0.10	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	7.6E-04	3.5E-01	8.9E-06	1.1E-04	
Methylene Chloride	75-09-2	VOC	10%	0.10	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	1	6.0E-03	1.2E-03	4.7E-01	3.3E-03	1.1E-03	6.0E-01
Pentachlorophenol	87-86-5	SVOC	10%	0.10	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	0.9	5.0E-03	6.6E-04	3.2E-01	2.5E-08	3.4E-07	
Pyridine	110-86-1	SVOC	10%	0.10	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1	1	1.0E-03	1.2E-03	4.8E-01	1.1E-05	1.9E-04	
Styrene	100-42-5	SVOC	10%	0.10	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	1.1E-03	4.4E-01	2.8E-03	1.0E-03	1.0E+00
1,4-Dioxane	123-91-1	VOC/SVOC	10%	0.10	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	1.1E-03	4.7E-01	4.8E-06	8.9E-05	3.0E-02
Immune																	
4-Chloroaniline	106-47-8	VOC	25%	0.25	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	1	5.0E-04	9.5E-04	4.1E-01	1.2E-06	2.0E-05	
Benzene	71-43-2	VOC	25%	0.25	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	1	4.0E-03	1.2E-03	4.9E-01	5.6E-03	1.2E-03	3.0E-02
2,6-Dinitrotoluene	606-20-2	SVOC	25%	0.25	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1	3.0E-04	1.8E-01	1.4E+01	7.5E-07	4.4E-04	
PCBs (total) ˜	1336-36-3	PCB	25%	0.25	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	5.9E-04	3.0E-01	2.8E-04	5.1E-04	

Appendix E-2, Table A3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
On-Site Utility Worker, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data												
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	kL (cm/sec)	kG (cm/sec)	HLC (atm*m3/mole)	K (cm/sec)	RfC (mg/m^3)
Musculoskeletal																	
2-Butanone (MEK)	78-93-3	SVOC	100%	1.00	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	1.3E-03	5.0E-01	5.7E-05	6.2E-04	5.0E+00
Nervous																	
2,4-Dimethylphenol	105-67-9	SVOC	17%	0.167	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.8E-04	4.2E-01	9.5E-07	1.7E-05	
Manganese	7439-96-5	Metal	17%	0.167	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04	1	2.4E-02	1.5E-03	5.5E-01			5.0E-05
2-Methylphenol	95-48-7	SVOC	17%	0.167	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.0E-03	4.3E-01	1.2E-06	2.2E-05	6.0E-01
Styrene	100-42-5	SVOC	17%	0.167	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	1.1E-03	4.4E-01	2.8E-03	1.0E-03	1.0E+00
Toluene	108-88-3	VOC	17%	0.167	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	1.1E-03	4.6E-01	6.6E-03	1.1E-03	5.0E+00
Xylenes	1330-20-7	VOC	17%	0.167	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	1.0E-03	4.4E-01	6.6E-03	1.0E-03	1.0E-01
Ocular																	
PCBs (total) ˜	1336-36-3	PCB	100%	1	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	5.9E-04	3.0E-01	2.8E-04	5.1E-04	
Reproductive																	
Cyanide	57-12-5	CN	100%	1	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	2.1E-03	7.0E-01	1.0E-04	1.2E-03	8.0E-04
Respiratory																	
Antimony	7440-36-0	Metal	13%	0.125	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04	9.8E-04	4.2E-01			3.0E-04
Chromium VI	18540-29-9	Metal	13%	0.125	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03	1.5E-03	5.6E-01			1.0E-04
Cobalt	7440-48-4	Metal	13%	0.125	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04	1.4E-03	5.3E-01			6.0E-06
2-Methylnaphthalene	91-57-6	SVOC	13%	0.125	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1	1	4.0E-03	9.1E-04	4.0E-01	5.2E-04	8.3E-04	
Naphthalene	91-20-3	SVOC	13%	0.125	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	9.5E-04	4.1E-01	4.4E-04	8.4E-04	3.0E-03
Nickel	7440-02-0	Metal	13%	0.125	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02	1.4E-03	5.3E-01			1.0E-05
Vanadium	7440-62-2	Metal	13%	0.125	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03	1.5E-03	5.6E-01			1.0E-04
1,4-Dioxane	123-91-1	VOC/SVOC	13%	0.125	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	1.1E-03	4.7E-01	4.8E-06	8.9E-05	3.0E-02
Thyroid																	
Cobalt	7440-48-4	Metal	50%	0.5	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04	1.4E-03	5.3E-01			6.0E-06
Cyanide	57-12-5	CN	50%	0.5	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	2.1E-03	7.0E-01	1.0E-04	1.2E-03	8.0E-04
Urinary																	
Benzaldehyde	100-52-7	VOC	17%	0.167	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	1.0E-03	4.4E-01	2.7E-05	3.4E-04	
1,1-Biphenyl	92-52-4	SVOC	17%	0.167	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	8.8E-04	3.9E-01	3.1E-04	7.5E-04	4.0E-04
Fluoranthene	206-44-0	SVOC	17%	0.167	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	7.6E-04	3.5E-01	8.9E-06	1.1E-04	
Pyrene	129-00-0	SVOC	17%	0.167	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1	1	3.0E-02	7.6E-04	3.5E-01	1.2E-05	1.5E-04	
Toluene	108-88-3	VOC	17%	0.167	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	1.1E-03	4.6E-01	6.6E-03	1.1E-03	5.0E+00
1,4-Dioxane	123-91-1	VOC/SVOC	17%	0.167	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	1.1E-03	4.7E-01	4.8E-06	8.9E-05	3.0E-02
Sources					EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RAGS	RTAP RSL	CALC	CALC	RAIS	CALC	RTAP RSL

Notes:
* FA <1 applies to a limited number of organic compounds. An FA of 1 was utilized for inorganics and for organic analytes not listed on RAGSE Exhibit B-3.
˜PCBs (total) using Aroclor 1254 values
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)
XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.

Appendix E-2, Table A3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
On-Site Utility Worker, Non-Carcinogenic Calculations

			Dermal Contact		Vapor Inhalation		Combined Dermal/Inhalation
			DA (ug/cm^2 * event)	RBSL (ug/L)	VF (L/m^3)	Utility RBSL (ug/L)	Utility RBSL (ug/L)
Chemical	CAS	Parameter Group	Noncancer	Noncancer	Utility	Noncancer	Noncancer
Body weight							
2-Methylphenol	95-48-7	SVOC	7.16E+00	1.96E+05	-	-	1.96E+05
Naphthalene	91-20-3	SVOC	2.86E+00	1.31E+04	2.70E-01	3.04E+02	2.97E+02
Nickel	7440-02-0	Metal	1.15E-01	1.43E+05	-	-	1.43E+05
Xylenes	1330-20-7	VOC	2.86E+01	1.32E+05	3.33E-01	8.22E+03	7.74E+03
Cardiovascular							
Arsenic	7440-38-2	Metal	1.72E-01	4.29E+04	-	-	4.29E+04
Dermal							
Arsenic	7440-38-2	Metal	4.29E-02	1.07E+04	-	-	1.07E+04
Thallium	7440-28-0	Metal	1.43E-03	3.58E+02	-	-	3.58E+02
Vanadium	7440-62-2	Metal	1.88E-02	4.69E+03	-	-	4.69E+03
PCBs (total) ˜	1336-36-3	PCB	2.86E-03	9.54E-01	1.64E-01	-	9.54E-01
Developmental							
2-Butanone (MEK)	78-93-3	SVOC	1.15E+02	2.63E+07	2.00E-01	9.15E+05	8.84E+05
Benzo[a]pyrene	50-32-8	SVOC	5.73E-02	8.88E+00	-	-	8.88E+00
Ethylbenzene	100-41-4	VOC	9.54E+00	4.47E+04	3.33E-01	1.09E+05	3.17E+04
Gastrointestinal							
Benzaldehyde	100-52-7	VOC	1.91E+01	1.04E+06	1.09E-01	-	1.04E+06
Chromium VI	18540-29-9	Metal	1.43E-02	1.79E+03	-	-	1.79E+03
Iron	7439-89-6	Metal	1.34E+02	3.34E+07	-	-	3.34E+07
Hematologic							
Antimony	7440-36-0	Metal	8.59E-03	2.15E+03	-	-	2.15E+03
2,4-Dimethylphenol	105-67-9	SVOC	2.86E+00	5.32E+04	-	-	5.32E+04
Fluorene	86-73-7	SVOC	5.73E+00	9.92E+03	1.73E-01	-	9.92E+03
Styrene	100-42-5	SVOC	2.86E+01	1.74E+05	3.32E-01	8.24E+04	5.60E+04
Hepatic							
Acenaphthene	83-32-9	SVOC	3.44E+00	8.07E+03	2.17E-01	-	8.07E+03
1,1-Biphenyl	92-52-4	SVOC	2.86E+01	6.18E+04	2.41E-01	1.81E+01	1.81E+01
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.15E+00	5.70E+01	-	-	5.70E+01
Ethylbenzene	100-41-4	VOC	2.86E+00	1.34E+04	3.33E-01	3.28E+04	9.52E+03
Fluoranthene	206-44-0	SVOC	2.29E+00	1.13E+03	-	-	1.13E+03
Methylene Chloride	75-09-2	VOC	3.44E-01	2.12E+04	3.69E-01	1.78E+04	9.67E+03
Pentachlorophenol	87-86-5	SVOC	2.86E-01	2.44E+02	-	-	2.44E+02
Pyridine	110-86-1	SVOC	5.73E-02	8.25E+03	6.17E-02	-	8.25E+03
Styrene	100-42-5	SVOC	1.15E+01	6.98E+04	3.32E-01	3.29E+04	2.24E+04
1,4-Dioxane	123-91-1	VOC/SVOC	1.72E+00	1.12E+06	-	-	1.12E+06
Immune							
4-Chloroaniline	106-47-8	VOC	7.16E-02	2.87E+03	-	-	2.87E+03
Benzene	71-43-2	VOC	5.73E-01	8.64E+03	3.88E-01	2.12E+03	1.70E+03
2,6-Dinitrotoluene	606-20-2	SVOC	4.29E-02	1.88E+03	-	-	1.88E+03
PCBs (total) ˜	1336-36-3	PCB	2.86E-03	5.18E-01	1.64E-01	-	5.18E-01

Appendix E-2, Table A3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
On-Site Utility Worker, Non-Carcinogenic Calculations

			Dermal Contact		Vapor Inhalation		Combined Dermal/Inhalation
			DA (ug/cm^2 * event)	RBSL (ug/L)	VF (L/m^3)	Utility RBSL (ug/L)	Utility RBSL (ug/L)
Chemical	CAS	Parameter Group	Noncancer	Noncancer	Utility	Noncancer	Noncancer
Musculoskeletal							
2-Butanone (MEK)	78-93-3	SVOC	3.44E+02	7.90E+07	2.00E-01	2.74E+06	2.65E+06
Nervous							
2,4-Dimethylphenol	105-67-9	SVOC	1.91E+00	3.55E+04	-	-	3.55E+04
Manganese	7439-96-5	Metal	9.16E-02	2.29E+04	-	-	2.29E+04
2-Methylphenol	95-48-7	SVOC	4.77E+00	1.31E+05	-	-	1.31E+05
Styrene	100-42-5	SVOC	1.91E+01	1.16E+05	3.32E-01	5.49E+04	3.73E+04
Toluene	108-88-3	VOC	7.63E+00	5.62E+04	3.58E-01	2.55E+05	4.61E+04
Xylenes	1330-20-7	VOC	1.91E+01	8.83E+04	3.33E-01	5.48E+03	5.16E+03
Ocular							
PCBs (total) ˜	1336-36-3	PCB	1.15E-02	2.07E+00	1.64E-01	-	2.07E+00
Reproductive							
Cyanide	57-12-5	CN	3.44E-01	8.59E+04	4.00E-01	2.19E+02	2.18E+02
Respiratory							
Antimony	7440-36-0	Metal	4.29E-03	1.07E+03	-	-	1.07E+03
Chromium VI	18540-29-9	Metal	5.37E-03	6.71E+02	-	-	6.71E+02
Cobalt	7440-48-4	Metal	2.15E-02	1.34E+04	-	-	1.34E+04
2-Methylnaphthalene	91-57-6	SVOC	2.86E-01	6.70E+02	2.65E-01	-	6.70E+02
Naphthalene	91-20-3	SVOC	1.43E+00	6.55E+03	2.70E-01	1.52E+02	1.48E+02
Nickel	7440-02-0	Metal	5.73E-02	7.16E+04	-	-	7.16E+04
Vanadium	7440-62-2	Metal	9.38E-03	2.34E+03	-	-	2.34E+03
1,4-Dioxane	123-91-1	VOC/SVOC	2.15E+00	1.40E+06	-	-	1.40E+06
Thyroid							
Cobalt	7440-48-4	Metal	8.59E-02	5.37E+04	-	-	5.37E+04
Cyanide	57-12-5	CN	1.72E-01	4.29E+04	4.00E-01	1.09E+02	1.09E+02
Urinary							
Benzaldehyde	100-52-7	VOC	9.54E+00	5.21E+05	1.09E-01	-	5.21E+05
1,1-Biphenyl	92-52-4	SVOC	4.77E+01	1.03E+05	2.41E-01	3.02E+01	3.02E+01
Fluoranthene	206-44-0	SVOC	3.82E+00	1.88E+03	-	-	1.88E+03
Pyrene	129-00-0	SVOC	2.86E+00	2.19E+03	4.69E-02	-	2.19E+03
Toluene	108-88-3	VOC	7.63E+00	5.62E+04	3.58E-01	2.55E+05	4.61E+04
1,4-Dioxane	123-91-1	VOC/SVOC	2.86E+00	1.86E+06	-	-	1.86E+06
Sources			CALC	CALC	CALC	CALC	CALC

Appendix E-2, Table A4
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
On-Site Utility Worker, Calculated Preliminary RBSLs

			Preliminary RBSLs for Protection of Onsite Utility Worker for Non-Cancer - Target Organ (ug/L)															Cancer RBSL (ug/L)	Preliminary RBSL (ug/L)
Chemical	CAS	Parameter Group	Body Weight	Cardiovascular	Dermal	Developmental	Gastrointestinal	Hematologic	Hepatic	Immune	Musculoskeletal	Nervous	Ocular	Reproductive	Respiratory	Thyroid	Urinary		
Cyanide	57-12-5	CN												2.18E+02		1.09E+02		-	109.13
Antimony	7440-36-0	Metal						2.15E+03							1.07E+03			-	1,073.53
Arsenic	7440-38-2	Metal		4.29E+04	1.07E+04													6.68E+03	6,679.74
Chromium VI	18540-29-9	Metal					1.79E+03								6.71E+02			2.50E+02	250.49
Cobalt	7440-48-4	Metal													1.34E+04	5.37E+04		-	13,419.12
Iron	7439-89-6	Metal					3.34E+07											-	33,398,692.81
Manganese	7439-96-5	Metal										2.29E+04						-	22,901.96
Nickel	7440-02-0	Metal	1.43E+05												7.16E+04			-	71,568.63
Thallium	7440-28-0	Metal			3.58E+02													-	357.84
Vanadium	7440-62-2	Metal			4.69E+03										2.34E+03			-	2,344.59
PCBs (total) ˜	1336-36-3	PCB			9.54E-01					5.18E-01			2.07E+00					3.47E+00	0.52
1,1-Biphenyl	92-52-4	SVOC							1.81E+01								3.02E+01	1.08E+04	18.14
2,4-Dimethylphenol	105-67-9	SVOC						5.32E+04				3.55E+04						-	35,473.83
2,6-Dinitrotoluene	606-20-2	SVOC								1.88E+03								1.17E+03	1,170.56
2-Butanone (MEK)	78-93-3	SVOC				8.84E+05					2.65E+06							-	883,932.75
2-Methylnaphthalene	91-57-6	SVOC													6.70E+02			-	670.22
2-Methylphenol	95-48-7	SVOC	1.96E+05									1.31E+05						-	130,567.87
Acenaphthene	83-32-9	SVOC							8.07E+03									-	8,071.21
Benz[a]anthracene	56-55-3	SVOC																9.03E+01	90.26
Benzo[a]pyrene	50-32-8	SVOC				8.88E+00												6.21E+00	6.21
Benzo[b]fluoranthene	205-99-2	SVOC																1.05E+02	105.06
Benzo[k]fluoranthene	207-08-9	SVOC																6.39E+02	639.47
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC							5.70E+01									1.42E+02	56.96
Chrysene	218-01-9	SVOC																8.54E+03	8,544.44
Dibenz[a,h]anthracene	53-70-3	SVOC																6.50E+00	6.50
Fluoranthene	206-44-0	SVOC							1.13E+03								1.88E+03	-	1,129.50
Fluorene	86-73-7	SVOC						9.92E+03										-	9,921.84
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC																5.23E+01	52.35
Naphthalene	91-20-3	SVOC	2.97E+02												1.48E+02			5.40E+02	148.41
Pentachlorophenol	87-86-5	SVOC							2.44E+02									8.53E+01	85.28
Pyrene	129-00-0	SVOC															2.19E+03	-	2,188.41
Pyridine	110-86-1	SVOC							8.25E+03									-	8,250.35
Styrene	100-42-5	SVOC						5.60E+04	2.24E+04			3.73E+04						-	22,380.59
4-Chloroaniline	106-47-8	VOC								2.87E+03								8.03E+03	2,869.36
Benzaldehyde	100-52-7	VOC					1.04E+06										5.21E+05	5.47E+05	521,326.37
Benzene	71-43-2	VOC								1.70E+03								2.06E+03	1,701.29
Ethylbenzene	100-41-4	VOC				3.17E+04			9.52E+03									5.98E+03	5,975.14
Methylene Chloride	75-09-2	VOC							9.67E+03									7.74E+05	9,669.08
Toluene	108-88-3	VOC										4.61E+04					4.61E+04	-	46,070.97
Xylenes	1330-20-7	VOC	7.74E+03									5.16E+03						-	5,159.51
1,4-Dioxane	123-91-1	VOC / SVOC							1.12E+06						1.40E+06		1.86E+06	2.61E+05	260,845.90

Appendix E-2, Table B1
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
(Recreational User / Fish and Crab Ingestion), Exposure Assumptions

Description	Variable	Value
Target cancer risk (unitless)	TR	1.00E-06
Target hazard quotient (unitless)	THQ	1
Averaging time - noncancer (days)	AT_{nc,rec_fish}	9490
Averaging time - cancer (days)	ATc	25550
Lifetime (yr)	LTc	70
Exposure duration (yr)	ED_{rec_fish}	26
Exposure frequency (days/yr)	EF_{rec_fish}	32
Body weight (kg)	BW_{rec_fish}	80
Fish Ingestion Rate (mg/day)	IRF	230,000

Notes:

(a) The weight of cooked fish ingested by an adult is 8 ounces/meal or 0.23 kg/meal (wet weight) (2016 Offshore Investigation, EA).

(b) Fish and crab ingestion assumed at 16 meals/yr from the Sparrows Point Area (2016 Offshore Investigation, EA).

Appendix E-2, Table B2
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Recreational User / Fish and Crab Ingestion, Carcinogenic Calculations

			Parameter Specific Data									Fish Ingestion	Fish Ingestion
												Fish Tissue Concentration (mg/kg)	RBSL in SW (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo $(mg/kg*day)^{-1}$	BCF (L/kg)	IUR $(ug/m^3)^{-1}$	Cancer	Cancer
Cyanide	57-12-5	CN	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1		NA		-	-
Antimony	7440-36-0	Metal	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15		1.0E+02		-	-
Arsenic	7440-38-2	Metal	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1.5E+00	3.0E+02	4.3E-03	7.12E-03	0.023736529
Chromium VI	18540-29-9	Metal	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	5.0E-01	2.0E+02	8.4E-02	2.14E-02	0.106814381
Cobalt	7440-48-4	Metal	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1		3.0E+02	9.0E-03	-	-
Iron	7439-89-6	Metal	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1		2.0E+02		-	-
Manganese	7439-96-5	Metal	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04		4.0E+02		-	-
Nickel	7440-02-0	Metal	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04		1.0E+02	2.6E-04	-	-
Thallium	7440-28-0	Metal	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1		1.0E+04		-	-
Vanadium	7440-62-2	Metal	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026		NA		-	-
PCBs (total) ˜	1336-36-3	PCB	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E+00	9.1E+03	5.7E-04	5.34E-03	0.000584132
1,1-Biphenyl	92-52-4	SVOC	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	8.0E-03	4.4E+02		1.34E+00	3.055331272
2,4-Dimethylphenol	105-67-9	SVOC	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1		1.5E+01		-	-
2,6-Dinitrotoluene	606-20-2	SVOC	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1.5E+00	2.2E+01		7.12E-03	0.323679943
2-Butanone (MEK)	78-93-3	SVOC	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1		3.2E+00		-	-
2-Methylnaphthalene	91-57-6	SVOC	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1		7.5E+01		-	-
2-Methylphenol	95-48-7	SVOC	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1		1.1E+01		-	-
Acenaphthene	83-32-9	SVOC	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1		7.6E+02		-	-
Benz[a]anthracene	56-55-3	SVOC	2.0E+00	3.2E+00	8.5E+00	5.5E-01	2.3E+02	1	1.0E-01	2.6E+02	6.0E-05	1.07E-01	0.410799332
Benzo[a]pyrene	50-32-8	SVOC	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1.0E+00	5.1E+03	6.0E-04	1.07E-02	0.002075275
Benzo[b]fluoranthene	205-99-2	SVOC	2.7E+00	2.5E+00	1.1E+01	4.2E-01	2.5E+02	1	1.0E-01	3.0E+03	6.0E-05	1.07E-01	0.035322216
Benzo[k]fluoranthene	207-08-9	SVOC	2.7E+00	4.2E+00	1.2E+01	6.9E-01	2.5E+02	1	1.0E-02	5.0E+03	6.0E-06	1.07E+00	0.213928262
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	1.4E-02	5.9E+02	2.4E-06	7.63E-01	1.297550793
Chrysene	218-01-9	SVOC	2.0E+00	3.5E+00	8.5E+00	6.0E-01	2.3E+02	1	1.0E-03	3.2E+03	6.0E-07	1.07E+01	3.374861967
Dibenz[a,h]anthracene	53-70-3	SVOC	3.8E+00	6.1E+00	1.7E+01	9.5E-01	2.8E+02	1	1.0E+00	9.6E+03	6.0E-04	1.07E-02	0.00111265
Fluoranthene	206-44-0	SVOC	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1		3.6E+03		-	-
Fluorene	86-73-7	SVOC	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1		5.3E+02		-	-
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7E+00	7.9E+00	1.7E+01	1.2E+00	2.8E+02	1	1.0E-01	1.2E+04	6.0E-05	1.07E-01	0.008769654
Naphthalene	91-20-3	SVOC	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1.2E-01	8.5E+01	3.4E-05	8.90E-02	1.053291266
Pentachlorophenol	87-86-5	SVOC	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	4.0E-01	6.0E+02	5.1E-06	2.67E-02	0.044809463
Pyrene	129-00-0	SVOC	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1		1.5E+03		-	-
Pyridine	110-86-1	SVOC	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1		3.2E+00		-	-
Styrene	100-42-5	SVOC	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1		1.4E+01		-	-
4-Chloroaniline	106-47-8	VOC	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	2.0E-01	7.0E+00		5.34E-02	7.651459976
Benzaldehyde	100-52-7	VOC	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	4.0E-03	4.4E+00		2.67E+00	606.8998936
Benzene	71-43-2	VOC	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	5.5E-02	4.3E+00	7.8E-06	1.94E-01	45.52679099
Ethylbenzene	100-41-4	VOC	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1.1E-02	5.6E+01	2.5E-06	9.71E-01	17.46474514
Methylene Chloride	75-09-2	VOC	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	2.0E-03	2.3E+01	1.0E-08	5.34E+00	231.1999595
Toluene	108-88-3	VOC	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1		8.3E+00		-	-
Xylenes	1330-20-7	VOC	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1		1.4E+01		-	-
1,4-Dioxane	123-91-1	VOC / SVOC	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1.0E-01	5.0E-01	5.0E-06	1.07E-01	213.6140082
Sources			EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAIS	RTAP RSL	CALC	CALC

Notes:
(a) PCBs (total) using Aroclor 1254 values

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Appendix E-2, Table B3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Recreational User / Fish and Crab Ingestion, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data								Fish Ingestion	Fish Ingestion
													Fish Tissue Concentration (mg/kg)	RBSL in SW (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	RfD (mg/kg*day)	BCF (L/kg)	Noncancer	Noncancer
Body weight														
2-Methylphenol	95-48-7	SVOC	25%	0.25	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	5.0E-02	7.5E+01	4.96E+01	664.224744
Naphthalene	91-20-3	SVOC	25%	0.25	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	2.0E-02	8.5E+01	1.98E+01	234.7334822
Nickel	7440-02-0	Metal	25%	0.25	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	2.0E-02	1.0E+02	1.98E+01	198.3695652
Xylenes	1330-20-7	VOC	25%	0.25	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	2.0E-01	1.4E+01	1.98E+02	14068.76349
Cardiovascular														
Arsenic	7440-38-2	Metal	100%	1.0	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	3.0E-04	3.0E+02	1.19E+00	3.967391304
Dermal														
Arsenic	7440-38-2	Metal	25%	0.25	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	3.0E-04	3.0E+02	2.98E-01	0.991847826
Thallium	7440-28-0	Metal	25%	0.25	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1	1.0E-05	1.0E+04	9.92E-03	0.000991848
Vanadium	7440-62-2	Metal	25%	0.25	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	5.0E-03		5.00E+00	--
PCBs (total) ˜	1336-36-3	PCB	25%	0.25	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E-05	9.1E+03	1.98E-02	0.002169633
Developmental														
2-Butanone (MEK)	78-93-3	SVOC	33%	0.33	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	6.0E-01	3.2E+00	7.93E+02	251100.7155
Benzo[a]pyrene	50-32-8	SVOC	33%	0.33	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	3.0E-04	5.1E+03	3.97E-01	0.077081626
Ethylbenzene	100-41-4	VOC	33%	0.33	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	5.0E-02	5.6E+01	6.61E+01	1189.265979
Gastrointestinal														
Benzaldehyde	100-52-7	VOC	33%	0.33	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1.0E-01	4.4E+00	1.32E+02	30055.99473
Chromium VI	18540-29-9	Metal	33%	0.33	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	3.0E-03	2.0E+02	3.97E+00	19.83695652
Iron	7439-89-6	Metal	33%	0.33	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1	7.0E-01	2.0E+02	9.26E+02	4628.623188
Hematologic														
Antimony	7440-36-0	Metal	25%	0.25	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	4.0E-04	1.0E+02	3.97E-01	3.967391304
2,4-Dimethylphenol	105-67-9	SVOC	25%	0.25	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	2.0E-02	1.5E+01	1.98E+01	1297.381067
Fluorene	86-73-7	SVOC	25%	0.25	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1	4.0E-02	5.3E+02	3.97E+01	75.5274874
Styrene	100-42-5	SVOC	25%	0.25	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	2.0E-01	1.4E+01	1.98E+02	14694.04187
Hepatic														
Acenaphthene	83-32-9	SVOC	10%	0.10	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1	6.0E-02	7.6E+02	2.38E+01	31.52893752
1,1-Biphenyl	92-52-4	SVOC	10%	0.10	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	5.0E-01	4.4E+02	1.98E+02	453.9349318
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	10%	0.10	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	2.0E-02	5.9E+02	7.93E+00	13.49452825
Ethylbenzene	100-41-4	VOC	10%	0.10	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	5.0E-02	5.6E+01	1.98E+01	356.7797936
Fluoranthene	206-44-0	SVOC	10%	0.10	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	4.0E-02	3.6E+03	1.59E+01	4.370841203
Methylene Chloride	75-09-2	VOC	10%	0.10	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	6.0E-03	2.3E+01	2.38E+00	103.0491248
Pentachlorophenol	87-86-5	SVOC	10%	0.10	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	5.0E-03	6.0E+02	1.98E+00	3.328702954
Pyridine	110-86-1	SVOC	10%	0.10	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1	1.0E-03	3.2E+00	3.97E-01	125.5503577
Styrene	100-42-5	SVOC	10%	0.10	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	2.0E-01	1.4E+01	7.93E+01	5877.616747
1,4-Dioxane	123-91-1	VOC/SVOC	10%	0.10	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	3.0E-02	5.0E-01	1.19E+01	23802.70377
Immune														
4-Chloroaniline	106-47-8	VOC	25%	0.25	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	5.0E-04	7.0E+00	4.96E-01	71.04927121
Benzene	71-43-2	VOC	25%	0.25	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	4.0E-03	4.3E+00	3.97E+00	930.0473017
2,6-Dinitrotoluene	606-20-2	SVOC	25%	0.25	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	3.0E-04	2.2E+01	2.98E-01	13.52519763
PCBs (total) ˜	1336-36-3	PCB	25%	0.25	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E-05	9.1E+03	1.98E-02	0.002169633
Musculoskeletal														
2-Butanone (MEK)	78-93-3	SVOC	100%	1.00	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	6.0E-01	3.2E+00	2.38E+03	753302.1464
Nervous														
2,4-Dimethylphenol	105-67-9	SVOC	17%	0.167	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	2.0E-02	1.5E+01	1.32E+01	864.9207117

Appendix E-2, Table B3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Recreational User / Fish and Crab Ingestion, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data								Fish Ingestion	Fish Ingestion
													Fish Tissue Concentration (mg/kg)	RBSL in SW (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	RfD (mg/kg*day)	BCF (L/kg)	Noncancer	Noncancer
Manganese	7439-96-5	Metal	17%	0.167	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04	2.4E-02	4.0E+02	1.59E+01	39.67391304
2-Methylphenol	95-48-7	SVOC	17%	0.167	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	5.0E-02	1.1E+01	3.31E+01	3089.868617
Styrene	100-42-5	SVOC	17%	0.167	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	2.0E-01	1.4E+01	1.32E+02	9796.027912
Toluene	108-88-3	VOC	17%	0.167	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	8.0E-02	8.3E+00	5.29E+01	6359.804618
Xylenes	1330-20-7	VOC	17%	0.167	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	2.0E-01	1.4E+01	1.32E+02	9379.17566
Ocular														
PCBs (total) ˇ	1336-36-3	PCB	100%	1.00	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E-05	9.1E+03	7.93E-02	0.008678533
Reproductive														
Cyanide	57-12-5	CN	100%	1.00	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	6.0E-04		2.38E+00	--
Respiratory														
Antimony	7440-36-0	Metal	13%	0.125	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	4.0E-04	1.0E+02	1.98E-01	1.983695652
Chromium VI	18540-29-9	Metal	13%	0.125	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	3.0E-03	2.0E+02	1.49E+00	7.438858696
Cobalt	7440-48-4	Metal	13%	0.125	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	3.0E-04	3.0E+02	1.49E-01	0.495923913
2-Methylnaphthalene	91-57-6	SVOC	13%	0.125	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1	4.0E-03	7.5E+01	1.98E+00	26.56898976
Naphthalene	91-20-3	SVOC	13%	0.125	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	2.0E-02	8.5E+01	9.92E+00	117.3667411
Nickel	7440-02-0	Metal	13%	0.125	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	2.0E-02	1.0E+02	9.92E+00	99.18478261
Vanadium	7440-62-2	Metal	13%	0.125	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	5.0E-03		2.50E+00	--
1,4-Dioxane	123-91-1	VOC/SVOC	13%	0.125	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	3.0E-02	5.0E-01	1.49E+01	29753.37972
Thyroid														
Cobalt	7440-48-4	Metal	50%	0.50	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	3.0E-04	3.0E+02	5.95E-01	1.983695652
Cyanide	57-12-5	CN	50%	0.50	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	6.0E-04		1.19E+00	--
Urinary														
Benzaldehyde	100-52-7	VOC	17%	0.167	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1.0E-01	4.4E+00	6.61E+01	15027.99736
1,1-Biphenyl	92-52-4	SVOC	17%	0.167	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	5.0E-01	4.4E+02	3.31E+02	756.5582197
Fluoranthene	206-44-0	SVOC	17%	0.167	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	4.0E-02	3.6E+03	2.64E+01	7.284735339
Pyrene	129-00-0	SVOC	17%	0.167	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1	3.0E-02	1.5E+03	1.98E+01	13.16664243
Toluene	108-88-3	VOC	17%	0.167	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	8.0E-02	8.3E+00	5.29E+01	6359.804618
1,4-Dioxane	123-91-1	VOC/SVOC	17%	0.167	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	3.0E-02	5.0E-01	1.98E+01	39671.17296
Sources					EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAIS	CALC	CALC

Notes:
(a) PCBs (total) using Aroclor 1254 values

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Appendix E-2, Table B4
Preliminary Surface Water Screening Level Calculations
Recreational User / Fish and Crab Ingestion, Calculated Surface Water Screening Levels

Chemical	CAS	Parameter Group	Surface Water Screening Levels for Protection of Offsite Recreational User for Non-Cancer - Target Organ (ug/L)															Cancer Surface Water Screening Level (ug/L)	Surface Water Screening Level (ug/L)
			Body Weight	Cardiovascular	Dermal	Developmental	Gastrointestinal	Hematologic	Hepatic	Immune	Musculoskeletal	Nervous	Ocular	Reproductive	Respiratory	Thyroid	Urinary		
Cyanide	57-12-5	CN												--		--		-	--
Antimony	7440-36-0	Metal						3.97E+00							1.98E+00			-	1.98
Arsenic	7440-38-2	Metal		3.97E+00	9.92E-01													2.37E-02	0.024
Chromium VI	18540-29-9	Metal					1.98E+01								7.44E+00			1.07E-01	0.11
Cobalt	7440-48-4	Metal													4.96E-01	1.98E+00		-	0.50
Iron	7439-89-6	Metal					4.63E+03											-	4,629
Manganese	7439-96-5	Metal										3.97E+01						-	39.67
Nickel	7440-02-0	Metal	1.98E+02												9.92E+01			-	99
Thallium	7440-28-0	Metal			9.92E-04													-	0.00099
Vanadium	7440-62-2	Metal			--										--			-	--
PCBs (total) ˜	1336-36-3	PCB			2.17E-03					2.17E-03			8.68E-03					5.84E-04	0.00058
1,1-Biphenyl	92-52-4	SVOC							4.54E+02								7.57E+02	3.06E+00	3.06
2,4-Dimethylphenol	105-67-9	SVOC						1.30E+03				8.65E+02						-	864.92
2,6-Dinitrotoluene	606-20-2	SVOC								1.35E+01								3.24E-01	0.32
2-Butanone (MEK)	78-93-3	SVOC				2.51E+05					7.53E+05							-	251,100.72
2-Methylnaphthalene	91-57-6	SVOC													2.66E+01			-	26.57
2-Methylphenol	95-48-7	SVOC	6.64E+02									3.09E+03						-	664
Acenaphthene	83-32-9	SVOC							3.15E+01									-	31.5
Benz[a]anthracene	56-55-3	SVOC																4.11E-01	0.41
Benzo[a]pyrene	50-32-8	SVOC				7.71E-02												2.08E-03	0.0021
Benzo[b]fluoranthene	205-99-2	SVOC																3.53E-02	0.035
Benzo[k]fluoranthene	207-08-9	SVOC																2.14E-01	0.21
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC							1.35E+01									1.30E+00	1.30
Chrysene	218-01-9	SVOC																3.37E+00	3.37
Dibenz[a,h]anthracene	53-70-3	SVOC																1.11E-03	0.0011
Fluoranthene	206-44-0	SVOC							4.37E+00								7.28E+00	-	4.37
Fluorene	86-73-7	SVOC						7.55E+01										-	75.53
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC																8.77E-03	0.0088
Naphthalene	91-20-3	SVOC	2.35E+02												1.17E+02			1.05E+00	1.05
Pentachlorophenol	87-86-5	SVOC							3.33E+00									4.48E-02	0.045
Pyrene	129-00-0	SVOC															1.32E+01	-	13.17
Pyridine	110-86-1	SVOC							1.26E+02									-	125.55
Styrene	100-42-5	SVOC						1.47E+04	5.88E+03			9.80E+03						-	5,878
4-Chloroaniline	106-47-8	VOC								7.10E+01								7.65E+00	7.65
Benzaldehyde	100-52-7	VOC					3.01E+04										1.50E+04	6.07E+02	607
Benzene	71-43-2	VOC								9.30E+02								4.55E+01	45.53
Ethylbenzene	100-41-4	VOC				1.19E+03			3.57E+02									1.75E+01	17.46
Methylene Chloride	75-09-2	VOC							1.03E+02									2.31E+02	103
Toluene	108-88-3	VOC										6.36E+03					6.36E+03	-	6,360
Xylenes	1330-20-7	VOC	1.41E+04									9.38E+03						-	9,379
1,4-Dioxane	123-91-1	VOC / SVOC							2.38E+04						2.98E+04		3.97E+04	2.14E+02	214

Appendix E-2, Table B5
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Summary of Applicable MDE Human Health for Consumption of Organism Only Water Quality Criteria

Constituents of Potential Concern		MDE Human Health for Consumption of Organism Only - Surface Water Screening Level (ug/L)	
Chemical	Parameter Group	Based on 1E-5	Revised to account for 1E-6, where needed
			Factor into Preliminary Risk Based Screening Levels
Cyanide	CN	140.0	140
Antimony	Metal	640	640
Arsenic	Metal	1.40	0.14
Chromium VI	Metal	--	--
Cobalt	Metal	--	--
Iron	Metal	--	--
Manganese	Metal	--	--
Nickel	Metal	4,600	4,600
Thallium	Metal	0.47	0.47
Vanadium	Metal	--	--
PCBs (total)	PCB	0.00064	0.000064
1,1-Biphenyl	SVOC	--	--
2,4-Dimethylphenol	SVOC	3,000	3,000
2,6-Dinitrotoluene	SVOC	--	--
2-Butanone (MEK)	SVOC	--	--
2-Methylnaphthalene	SVOC	--	--
2-Methylphenol	SVOC	--	--
Acenaphthene	SVOC	90	90
Benz[a]anthracene	SVOC	0.0130	0.0013
Benzo[a]pyrene	SVOC	0.0013	0.00013
Benzo[b]fluoranthene	SVOC	0.0130	0.0013
Benzo[k]fluoranthene	SVOC	0.130	0.013
bis(2-Ethylhexyl)phthalate	SVOC	3.7	0.37
Chrysene	SVOC	0.18	0.018
Dibenz[a,h]anthracene	SVOC	0.0013	0.00013
Fluoranthene	SVOC	20.0	20.0
Fluorene	SVOC	70.0	70.0
Indeno[1,2,3-c,d]pyrene	SVOC	0.0130	0.0013
Naphthalene	SVOC	--	--
Pentachlorophenol	SVOC	30.0	3.0
Pyrene	SVOC	30.0	30.0
Pyridine	SVOC	--	--
Styrene	SVOC	--	--
4-Chloroaniline	VOC	--	--
Benzaldehyde	VOC	--	--
Benzene	VOC	510	51
Ethylbenzene	VOC	2,100	2,100
Methylene Chloride	VOC	10,000	1,000
Toluene	VOC	15,000	15,000
Xylenes	VOC	--	--
1,4-Dioxane	VOC/SVOC	--	--

COMAR noted that value was based on 1E-5. Value was divided by 10 to account for the 1E-6 value.

-- No applicable surface water screening levels

Reference: Code of Maryland Regulations (COMAR), 26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Human Health for Consumption of Organism Only (May 16, 2024)

Appendix E-2, Table B6
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Recreational User / Fish and Crab Ingestion Calculated Preliminary Risk-Based Screening Levels

Constituents of Potential Concern		MDE Human Health for Consumption of Organism Only - Surface Water Screening Level (ug/L)	Calculated Surface Water Screening Level based on Fish Ingestion RSL equations and BCF (ug/L)	Calculated Perimeter Well Preliminary Risk Based Screening Level (µg/L)
Chemical	Parameter Group			
		PRIMARY	SECONDARY	
Cyanide	CN	140	--	16,940
Antimony	Metal	640	1.98	77,440
Arsenic	Metal	0.14	0.02	16.9
Chromium VI	Metal	--	0.11	12.9
Cobalt	Metal	--	0.50	60.0
Iron	Metal	--	4,629	560,063
Manganese	Metal	--	39.7	4,801
Nickel	Metal	4,600	99	556,600
Thallium	Metal	0.47	0.00099	56.9
Vanadium	Metal	--	--	--
PCBs (total)	PCB	0.000064	0.00058	0.0077
1,1-Biphenyl	SVOC	--	3.06	370
2,4-Dimethylphenol	SVOC	3,000	865	363,000
2,6-Dinitrotoluene	SVOC	--	0.32	39.2
2-Butanone (MEK)	SVOC	--	251,101	30,383,187
2-Methylnaphthalene	SVOC	--	26.6	3,215
2-Methylphenol	SVOC	--	664	80,371
Acenaphthene	SVOC	90	31.53	10,890
Benz[a]anthracene	SVOC	0.0013	0.41	0.157
Benzo[a]pyrene	SVOC	0.00013	0.0021	0.0157
Benzo[b]fluoranthene	SVOC	0.0013	0.035	0.157
Benzo[k]fluoranthene	SVOC	0.013	0.21	1.57
bis(2-Ethylhexyl)phthalate	SVOC	0.37	1.30	44.8
Chrysene	SVOC	0.018	3.37	2.18
Dibenz[a,h]anthracene	SVOC	0.00013	0.0011	0.0157
Fluoranthene	SVOC	20.0	4.37	2,420
Fluorene	SVOC	70.0	76	8,470
Indeno[1,2,3-c,d]pyrene	SVOC	0.0013	0.0088	0.157
Naphthalene	SVOC	--	1.05	127
Pentachlorophenol	SVOC	3.0	0.045	363
Pyrene	SVOC	30	13.17	3,630
Pyridine	SVOC	--	126	15,192
Styrene	SVOC	--	5,878	711,192
4-Chloroaniline	VOC	--	7.65	926
Benzaldehyde	VOC	--	607	73,435
Benzene	VOC	51.0	45.5	6,171
Ethylbenzene	VOC	2,100	17.5	254,100
Methylene Chloride	VOC	1,000	103	121,000
Toluene	VOC	15,000	6,360	1,815,000
Xylenes	VOC	--	9,379	1,134,880
1,4-Dioxane	VOC/SVOC	--	214	25,847

Notes:

(a) Perimeter Well Preliminary Risk Based Screening Levels (Groundwater) = Surface Water Screening Level x Mixing / Attenuation Factor of **121**

(b) There is no proposed GW cleanup levels for lead (no identified target organs based on reference dose for oral exposure) or vanadium (no available BCF value).

References:

Maryland = Code of Maryland Regulations, 26.08.02.03-2 Numerical Criteria for Toxic Substances in Surface Waters, Human Health for Consumption of Organism Only (2024). Based on 1E-6.

Appendix E-2, Table C1
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Resource Restoration - Industrial Non-Potable Water User, Exposure Assumptions

Description	Variable	Value
Target cancer risk (unitless)	TR	1.00E-06
Target hazard quotient (unitless)	THQ	1
Averaging time - noncancer (days) - Ind Non-Potable Water User	ATnc,rr	9125
Averaging time - cancer (days)	ATc	25550
Lifetime (yr)	LTc	70
Exposure duration (yr) - Ind Non-Potable Water User	EDrr	25
Exposure frequency (days/yr) - Ind Non-Potable Water User	EFrr	150
Exposure Time (hours/day) - Ind Non-Potable Water User	ETrr	4
Body weight (kg) - Ind Non-Potable Water User	BWrr	80
Skin surface area (cm2) - Ind Non-Potable Water User	SArr	2550
Fraction of floor contaminant can enter (unitless)	F	1
Average wind speed in the mixing zone (m/s)	Uair	4.69
Ambient Air Mixing Zone Height (m)	dair	2
Length of source parallel to wind direction (m)	L	0.6096
Work Area Width (m)	W	6.096
Groundwater Extraction Rate (L/s)	Qgw	0.31542

Appendix E-2, Table C2
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Resource Restoration - Industrial Non-Potable Water User, Carcinogenic Calculations

			Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
													DA (ug/cm^2 * event)	RBSL (ug/L)	C_{air} (ug/m^3)	RBSL (ug/L)	Industrial Non-Potable Water User RBSL (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo $(mg/kg*day)^{-1}$	FA (unitless)	HLC (atm*m3/ mole)	IUR $(ug/m^3)^{-1}$	Cancer	Cancer	Cancer	Cancer	Cancer
Cyanide	57-12-5	CN	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1		0.01	1.0E-04		-	-	-	-	-
Antimony	7440-36-0	Metal	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15		1 *			-	-	-	-	-
Arsenic	7440-38-2	Metal	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1.5E+00	1 *		4.3E-03	1.43E-04	3.56E+01	-	-	3.56E+01
Chromium VI	18540-29-9	Metal	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	5.0E-01	1 *		8.4E-02	1.07E-05	1.34E+00	-	-	1.34E+00
Cobalt	7440-48-4	Metal	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1		1 *		9.0E-03	-	-	-	-	-
Iron	7439-89-6	Metal	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1		1 *			-	-	-	-	-
Manganese	7439-96-5	Metal	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04		1 *			-	-	-	-	-
Nickel	7440-02-0	Metal	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04		1 *		2.6E-04	-	-	-	-	-
Thallium	7440-28-0	Metal	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1		1 *			-	-	-	-	-
Vanadium	7440-62-2	Metal	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026		1 *			-	-	-	-	-
PCBs (total) ˜	1336-36-3	PCB	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E+00	0.5	2.8E-04	5.7E-04	1.07E-04	1.93E-02	7.16E-02	12.978902	1.93E-02
1,1-Biphenyl	92-52-4	SVOC	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	8.0E-03	1 *	3.1E-04		2.67E-02	5.77E+01	-	-	5.77E+01
2,4-Dimethylphenol	105-67-9	SVOC	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1		1	9.5E-07		-	-	-	-	-
2,6-Dinitrotoluene	606-20-2	SVOC	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1.5E+00	1	7.5E-07		1.43E-04	6.24E+00	-	-	6.24E+00
2-Butanone (MEK)	78-93-3	SVOC	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1		1	5.7E-05		-	-	-	-	-
2-Methylnaphthalene	91-57-6	SVOC	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1		1 *	5.2E-04		-	-	-	-	-
2-Methylphenol	95-48-7	SVOC	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1		1	1.2E-06		-	-	-	-	-
Acenaphthene	83-32-9	SVOC	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1		1 *	1.8E-04		-	-	-	-	-
Benz[a]anthracene	56-55-3	SVOC	2.0E+00	3.2E+00	8.5E+00	5.5E-01	2.3E+02	1	1.0E-01	1	1.2E-05	6.0E-05	2.14E-03	4.97E-01	6.81E-01	123.51588	4.95E-01
Benzo[a]pyrene	50-32-8	SVOC	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1.0E+00	1	4.6E-07	6.0E-04	2.14E-04	3.31E-02	-	-	3.31E-02
Benzo[b]fluoranthene	205-99-2	SVOC	2.7E+00	2.5E+00	1.1E+01	4.2E-01	2.5E+02	1	1.0E-01	1	6.6E-07	6.0E-05	2.14E-03	5.60E-01	-	-	5.60E-01
Benzo[k]fluoranthene	207-08-9	SVOC	2.7E+00	4.2E+00	1.2E+01	6.9E-01	2.5E+02	1	1.0E-02	1 *	5.8E-07	6.0E-06	2.14E-02	3.41E+00	-	-	3.41E+00
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	1.4E-02	0.8	2.7E-07	2.4E-06	1.53E-02	7.60E-01	-	-	7.60E-01
Chrysene	218-01-9	SVOC	2.0E+00	3.5E+00	8.5E+00	6.0E-01	2.3E+02	1	1.0E-03	1	5.2E-06	6.0E-07	2.14E-01	4.56E+01	-	-	4.56E+01
Dibenz[a,h]anthracene	53-70-3	SVOC	3.8E+00	6.1E+00	1.7E+01	9.5E-01	2.8E+02	1	1.0E+00	0.6	1.4E-07	6.0E-04	2.14E-04	3.47E-02	-	-	3.47E-02
Fluoranthene	206-44-0	SVOC	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1		1	8.9E-06		-	-	-	-	-
Fluorene	86-73-7	SVOC	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1		1 *	9.6E-05		-	-	-	-	-
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7E+00	7.9E+00	1.7E+01	1.2E+00	2.8E+02	1	1.0E-01	0.6	3.5E-07	6.0E-05	2.14E-03	2.79E-01	-	-	2.79E-01
Naphthalene	91-20-3	SVOC	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1.2E-01	1	4.4E-04	3.4E-05	1.78E-03	8.16E+00	1.20E+00	217.9692	7.86E+00
Pentachlorophenol	87-86-5	SVOC	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	4.0E-01	0.9	2.5E-08	5.1E-06	5.34E-04	4.55E-01	-	-	4.55E-01
Pyrene	129-00-0	SVOC	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1		1 *	1.2E-05		-	-	-	-	-
Pyridine	110-86-1	SVOC	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1		1 *	1.1E-05		-	-	-	-	-
Styrene	100-42-5	SVOC	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1		1	2.8E-03		-	-	-	-	-
4-Chloroaniline	106-47-8	VOC	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	2.0E-01	1 *	1.2E-06		1.07E-03	4.28E+01	-	-	4.28E+01
Benzaldehyde	100-52-7	VOC	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	4.0E-03	1 *	2.7E-05		5.34E-02	2.92E+03	-	-	2.92E+03
Benzene	71-43-2	VOC	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	5.5E-02	1	5.6E-03	7.8E-06	3.89E-03	5.87E+01	5.24E+00	950.12215	5.53E+01
Ethylbenzene	100-41-4	VOC	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1.1E-02	1	7.9E-03	2.5E-06	1.94E-02	9.10E+01	1.64E+01	2964.3811	8.83E+01
Methylene Chloride	75-09-2	VOC	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	2.0E-03	1	3.3E-03	1.0E-08	1.07E-01	6.58E+03	4.09E+03	741095.28	6.52E+03
Toluene	108-88-3	VOC	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1		1	6.6E-03		-	-	-	-	-

Appendix E-2, Table C2
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Resource Restoration - Industrial Non-Potable Water User, Carcinogenic Calculations

			Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
													DA (ug/cm^2 * event)	RBSL (ug/L)	C_{air} (ug/m^3)	RBSL (ug/L)	Industrial Non-Potable Water User RBSL (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo $(mg/kg*day)^{-1}$	FA (unitless)	HLC (atm*m3/ mole)	IUR $(ug/m^3)^{-1}$	Cancer	Cancer	Cancer	Cancer	Cancer
Xylenes	1330-20-7	VOC	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1		1	6.6E-03		-	-	-	-	-
1,4-Dioxane	123-91-1	VOC / SVOC	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1.0E-01	1	4.8E-06	5.0E-06	2.14E-03	1.39E+03	-	-	1.39E+03
Sources			EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAGSE	EPA CS	RTAP RSL	CALC	CALC	CALC	CALC	CALC

Notes:
(a) Chromium uses Chromium (III), Insoluble Salts values for RfD.
XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.
(b) PCBs (total) using Aroclor 1254 values
* FA <1 applies to a limited number of organic compounds. An FA of 1 was utilized for inorganics and for organic analytes not listed on RAGSE Exhibit B-3.

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Appendix E-2, Table C3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Resource Restoration - Industrial Non-Potable Water User, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
															DA (ug/cm^2 * event)	RBSL (ug/L)	C_{air} (ug/m^3)	RBSL (ug/L)	Industrial Non-Potable Water User RBSL (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	HLC (atm*m3 / mole)	RfC (mg/m^3)	Noncancer	Noncancer	Noncancer	Noncancer	Noncancer
Body weight																			
2-Methylphenol	95-48-7	SVOC	25%	0.25	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.2E-06	6.0E-01	9.54E-01	2.40E+04	-	-	2.40E+04
Naphthalene	91-20-3	SVOC	25%	0.25	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	4.4E-04	3.0E-03	3.82E-01	1.55E+03	1.10E+01	1985.0766	8.70E+02
Nickel	7440-02-0	Metal	25%	0.25	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02		1.0E-05	1.53E-02	1.91E+04	-	-	1.91E+04
Xylenes	1330-20-7	VOC	25%	0.25	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	6.6E-03	1.0E-01	3.82E+00	1.68E+04	3.65E+02	66169.221	1.34E+04
Cardiovascular																			
Arsenic	7440-38-2	Metal	100%	1	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04		1.5E-05	2.29E-02	5.73E+03	-	-	5.73E+03
Dermal																			
Arsenic	7440-38-2	Metal	25%	0.25	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04		1.5E-05	5.73E-03	1.43E+03	-	-	1.43E+03
Thallium	7440-28-0	Metal	25%	0.25	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1	1	1.0E-05			1.91E-04	4.77E+01	-	-	4.77E+01
Vanadium	7440-62-2	Metal	25%	0.25	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03		1.0E-04	2.50E-03	6.25E+02	-	-	6.25E+02
PCBs (total) ˜	1336-36-3	PCB	25%	0.25	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	2.8E-04		3.82E-04	6.91E-02	-	-	6.91E-02
Developmental																			
2-Butanone (MEK)	78-93-3	SVOC	33%	0.333	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	5.7E-05	5.0E+00	1.53E+01	3.42E+06	2.43E+04	4411281.4	1.93E+06
Benzo[a]pyrene	50-32-8	SVOC	33%	0.333	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1	3.0E-04	4.6E-07	2.0E-06	7.63E-03	1.18E+00	-	-	1.18E+00
Ethylbenzene	100-41-4	VOC	33%	0.333	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	7.9E-03	1.0E+00	1.27E+00	5.66E+03	4.87E+03	882256.28	5.62E+03
Gastrointestinal																			
Benzaldehyde	100-52-7	VOC	33%	0.333	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	2.7E-05		2.54E+00	1.28E+05	-	-	1.28E+05
Chromium VI	18540-29-9	Metal	33%	0.333	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03		1.0E-04	1.91E-03	2.39E+02	-	-	2.39E+02
Iron	7439-89-6	Metal	33%	0.333	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1	1	7.0E-01			1.78E+01	4.45E+06	-	-	4.45E+06
Hematologic																			
Antimony	7440-36-0	Metal	25%	0.25	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04		3.0E-04	1.15E-03	2.86E+02	-	-	2.86E+02
2,4-Dimethylphenol	105-67-9	SVOC	25%	0.25	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.5E-07		3.82E-01	6.18E+03	-	-	6.18E+03
Fluorene	86-73-7	SVOC	25%	0.25	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1	1	4.0E-02	9.6E-05		7.63E-01	1.09E+03	-	-	1.09E+03
Styrene	100-42-5	SVOC	25%	0.25	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	2.8E-03	1.0E+00	3.82E+00	2.20E+04	3.65E+03	661692.21	2.13E+04
Hepatic																			
Acenaphthene	83-32-9	SVOC	10%	0.100	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1	1	6.0E-02	1.8E-04		4.58E-01	8.99E+02	-	-	8.99E+02
1,1-Biphenyl	92-52-4	SVOC	10%	0.100	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	3.1E-04	4.0E-04	3.82E+00	7.02E+03	5.84E-01	105.87075	1.04E+02
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	10%	0.100	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	0.8	2.0E-02	2.7E-07		1.53E-01	7.60E+00	-	-	7.60E+00
Ethylbenzene	100-41-4	VOC	10%	0.100	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	7.9E-03	1.0E+00	3.82E-01	1.70E+03	1.46E+03	264676.88	1.69E+03
Fluoranthene	206-44-0	SVOC	10%	0.100	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	8.9E-06		3.05E-01	1.51E+02	-	-	1.51E+02
Methylene Chloride	75-09-2	VOC	10%	0.100	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	1	6.0E-03	3.3E-03	6.0E-01	4.58E-02	2.71E+03	8.76E+02	158806.13	2.67E+03
Pentachlorophenol	87-86-5	SVOC	10%	0.100	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	0.9	5.0E-03	2.5E-08		3.82E-02	3.25E+01	-	-	3.25E+01
Pyridine	110-86-1	SVOC	10%	0.100	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1	1	1.0E-03	1.1E-05		7.63E-03	1.07E+03	-	-	1.07E+03
Styrene	100-42-5	SVOC	10%	0.100	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	2.8E-03	1.0E+00	1.53E+00	8.79E+03	1.46E+03	264676.88	8.50E+03
1,4-Dioxane	123-91-1	VOC/SVOC	10%	0.100	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	4.8E-06	3.0E-02	2.29E-01	1.42E+05	-	-	1.42E+05
Immune																			
4-Chloroaniline	106-47-8	VOC	25%	0.25	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	1	5.0E-04	1.2E-06		9.54E-03	3.23E+02	-	-	3.23E+02
Benzene	71-43-2	VOC	25%	0.25	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	1	4.0E-03	5.6E-03	3.0E-02	7.63E-02	1.12E+03	1.10E+02	19850.766	1.06E+03
2,6-Dinitrotoluene	606-20-2	SVOC	25%	0.25	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1	3.0E-04	7.5E-07		5.73E-03	1.12E+02	-	-	1.12E+02
PCBs (total) ˜	1336-36-3	PCB	25%	0.25	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	2.8E-04		3.82E-04	6.91E-02	-	-	6.91E-02
Musculoskeletal																			
2-Butanone (MEK)	78-93-3	SVOC	100%	1.0	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	5.7E-05	5.0E+00	4.58E+01	1.03E+07	7.30E+04	13233844	5.78E+06
Nervous																			
2,4-Dimethylphenol	105-67-9	SVOC	17%	0.167	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.5E-07		2.54E-01	4.12E+03	-	-	4.12E+03
Manganese	7439-96-5	Metal	17%	0.167	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04	1	2.4E-02		5.0E-05	1.22E-02	3.05E+03	-	-	3.05E+03
2-Methylphenol	95-48-7	SVOC	17%	0.167	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.2E-06	6.0E-01	6.36E-01	1.60E+04	-	-	1.60E+04
Styrene	100-42-5	SVOC	17%	0.167	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	2.8E-03	1.0E+00	2.54E+00	1.46E+04	2.43E+03	441128.14	1.42E+04

Appendix E-2, Table C3
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Resource Restoration - Industrial Non-Potable Water User, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
															DA (ug/cm^2 * event)	RBSL (ug/L)	C_{air} (ug/m^3)	RBSL (ug/L)	Industrial Non-Potable Water User RBSL (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	HLC (atm*m3 / mole)	RfC (mg/m^3)	Noncancer	Noncancer	Noncancer	Noncancer	Noncancer
Toluene	108-88-3	VOC	17%	0.167	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	6.6E-03	5.0E+00	1.02E+00	7.19E+03	1.22E+04	2205640.7	7.16E+03
Xylenes	1330-20-7	VOC	17%	0.167	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	6.6E-03	1.0E-01	2.54E+00	1.12E+04	2.43E+02	44112.814	8.92E+03
Ocular																			
PCBs (total) ˜	1336-36-3	PCB	100%	1.0	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	2.8E-04		1.53E-03	2.76E-01	-	-	2.76E-01
Reproductive																			
Cyanide	57-12-5	CN	100%	1.0	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	1.0E-04	8.0E-04	4.58E-02	1.15E+04	1.17E+01	2117.4151	1.79E+03
Respiratory																			
Antimony	7440-36-0	Metal	13%	0.125	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04		3.0E-04	5.73E-04	1.43E+02	-	-	1.43E+02
Chromium VI	18540-29-9	Metal	13%	0.125	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03		1.0E-04	7.16E-04	8.95E+01	-	-	8.95E+01
Cobalt	7440-48-4	Metal	13%	0.125	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04		6.0E-06	2.86E-03	1.79E+03	-	-	1.79E+03
2-Methylnaphthalene	91-57-6	SVOC	13%	0.125	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1	1	4.0E-03	5.2E-04		3.82E-02	8.05E+01	-	-	8.05E+01
Naphthalene	91-20-3	SVOC	13%	0.125	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	4.4E-04	3.0E-03	1.91E-01	7.74E+02	5.48E+00	992.53832	4.35E+02
Nickel	7440-02-0	Metal	13%	0.125	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02		1.0E-05	7.63E-03	9.54E+03	-	-	9.54E+03
Vanadium	7440-62-2	Metal	13%	0.125	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03		1.0E-04	1.25E-03	3.13E+02	-	-	3.13E+02
1,4-Dioxane	123-91-1	VOC/SVOC	13%	0.125	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	4.8E-06	3.0E-02	2.86E-01	1.78E+05	-	-	1.78E+05
Thyroid																			
Cobalt	7440-48-4	Metal	50%	0.500	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04		6.0E-06	1.15E-02	7.16E+03	-	-	7.16E+03
Cyanide	57-12-5	CN	50%	0.500	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	1.0E-04	8.0E-04	2.29E-02	5.73E+03	5.84E+00	1058.7075	8.93E+02
Urinary																			
Benzaldehyde	100-52-7	VOC	17%	0.167	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	2.7E-05		1.27E+00	6.40E+04	-	-	6.40E+04
1,1-Biphenyl	92-52-4	SVOC	17%	0.167	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	3.1E-04	4.0E-04	6.36E+00	1.17E+04	9.73E-01	176.45126	1.74E+02
Fluoranthene	206-44-0	SVOC	17%	0.167	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	8.9E-06		5.09E-01	2.51E+02	-	-	2.51E+02
Pyrene	129-00-0	SVOC	17%	0.167	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1	1	3.0E-02	1.2E-05		3.82E-01	2.92E+02	-	-	2.92E+02
Toluene	108-88-3	VOC	17%	0.167	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	6.6E-03	5.0E+00	1.02E+00	7.19E+03	1.22E+04	2205640.7	7.16E+03
1,4-Dioxane	123-91-1	VOC/SVOC	17%	0.167	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	4.8E-06	3.0E-02	3.82E-01	2.37E+05	-	-	2.37E+05
Sources					EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RAGS	RTAP RSL	RAIS	RTAP RSL	CALC	CALC	CALC	CALC	CALC

Notes:
(a) PCBs (total) using Aroclor 1254 values

XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Appendix E-2, Table C4
Preliminary Risk Based Screening Level Calculations (TR = 1E-06)
Resource Restoration - Industrial Non-Potable Water User, Calculated Preliminary RBSLs

Chemical	CAS	Parameter Group	Preliminary RBSLs for Protection of Industrial Non-Potable Water User for Non-Cancer - Target Organ (ug/L)															Cancer RBSL (ug/L)	Preliminary RBSLs (ug/L)
			Body Weight	Cardiovascular	Dermal	Developmental	Gastrointestinal	Hematologic	Hepatic	Immune	Musculoskeletal	Nervous	Ocular	Reproductive	Respiratory	Thyroid	Urinary		
Cyanide	57-12-5	CN												1.79E+03		8.93E+02		-	893
Antimony	7440-36-0	Metal						2.86E+02							1.43E+02			-	143
Arsenic	7440-38-2	Metal		5.73E+03	1.43E+03													3.56E+01	35.6
Chromium VI	18540-29-9	Metal					2.39E+02								8.95E+01			1.34E+00	1.34
Cobalt	7440-48-4	Metal													1.79E+03	7.16E+03		-	1,789
Iron	7439-89-6	Metal					4.45E+06											-	4,453,159
Manganese	7439-96-5	Metal										3.05E+03						-	3,054
Nickel	7440-02-0	Metal	1.91E+04												9.54E+03			-	9,542
Thallium	7440-28-0	Metal			4.77E+01													-	47.7
Vanadium	7440-62-2	Metal			6.25E+02										3.13E+02			-	313
PCBs (total) ˜	1336-36-3	PCB			6.91E-02					6.91E-02			2.76E-01					1.93E-02	0.019
1,1-Biphenyl	92-52-4	SVOC							1.04E+02								1.74E+02	5.77E+01	57.7
2,4-Dimethylphenol	105-67-9	SVOC						6.18E+03				4.12E+03						-	4,122
2,6-Dinitrotoluene	606-20-2	SVOC								1.12E+02								6.24E+00	6.24
2-Butanone (MEK)	78-93-3	SVOC				1.93E+06					5.78E+06							-	1,927,801
2-Methylnaphthalene	91-57-6	SVOC													8.05E+01			-	81
2-Methylphenol	95-48-7	SVOC	2.40E+04									1.60E+04						-	16,006
Acenaphthene	83-32-9	SVOC							8.99E+02									-	899
Benz[a]anthracene	56-55-3	SVOC																4.95E-01	0.50
Benzo[a]pyrene	50-32-8	SVOC				1.18E+00												3.31E-02	0.033
Benzo[b]fluoranthene	205-99-2	SVOC																5.60E-01	0.56
Benzo[k]fluoranthene	207-08-9	SVOC																3.41E+00	3.41
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC							7.60E+00									7.60E-01	0.76
Chrysene	218-01-9	SVOC																4.56E+01	46
Dibenz[a,h]anthracene	53-70-3	SVOC																3.47E-02	0.035
Fluoranthene	206-44-0	SVOC							1.51E+02								2.51E+02	-	151
Fluorene	86-73-7	SVOC						1.09E+03										-	1,087
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC																2.79E-01	0.28
Naphthalene	91-20-3	SVOC	8.70E+02												4.35E+02			7.86E+00	7.86
Pentachlorophenol	87-86-5	SVOC							3.25E+01									4.55E-01	0.45
Pyrene	129-00-0	SVOC															2.92E+02	-	292
Pyridine	110-86-1	SVOC							1.07E+03									-	1,066
Styrene	100-42-5	SVOC						2.13E+04	8.50E+03			1.42E+04						-	8,504
4-Chloroaniline	106-47-8	VOC								3.23E+02								4.28E+01	42.8
Benzaldehyde	100-52-7	VOC					1.28E+05										6.40E+04	2.92E+03	2,919
Benzene	71-43-2	VOC								1.06E+03								5.53E+01	55.3
Ethylbenzene	100-41-4	VOC				5.62E+03			1.69E+03									8.83E+01	88
Methylene Chloride	75-09-2	VOC							2.67E+03									6.52E+03	2,668
Toluene	108-88-3	VOC										7.16E+03					7.16E+03	-	7,165
Xylenes	1330-20-7	VOC	1.34E+04									8.92E+03						-	8,919
1,4-Dioxane	123-91-1	VOC / SVOC							1.42E+05						1.78E+05		2.37E+05	1.39E+03	1,391

APPENDIX E-3

Appendix E-3 - Mixing Factor Calculations
CPA Groundwater CMS

Shoreline Groundwater Geometric Means

	Benzene (ug/L)	Naphthalene (ug/L)	# of Sample Locations
Cell 2 Geomean	18,577.02	1,270.36	8
Cell 3 Geomean	2,316.10	829.26	8
Cell 5 Geomean	--	3,330.05	6
All CPA Geomean	4,983.19	1,414.85	22

Surface Water Geometric Means

	Benzene (ug/L)	Naphthalene (ug/L)	# of Sample Locations
Cell 2 Geomean	0.72	0.22	10
Cell 3 Geomean	19.15	0.87	31
Cell 5 Geomean	--	0.19	16
All CPA Geomean	8.61	0.45	57

Shallow Pore Water Geometric Means

	Benzene (ug/L)	Naphthalene (ug/L)	# of Sample Locations
Cell 2 Geomean	1.59	3.88	16
Cell 3 Geomean	20.91	2,866.97	3
Cell 5 Geomean	--	44.52	7
All CPA Geomean	2.60	16.03	26

Not enough samples in data set

Groundwater to Surface Water Mixing / Attenuation Factor:

	Benzene (ug/L)	Naphthalene (ug/L)
Cell 2 Geomean	25,678.52	5,783.56
Cell 3 Geomean	120.96	952.96
Cell 5 Geomean	--	17,327.20
All CPA Geomean	578.63	3,163.00

Groundwater to Shallow Pore Water Attenuation Factor:

	Benzene (ug/L)	Naphthalene (ug/L)
Cell 2 Geomean	11,690.10	327.78
Cell 3 Geomean	N/A	N/A
Cell 5 Geomean	--	74.80
All CPA Geomean	1,919.45	88.28

Selected Groundwater to Surface Water Mixing / Attenuation Factor:	**121**

Selected Groundwater to Shallow Pore Water Attenuation Factor:	**75**

APPENDIX E-4

Mass Balance Equation for Resource Restoration / Industrial Non-Potable Water User

The Resource Restoration / Industrial Non-Potable Water User scenario is based on groundwater exposure during truck washing or similar (a point source), and discharge of that groundwater to the surrounding water bodies. A mass balance approach will be utilized, where the mass of contaminants in the groundwater point source is balanced with the mass of contaminants volatilizing from the groundwater into the volume of air passing through the work space (or box). Total contaminant mass flux of groundwater coming into the work space (or box) can be calculated as follows:

$$F_{GW}\left[\frac{\mu g}{s}\right] = C_w\left[\frac{\mu g}{L}\right] x\ Q_w\left[\frac{L}{s}\right]$$

Where:
F_{GW} = Mass flux in groundwater (µg/s)
C_w = concentration in groundwater (µg/L), will also be referred to as $RBSL_{rr\text{-}gw}$
Q_w = groundwater extraction rate (L/s). Assumption of 0.31542 L/s (5 gallons per minute), refer to **Table 1**.

Total contaminant mass flux for the mass volatilizing into the volume of air passing through the work space (box):

$$F_{AA}\left[\frac{\mu g}{s}\right] = SL_{rr-air}\left[\frac{\mu g}{m^3}\right]\ x\ U_W\left[\frac{m}{s}\right]\ x\ W[m]\ x\ H_m[m]$$

Where:
F_{AA} = Mass flux in ambient air (µg/s)
$SL_{rr\text{-}air}$ = Outdoor air concentration calculated using the EPA RSL equation for composite worker ($\mu g/m^3$)
U_w = Wind speed (m/sec). Assumption of 4.69 m/s, refer to **Table 1**.
H_m = Ambient air mixing zone height (m). Assumption of 2 m, refer to **Table 1**.
W = Work area width perpendicular to wind direction (m). Assumption of 6 m, refer to **Table 1**.

We utilized a conservative assumption of 100% volatilization (100% of the mass from the groundwater point source is volatilized into the ambient air). Therefore the mass flux of contaminants groundwater entering the work space is equal to the mass flux of contaminants in ambient air exiting the work space. The resulting mass balance is:

$$C_w\ x\ Q_w = SL_{rr-air}\ x\ U_W\ x\ W\ x\ H_m$$

Then, the calculated outdoor air concentration ($SL_{rr\text{-}air}$) is converted to an applicable groundwater cleanup level ($RBSL_{rr\text{-}gw}$) using the following equation (previous equation re-arranged):

$$RBSL_{rr-gw}\left[\frac{\mu g}{L}\right] = \frac{SL_{rr-air}\left[\frac{\mu g}{m^3}\right]\ x\ U_w\left[\frac{m}{s}\right] x\ H_m[m] x\ W[m]}{Q_w\left[\frac{L}{s}\right]}$$

Where:
$RBSL_{rr-gw}$ or C_w = concentration in groundwater (µg/L)
SL_{rr-air} = Outdoor air concentration calculated using the EPA RSL equation for composite worker (µg/m^3)
U_w = Wind speed (m/sec). Assumption of 4.69 m/s, refer to **Table 1**.
H_m = Ambient air mixing zone height (m). Assumption of 2 m, refer to **Table 1**.
W = Work area width perpendicular to wind direction (m). Assumption of 6 m, refer to **Table 1**.
Q_w = Groundwater extraction rate (L/s). Assumption of 0.31542 L/s (5 gallons per minute), refer to **Table 1**.

APPENDIX E-5

Appendix E-5, Table A - Maximum Groundwater Concentrations
CPA Groundwater CMS

		Sitewide Max Concentration			Shoreline Max Concentration		
Chemical	**CAS**	**Result (ug/L)**	**Location**	**Date**	**Result (ug/L)**	**Location**	**Date**
Cyanide	57-12-5	380	SW18-PZM053	3/12/2020	96	CP22-MWS	2/28/2020
Antimony	7440-36-0	35.86	CP05-PZM019	5/14/2024	35.86	CP05-PZM019	5/14/2024
Arsenic	7440-38-2	537.6	CO28-PZM048	2/11/2025	537.6	CO28-PZM048	2/11/2025
Chromium VI	18540-29-9	38.8	CO32-PZM041	3/16/2020	27.2	CP23-MWI	3/13/2020
Cobalt	7440-48-4	59.9	B18-070-PZ	12/14/2016	2.35	CO26-PZM032	2/10/2025
Iron	7439-89-6	205,000	CP22-MWI	2/28/2020	205,000	CP22-MWI	2/28/2020
Manganese	7439-96-5	6,392	CO18-PZM006	2/14/2025	4433	CO26-PZM032	2/10/2025
Nickel	7440-02-0	65.7	B18-070-PZ	12/14/2016	12.5	CP26-MWS	3/11/2020
Thallium	7440-28-0	4.8	SW-030-MWS	2/1/2016	ND		
Vanadium	7440-62-2	1,430	CO203-MWS	2/10/2025	1430	CO203-MWS	2/10/2025
PCBs (total)	1336-36-3	ND			ND		
1,1-Biphenyl	92-52-4	110	CO212-MWS	11/5/2024	18	CO209-MWS	12/18/2024
1,4-Dioxane	123-91-1	4.1	BA-81-7946	11/29/2018	1.2	CP15-PZM020	10/12/2023
2,4-Dimethylphenol	105-67-9	277	B18-082-PZ	11/29/2018	44.0	CP23-MWS	12/19/2024
2,6-Dinitrotoluene	606-20-2	8.3	CP05-PZM008	5/14/2024	8.3	CP05-PZM008	5/14/2024
2-Butanone (MEK)	78-93-3	571	TS06-PPM008	6/11/2015	571	TS06-PPM008	6/11/2015
2-Methylnaphthalene	91-57-6	582	B18-044-PZ	11/30/2018	281	SW-086-MWS	11/28/2018
2-Methylphenol	95-48-7	584	B18-082-PZ	11/29/2018	53.0	CP23-MWS	12/19/2024
4-Chloroaniline	106-47-8	46.9	B18-082-PZ	11/29/2018	ND		
Acenaphthene	83-32-9	76	CO209-MWI	12/18/2024	76	CO209-MWI	12/18/2024
Benz[a]anthracene	56-55-3	41.8	B18-044-PZ	11/30/2018	6	SW-085-MWS	11/28/2018
Benzo[a]pyrene	50-32-8	24.2	B18-044-PZ	11/30/2018	5.2	SW-085-MWS	11/28/2018
Benzo[b]fluoranthene	205-99-2	15.1	B18-044-PZ	11/30/2018	7.5	SW-085-MWS	11/28/2018
Benzo[k]fluoranthene	207-08-9	12.2	B18-044-PZ	11/30/2018	6	SW-085-MWS	11/28/2018
bis(2-Ethylhexyl)phthalate	117-81-7	18	CP19R-PZM008	4/24/2023	2.4	CO58-PZM001	2/11/2025
Chrysene	218-01-9	55.6	B18-044-PZ	11/30/2018	4.6	SW-085-MWS	11/28/2018
Dibenz[a,h]anthracene	53-70-3	2.9	B18-044-PZ	11/30/2018	0.52	SW-085-MWS	11/28/2018
Fluoranthene	206-44-0	48.1	CO05B-PZM	5/20/2021	13.1	SW-085-MWS	11/28/2018
Fluorene	86-73-7	102	CO05B-PZM	5/20/2021	34	CO209-MWI	12/18/2024
Indeno[1,2,3-c,d]pyrene	193-39-5	3.7	B18-044-PZ	11/30/2018	1.2	SW-085-MWS	11/28/2018
Naphthalene	91-20-3	64,100	CO184-MWI	10/8/2019	18,000	CO209-MWI	12/18/2024
Pentachlorophenol	87-86-5	2.8	CO93-PZM	6/9/2015	0.42	CO35-PZM013	6/11/2015
Pyrene	129-00-0	266	B18-044-PZ	11/30/2018	18.2	SW-085-MWS	11/28/2018
Pyridine	110-86-1	38.1	CO26-PZM007	6/10/2015	13.4	CO28-PZM048	6/9/2015
Styrene	100-42-5	805	B18-082-PZ	11/29/2018	582	CO179-MWI	10/2/2019
Benzaldehyde	100-52-7	22.9	B18-082-PZ	11/29/2018	0.91	CP23-MWS	3/13/2020
Benzene	71-43-2	710,000	CO187-MWS	9/18/2024	150,000 (c)	GD02-MWI	11/28/2023
Ethylbenzene	100-41-4	1,500	CO93-PZM	8/15/2023	373 (d)	CO179-MWI	10/2/2019
Methylene Chloride	75-09-2	531	CO08-PZM036	6/11/2015	57	TS06-PPM008	6/11/2015
Toluene	108-88-3	100,000 (a)	CO41-PZM036	3/4/2024	13,000 (e)	CO179-MWI	10/2/2019
Xylenes	1330-20-7	21,000 (b)	CO41-PZM036	8/13/2024	4,800 (f)	CO28-PZM048	5/24/2023
1,4-Dioxane	123-91-1	4.1	BA-81-7946	11/29/2018	1.2	CP15-PZM020	10/12/2023

ND — Not detected. Parameter was not detected in any of the sampled locations.

Notes:

1. If the maxmimum concentration identified in the groundwater database was from 2015 or 2016, then the database was reviewed to determine if there was more recent sampling results for that location. In some cases, the maximum value was then updated to reflect more recent (more representative) conditions.

(a) Sitewide toluene: Maximum value as per the groundwatwer database is 138,000 ug/L from CO41-PZM036 in 2015. However, there are multiple toluene results for CO41-PZM036 from 2023 and 2024 with lower values (range from 57,000 - 100,000 ug/L). The maximum six toluene results in the database are from CO41-PZM036. The maximum toluene concentration from recent years is utilized: 100,000 ug/L.

(b) Sitewide xylenes: Maximum value as per the groundwatwer database is 37,000 ug/L from CO93-PZM in 2015. However, there are multiple xylene results for CO93-PZM from 2023 and 2024 with lower values (range from 12,000 - 17,000 ug/L). The next highest xylene result is 30,000 ug/L from CO41-PZM036 in 2015. However, 2023 and 2024 xylene results for CO41-PZM036 range from 10,000 - 21,000 ug/L). The maximum xylenes concentration from these two wells in recent years is utilized: 21,000 ug/L.

(c) Shoreline benzene: Maximum value as per the groundwatwer database is 291,000 ug/L from CO28-PZM048 in 2015. However, May 2023 benzene result for CO28-PZM048 is 93,000 ug/L. The second highest shoreline benzene result is 150,000 ug/L at GD02-MWI in November 2023. This result was used.

(d) Shoreline ethylbenzene: Maximum value as per the groundwatwer database is 525 ug/L from CO28-PZM048 in 2015. However, May 2023 ethylbenzene result for CO28-PZM048 is 260 J ug/L. The second highest shoreline benzene result is 373 ug/L at CO179-MWI in October 2019 (no more recent results available). This result was used.

(e) Shoreline toluene: Maximum value as per the groundwatwer database is 34,300 ug/L from CO28-PZM048 in 2015. However, May 2023 toluene result for CO28-PZM048 is 1,900 ug/L. The second highest shoreline benzene result is 13,000 ug/L at CO179-MWI in October 2019 (no more recent results available). This result was used.

(f) Shoreline xylene: Maximum value as per the groundwatwer database is 6,610 ug/L from CO28-PZM048 in 2015. However, May 2023 xylene result for CO28-PZM048 is 4,800 ug/L. This is also the second highest shoreline xylene result. This result was used.

Appendix E-5, Table B1
Final Remedial Goal Calculations
On-Site Industrial Worker, Vapor Intrusion Screening Levels (VISLs)

Chemical	CAS	Cancer VISL (ug/L)	Non-Cancer VISL (ug/L)
Cyanide	57-12-5		8.44E+02
Antimony	7440-36-0		
Arsenic	7440-38-2		
Chromium VI	18540-29-9		
Cobalt	7440-48-4		
Iron	7439-89-6		
Manganese	7439-96-5		
Nickel	7440-02-0		
Thallium	7440-28-0		
Vanadium	7440-62-2		
PCBs (total)	1336-36-3	1.26	
1,1-Biphenyl	92-52-4		1.39E+02
2,4-Dimethylphenol	105-67-9		
2,6-Dinitrotoluene	606-20-2		
2-Butanone (MEK)	78-93-3		9.41E+06
2-Methylnaphthalene	91-57-6		
2-Methylphenol	95-48-7		
Acenaphthene	83-32-9		
Benz[a]anthracene	56-55-3	4.14E+02	
Benzo[a]pyrene	50-32-8		
Benzo[b]fluoranthene	205-99-2		
Benzo[k]fluoranthene	207-08-9		
bis(2-Ethylhexyl)phthalate	117-81-7		
Chrysene	218-01-9		
Dibenz[a,h]anthracene	53-70-3		
Fluoranthene	206-44-0		
Fluorene	86-73-7		
Indeno[1,2,3-c,d]pyrene	193-39-5		
Naphthalene	91-20-3	2.01E+01	7.30E+02
Pentachlorophenol	87-86-5		
Pyrene	129-00-0		
Pyridine	110-86-1		
Styrene	100-42-5		3.90E+04
4-Chloroaniline	106-47-8		
Benzaldehyde	100-52-7		
Benzene	71-43-2	6.93	5.79E+02
Ethylbenzene	100-41-4	1.52E+01	
Methylene Chloride	75-09-2		1.98E+04
Toluene	108-88-3		8.07E+04
Xylenes	1330-20-7		1.62E+03
1,4-Dioxane	123-91-1	1.25E+04	6.70E+05

Appendix E-5, Table C1
Final Remedial Goal Calculations
On-Site Utility Worker, Exposure Assumptions

Description	Variable	Value
Target cancer risk (unitless)	TR	1.00E-06
Target hazard quotient (unitless)	THQ	1
Averaging time - noncancer (days) - Utility Worker	ATnc,uw	365
Averaging time - cancer (days)	ATc	25550
Lifetime (yr)	LTc	70
Exposure duration (yr) - Utility Worker	EDuw	1
Exposure frequency (events/yr) - Utility Worker	EFuw	20
Hours worked per day - Utility Worker	ETuw	4
Body weight (kg) - Utility Worker	BWuw	80
Skin surface area (cm2) - Utility Worker	SAuw	2550
Hourly Air Exchange Rate (Utility Worker)	ACHuw	46
Area of Trench (m2)	A	2.44
Volume of Trench (m3)	V	5.95
Fraction of floor contaminant can enter (unitless)	F	1
Molecular weight of O2 (g/mol)	MWo2	32
Molecular weight of H2O (g/mol)	MWh2o	18
Groundwater temp (degree K)	Tgw	284
Liquid phase transfer coeff of O2 (cm/sec)	kLO2	0.002
Gas phase transfer coeff of H2O (cm/sec)	kGH2O	0.833
Ideal Gas Constant	R	8.20E-05

Appendix E-5, Table C2
Final Remedial Goal Calculations
On-Site Utility Worker, Carcinogenic Calculations

			Parameter Specific Data													Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
																DA (ug/cm^2 * event)	RG (ug/L)	VF (L/m^3)	Utility RG (ug/L)	Utility RG (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo (mg/kg*day)$^{-1}$	FA (unitless)	kL (cm/sec)	kG (cm/sec)	HLC (atm*m^3/mole)	K (cm/sec)	IUR (ug/m^3)$^{-1}$	Cancer	Cancer	Utility	Cancer	Cancer
Cyanide	57-12-5	CN	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1		0.01	2.1E-03	7.0E-01	1.0E-04	1.2E-03		-	-	4.00E-01	-	-
Antimony	7440-36-0	Metal	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15		1 *	9.8E-04	4.2E-01				-	-	-	-	-
Arsenic	7440-38-2	Metal	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1.5E+00	1 *	1.2E-03	4.9E-01			4.3E-03	2.67E-02	6.68E+03	-	-	6.68E+03
Chromium VI	18540-29-9	Metal	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	5.0E-01	1 *	1.5E-03	5.6E-01			8.4E-02	2.00E-03	2.50E+02	-	-	2.50E+02
Cobalt	7440-48-4	Metal	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1		1 *	1.4E-03	5.3E-01			9.0E-03	-	-	-	-	-
Iron	7439-89-6	Metal	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1		1 *	1.4E-03	5.4E-01				-	-	-	-	-
Manganese	7439-96-5	Metal	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04		1 *	1.5E-03	5.5E-01				-	-	-	-	-
Nickel	7440-02-0	Metal	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04		1 *	1.4E-03	5.3E-01			2.6E-04	-	-	-	-	-
Thallium	7440-28-0	Metal	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1		1 *	7.6E-04	3.5E-01				-	-	-	-	-
Vanadium	7440-62-2	Metal	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026		1 *	1.5E-03	5.6E-01				-	-	-	-	-
PCBs (total) ˜	1336-36-3	PCB	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E+00	0.5	5.9E-04	3.0E-01	2.8E-04	5.1E-04	5.7E-04	2.00E-02	3.63E+00	1.64E-01	8.20E+01	3.47E+00
1,1-Biphenyl	92-52-4	SVOC	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	8.0E-03	1 *	8.8E-04	3.9E-01	3.1E-04	7.5E-04		5.01E+00	1.08E+04	2.41E-01	-	1.08E+04
2,4-Dimethylphenol	105-67-9	SVOC	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1		1	9.8E-04	4.2E-01	9.5E-07	1.7E-05		-	-	-	-	-
2,6-Dinitrotoluene	606-20-2	SVOC	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1.5E+00	1	8.0E-04	3.7E-01	7.5E-07	1.2E-05		2.67E-02	1.17E+03	-	-	1.17E+03
2-Butanone (MEK)	78-93-3	SVOC	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1		1	1.3E-03	5.0E-01	5.7E-05	6.2E-04		-	-	2.00E-01	-	-
2-Methylnaphthalene	91-57-6	SVOC	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1		1 *	9.1E-04	4.0E-01	5.2E-04	8.3E-04		-	-	2.65E-01	-	-
2-Methylphenol	95-48-7	SVOC	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1		1	1.0E-03	4.3E-01	1.2E-06	2.2E-05		-	-	-	-	-
Acenaphthene	83-32-9	SVOC	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1		1 *	8.7E-04	3.9E-01	1.8E-04	6.8E-04		-	-	2.17E-01	-	-
Benz[a]anthracene	56-55-3	SVOC	2.0E+00	3.2E+00	8.5E+00	5.5E-01	2.3E+02	1	1.0E-01	1	7.1E-04	3.4E-01	1.2E-05	1.4E-04	6.0E-05	4.01E-01	9.32E+01	4.49E-02	2.85E+03	9.03E+01
Benzo[a]pyrene	50-32-8	SVOC	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1.0E+00	1	6.8E-04	3.3E-01	4.6E-07	6.4E-06	6.0E-04	4.01E-02	6.21E+00	-	-	6.21E+00
Benzo[b]fluoranthene	205-99-2	SVOC	2.7E+00	2.5E+00	1.1E+01	4.2E-01	2.5E+02	1	1.0E-01	1	6.8E-04	3.3E-01	6.6E-07	9.1E-06	6.0E-05	4.01E-01	1.05E+02	-	-	1.05E+02
Benzo[k]fluoranthene	207-08-9	SVOC	2.7E+00	4.2E+00	1.2E+01	6.9E-01	2.5E+02	1	1.0E-02	1 *	6.8E-04	3.3E-01	5.8E-07	8.1E-06	6.0E-06	4.01E+00	6.39E+02	-	-	6.39E+02
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	1.4E-02	0.8	5.5E-04	2.8E-01	2.7E-07		2.4E-06	2.86E+00	1.42E+02	-	-	1.42E+02
Chrysene	218-01-9	SVOC	2.0E+00	3.5E+00	8.5E+00	6.0E-01	2.3E+02	1	1.0E-03	1	7.1E-04	3.4E-01	5.2E-06	6.9E-05	6.0E-07	4.01E+01	8.54E+03	-	-	8.54E+03
Dibenz[a,h]anthracene	53-70-3	SVOC	3.8E+00	6.1E+00	1.7E+01	9.5E-01	2.8E+02	1	1.0E+00	0.6	6.5E-04	3.2E-01	1.4E-07	1.9E-06	6.0E-04	4.01E-02	6.50E+00	-	-	6.50E+00
Fluoranthene	206-44-0	SVOC	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1		1	7.6E-04	3.5E-01	8.9E-06	1.1E-04		-	-	-	-	-
Fluorene	86-73-7	SVOC	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1		1 *	8.3E-04	3.7E-01	9.6E-05	5.4E-04		-	-	1.73E-01	-	-
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7E+00	7.9E+00	1.7E+01	1.2E+00	2.8E+02	1	1.0E-01	0.6	6.4E-04	3.2E-01	3.5E-07	4.7E-06	6.0E-05	4.01E-01	5.23E+01	-	-	5.23E+01
Naphthalene	91-20-3	SVOC	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1.2E-01	1	9.5E-04	4.1E-01	4.4E-04	8.4E-04	3.4E-05	3.34E-01	1.53E+03	2.70E-01	8.34E+02	5.40E+02
Pentachlorophenol	87-86-5	SVOC	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	4.0E-01	0.9	6.6E-04	3.2E-01	2.5E-08	3.4E-07	5.1E-06	1.00E-01	8.53E+01	-	-	8.53E+01
Pyrene	129-00-0	SVOC	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1		1 *	7.6E-04	3.5E-01	1.2E-05	1.5E-04		-	-	4.69E-02	-	-
Pyridine	110-86-1	SVOC	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1		1 *	1.2E-03	4.8E-01	1.1E-05	1.9E-04		-	-	6.17E-02	-	-
Styrene	100-42-5	SVOC	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1		1	1.1E-03	4.4E-01	2.8E-03	1.0E-03		-	-	3.32E-01	-	-
4-Chloroaniline	106-47-8	VOC	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	2.0E-01	1 *	9.5E-04	4.1E-01	1.2E-06	2.0E-05		2.00E-01	8.03E+03	-	-	8.03E+03
Benzaldehyde	100-52-7	VOC	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	4.0E-03	1 *	1.0E-03	4.4E-01	2.7E-05	3.4E-04		1.00E+01	5.47E+05	1.09E-01	-	5.47E+05
Benzene	71-43-2	VOC	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	5.5E-02	1	1.2E-03	4.9E-01	5.6E-03	1.2E-03	7.8E-06	7.29E-01	1.10E+04	3.88E-01	2.53E+03	2.06E+03
Ethylbenzene	100-41-4	VOC	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1.1E-02	1	1.0E-03	4.4E-01	7.9E-03	1.0E-03	2.5E-06	3.64E+00	1.71E+04	3.33E-01	9.19E+03	5.98E+03
Methylene Chloride	75-09-2	VOC	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	2.0E-03	1	1.2E-03	4.7E-01	3.3E-03	1.1E-03	1.0E-08	2.00E+01	1.23E+06	3.69E-01	2.08E+06	7.74E+05
Toluene	108-88-3	VOC	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1		1	1.1E-03	4.6E-01	6.6E-03	1.1E-03		-	-	3.58E-01	-	-
Xylenes	1330-20-7	VOC	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1		1	1.0E-03	4.4E-01	6.6E-03	1.0E-03		-	-	3.33E-01	-	-
1,4-Dioxane	123-91-1	VOC / SVOC	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1.0E-01	1	1.1E-03	4.7E-01	4.8E-06	8.9E-05	5.0E-06	4.01E-01	2.61E+05	-	-	2.61E+05
Sources			EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAGSE	CALC	CALC	EPA CS	CALC	RTAP RSL	CALC	CALC	CALC	CALC	CALC

Notes:
* FA <1 applies to a limited number of organic compounds. An FA of 1 was utilized for inorganics and for organic analytes not listed on RAGSE Exhibit B-3.
˜PCBs (total) using Aroclor 1254 values
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)
XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.

Appendix E-5, Table C3
Final Remedial Goal Calculations
On-Site Utility Worker, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data												
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	kL (cm/sec)	kG (cm/sec)	HLC (atm*m3/mole)	K (cm/sec)	RfC (mg/m^3)
Body weight																	
2-Methylphenol	95-48-7	SVOC	100%	1	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.0E-03	4.3E-01	1.2E-06	2.2E-05	6.0E-01
Naphthalene	91-20-3	SVOC	100%	1	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	9.5E-04	4.1E-01	4.4E-04	8.4E-04	3.0E-03
Nickel	7440-02-0	Metal	100%	1	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02	1.4E-03	5.3E-01			1.0E-05
Xylenes	1330-20-7	VOC	100%	1	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	1.0E-03	4.4E-01	6.6E-03	1.0E-03	1.0E-01
Cardiovascular																	
Arsenic	7440-38-2	Metal	100%	1	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04	1.2E-03	4.9E-01			1.5E-05
Dermal																	
Arsenic	7440-38-2	Metal	100%	1	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04	1.2E-03	4.9E-01			1.5E-05
Thallium	7440-28-0	Metal	100%	1	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1	1	1.0E-05	7.6E-04	3.5E-01			
Vanadium	7440-62-2	Metal	100%	1	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03	1.5E-03	5.6E-01			1.0E-04
PCBs (total) ˜	1336-36-3	PCB	100%	1	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	5.9E-04	3.0E-01	2.8E-04	5.1E-04	
Developmental																	
2-Butanone (MEK)	78-93-3	SVOC	100%	1.00	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	1.3E-03	5.0E-01	5.7E-05	6.2E-04	5.0E+00
Benzo[a]pyrene	50-32-8	SVOC	100%	1.00	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1	3.0E-04	6.8E-04	3.3E-01	4.6E-07	6.4E-06	2.0E-06
Ethylbenzene	100-41-4	VOC	100%	1.00	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	1.0E-03	4.4E-01	7.9E-03	1.0E-03	1.0E+00
Gastrointestinal																	
Benzaldehyde	100-52-7	VOC	100%	1.00	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	1.0E-03	4.4E-01	2.7E-05	3.4E-04	
Chromium VI	18540-29-9	Metal	100%	1.00	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03	1.5E-03	5.6E-01			1.0E-04
Iron	7439-89-6	Metal	100%	1.00	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1	1	7.0E-01	1.4E-03	5.4E-01			
Hematologic																	
Antimony	7440-36-0	Metal	100%	1	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04	9.8E-04	4.2E-01			3.0E-04
2,4-Dimethylphenol	105-67-9	SVOC	100%	1	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.8E-04	4.2E-01	9.5E-07	1.7E-05	
Fluorene	86-73-7	SVOC	100%	1	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1	1	4.0E-02	8.3E-04	3.7E-01	9.6E-05	5.4E-04	
Styrene	100-42-5	SVOC	100%	1	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	1.1E-03	4.4E-01	2.8E-03	1.0E-03	1.0E+00
Hepatic																	
Acenaphthene	83-32-9	SVOC	100%	1.00	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1	1	6.0E-02	8.7E-04	3.9E-01	1.8E-04	6.8E-04	
1,1-Biphenyl	92-52-4	SVOC	100%	1.00	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	8.8E-04	3.9E-01	3.1E-04	7.5E-04	4.0E-04
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	100%	1.00	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	0.8	2.0E-02	5.5E-04	2.8E-01	2.7E-07	3.3E-06	
Ethylbenzene	100-41-4	VOC	100%	1.00	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	1.0E-03	4.4E-01	7.9E-03	1.0E-03	1.0E+00
Fluoranthene	206-44-0	SVOC	100%	1.00	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	7.6E-04	3.5E-01	8.9E-06	1.1E-04	
Methylene Chloride	75-09-2	VOC	100%	1.00	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	1	6.0E-03	1.2E-03	4.7E-01	3.3E-03	1.1E-03	6.0E-01
Pentachlorophenol	87-86-5	SVOC	100%	1.00	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	0.9	5.0E-03	6.6E-04	3.2E-01	2.5E-08	3.4E-07	
Pyridine	110-86-1	SVOC	100%	1.00	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1	1	1.0E-03	1.2E-03	4.8E-01	1.1E-05	1.9E-04	
Styrene	100-42-5	SVOC	100%	1.00	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	1.1E-03	4.4E-01	2.8E-03	1.0E-03	1.0E+00
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1.00	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	1.1E-03	4.7E-01	4.8E-06	8.9E-05	3.0E-02
Immune																	
4-Chloroaniline	106-47-8	VOC	100%	1.00	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	1	5.0E-04	9.5E-04	4.1E-01	1.2E-06	2.0E-05	
Benzene	71-43-2	VOC	100%	1.00	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	1	4.0E-03	1.2E-03	4.9E-01	5.6E-03	1.2E-03	3.0E-02
2,6-Dinitrotoluene	606-20-2	SVOC	100%	1.00	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1	3.0E-04	1.8E-01	1.4E+01	7.5E-07	4.4E-04	
PCBs (total) ˜	1336-36-3	PCB	100%	1.00	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	5.9E-04	3.0E-01	2.8E-04	5.1E-04	

Appendix E-5, Table C3
Final Remedial Goal Calculations
On-Site Utility Worker, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data												
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	kL (cm/sec)	kG (cm/sec)	HLC (atm*m3/mole)	K (cm/sec)	RfC (mg/m^3)
Musculoskeletal																	
2-Butanone (MEK)	78-93-3	SVOC	100%	1.00	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	1.3E-03	5.0E-01	5.7E-05	6.2E-04	5.0E+00
Nervous																	
2,4-Dimethylphenol	105-67-9	SVOC	100%	1.000	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.8E-04	4.2E-01	9.5E-07	1.7E-05	
Manganese	7439-96-5	Metal	100%	1.000	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04	1	2.4E-02	1.5E-03	5.5E-01			5.0E-05
2-Methylphenol	95-48-7	SVOC	100%	1.000	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.0E-03	4.3E-01	1.2E-06	2.2E-05	6.0E-01
Styrene	100-42-5	SVOC	100%	1.000	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	1.1E-03	4.4E-01	2.8E-03	1.0E-03	1.0E+00
Toluene	108-88-3	VOC	100%	1.000	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	1.1E-03	4.6E-01	6.6E-03	1.1E-03	5.0E+00
Xylenes	1330-20-7	VOC	100%	1.000	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	1.0E-03	4.4E-01	6.6E-03	1.0E-03	1.0E-01
Ocular																	
PCBs (total) ˜	1336-36-3	PCB	100%	1	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	5.9E-04	3.0E-01	2.8E-04	5.1E-04	
Reproductive																	
Cyanide	57-12-5	CN	100%	1	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	2.1E-03	7.0E-01	1.0E-04	1.2E-03	8.0E-04
Respiratory																	
Antimony	7440-36-0	Metal	100%	1	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04	9.8E-04	4.2E-01			3.0E-04
Chromium VI	18540-29-9	Metal	100%	1	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03	1.5E-03	5.6E-01			1.0E-04
Cobalt	7440-48-4	Metal	100%	1	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04	1.4E-03	5.3E-01			6.0E-06
2-Methylnaphthalene	91-57-6	SVOC	100%	1	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1	1	4.0E-03	9.1E-04	4.0E-01	5.2E-04	8.3E-04	
Naphthalene	91-20-3	SVOC	100%	1	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	9.5E-04	4.1E-01	4.4E-04	8.4E-04	3.0E-03
Nickel	7440-02-0	Metal	100%	1	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02	1.4E-03	5.3E-01			1.0E-05
Vanadium	7440-62-2	Metal	100%	1	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03	1.5E-03	5.6E-01			1.0E-04
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	1.1E-03	4.7E-01	4.8E-06	8.9E-05	3.0E-02
Thyroid																	
Cobalt	7440-48-4	Metal	100%	1	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04	1.4E-03	5.3E-01			6.0E-06
Cyanide	57-12-5	CN	100%	1	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	2.1E-03	7.0E-01	1.0E-04	1.2E-03	8.0E-04
Urinary																	
Benzaldehyde	100-52-7	VOC	100%	1.000	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	1.0E-03	4.4E-01	2.7E-05	3.4E-04	
1,1-Biphenyl	92-52-4	SVOC	100%	1.000	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	8.8E-04	3.9E-01	3.1E-04	7.5E-04	4.0E-04
Fluoranthene	206-44-0	SVOC	100%	1.000	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	7.6E-04	3.5E-01	8.9E-06	1.1E-04	
Pyrene	129-00-0	SVOC	100%	1.000	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1	1	3.0E-02	7.6E-04	3.5E-01	1.2E-05	1.5E-04	
Toluene	108-88-3	VOC	100%	1.000	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	1.1E-03	4.6E-01	6.6E-03	1.1E-03	5.0E+00
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1.000	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	1.1E-03	4.7E-01	4.8E-06	8.9E-05	3.0E-02
Sources					EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RAGS	RTAP RSL	CALC	CALC	RAIS	CALC	RTAP RSL

Notes:
* FA <1 applies to a limited number of organic compounds. A FA of 1 was utilized for inorganics and for organic analytes not listed on RAGSE Exhibit B-3.
˜PCBs (total) using Aroclor 1254 values
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)
XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.

Appendix E-5, Table C3
Final Remedial Goal Calculations
On-Site Utility Worker, Non-Carcinogenic Calculations

			Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
			DA (ug/cm^2 * event)	RG (ug/L)	VF (L/m^3)	Utility RG (ug/L)	Utility RG (ug/L)
Chemical	CAS	Parameter Group	Noncancer	Noncancer	Utility	Noncancer	Noncancer
Body weight							
2-Methylphenol	95-48-7	SVOC	2.86E+01	7.83E+05	-	-	7.83E+05
Naphthalene	91-20-3	SVOC	1.15E+01	5.24E+04	2.70E-01	1.21E+03	1.19E+03
Nickel	7440-02-0	Metal	4.58E-01	5.73E+05	-	-	5.73E+05
Xylenes	1330-20-7	VOC	1.15E+02	5.30E+05	3.33E-01	3.29E+04	3.10E+04
Cardiovascular							
Arsenic	7440-38-2	Metal	1.72E-01	4.29E+04	-	-	4.29E+04
Dermal							
Arsenic	7440-38-2	Metal	1.72E-01	4.29E+04	-	-	4.29E+04
Thallium	7440-28-0	Metal	5.73E-03	1.43E+03	-	-	1.43E+03
Vanadium	7440-62-2	Metal	7.50E-02	1.88E+04	-	-	1.88E+04
PCBs (total) ˜	1336-36-3	PCB	1.15E-02	3.82E+00	1.64E-01	-	3.82E+00
Developmental							
2-Butanone (MEK)	78-93-3	SVOC	3.44E+02	7.90E+07	2.00E-01	2.74E+06	2.65E+06
Benzo[a]pyrene	50-32-8	SVOC	1.72E-01	2.66E+01	-	-	2.66E+01
Ethylbenzene	100-41-4	VOC	2.86E+01	1.34E+05	3.33E-01	3.28E+05	9.52E+04
Gastrointestinal							
Benzaldehyde	100-52-7	VOC	5.73E+01	3.13E+06	1.09E-01	-	3.13E+06
Chromium VI	18540-29-9	Metal	4.29E-02	5.37E+03	-	-	5.37E+03
Iron	7439-89-6	Metal	4.01E+02	1.00E+08	-	-	1.00E+08
Hematologic							
Antimony	7440-36-0	Metal	3.44E-02	8.59E+03	-	-	8.59E+03
2,4-Dimethylphenol	105-67-9	SVOC	1.15E+01	2.13E+05	-	-	2.13E+05
Fluorene	86-73-7	SVOC	2.29E+01	3.97E+04	1.73E-01	-	3.97E+04
Styrene	100-42-5	SVOC	1.15E+02	6.98E+05	3.32E-01	3.29E+05	2.24E+05
Hepatic							
Acenaphthene	83-32-9	SVOC	3.44E+01	8.07E+04	2.17E-01	-	8.07E+04
1,1-Biphenyl	92-52-4	SVOC	2.86E+02	6.18E+05	2.41E-01	1.81E+02	1.81E+02
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.15E+01	5.70E+02	-	-	5.70E+02
Ethylbenzene	100-41-4	VOC	2.86E+01	1.34E+05	3.33E-01	3.28E+05	9.52E+04
Fluoranthene	206-44-0	SVOC	2.29E+01	1.13E+04	-	-	1.13E+04
Methylene Chloride	75-09-2	VOC	3.44E+00	2.12E+05	3.69E-01	1.78E+05	9.67E+04
Pentachlorophenol	87-86-5	SVOC	2.86E+00	2.44E+03	-	-	2.44E+03
Pyridine	110-86-1	SVOC	5.73E-01	8.25E+04	6.17E-02	-	8.25E+04
Styrene	100-42-5	SVOC	1.15E+02	6.98E+05	3.32E-01	3.29E+05	2.24E+05
1,4-Dioxane	123-91-1	VOC/SVOC	1.72E+01	1.12E+07	-	-	1.12E+07
Immune							
4-Chloroaniline	106-47-8	VOC	2.86E-01	1.15E+04	-	-	1.15E+04
Benzene	71-43-2	VOC	2.29E+00	3.46E+04	3.88E-01	8.47E+03	6.81E+03
2,6-Dinitrotoluene	606-20-2	SVOC	1.72E-01	7.53E+03	-	-	7.53E+03
PCBs (total) ˜	1336-36-3	PCB	1.15E-02	2.07E+00	1.64E-01	-	2.07E+00

Appendix E-5, Table C3
Final Remedial Goal Calculations
On-Site Utility Worker, Non-Carcinogenic Calculations

			Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
			DA (ug/cm^2 * event)	RG (ug/L)	VF (L/m^3)	Utility RG (ug/L)	Utility RG (ug/L)
Chemical	CAS	Parameter Group	Noncancer	Noncancer	Utility	Noncancer	Noncancer
Musculoskeletal							
2-Butanone (MEK)	78-93-3	SVOC	3.44E+02	7.90E+07	2.00E-01	2.74E+06	2.65E+06
Nervous							
2,4-Dimethylphenol	105-67-9	SVOC	1.15E+01	2.13E+05	-	-	2.13E+05
Manganese	7439-96-5	Metal	5.50E-01	1.37E+05	-	-	1.37E+05
2-Methylphenol	95-48-7	SVOC	2.86E+01	7.83E+05	-	-	7.83E+05
Styrene	100-42-5	SVOC	1.15E+02	6.98E+05	3.32E-01	3.29E+05	2.24E+05
Toluene	108-88-3	VOC	4.58E+01	3.37E+05	3.58E-01	1.53E+06	2.76E+05
Xylenes	1330-20-7	VOC	1.15E+02	5.30E+05	3.33E-01	3.29E+04	3.10E+04
Ocular							
PCBs (total) ˜	1336-36-3	PCB	1.15E-02	2.07E+00	1.64E-01	-	2.07E+00
Reproductive							
Cyanide	57-12-5	CN	3.44E-01	8.59E+04	4.00E-01	2.19E+02	2.18E+02
Respiratory							
Antimony	7440-36-0	Metal	3.44E-02	8.59E+03	-	-	8.59E+03
Chromium VI	18540-29-9	Metal	4.29E-02	5.37E+03	-	-	5.37E+03
Cobalt	7440-48-4	Metal	1.72E-01	1.07E+05	-	-	1.07E+05
2-Methylnaphthalene	91-57-6	SVOC	2.29E+00	5.36E+03	2.65E-01	-	5.36E+03
Naphthalene	91-20-3	SVOC	1.15E+01	5.24E+04	2.70E-01	1.21E+03	1.19E+03
Nickel	7440-02-0	Metal	4.58E-01	5.73E+05	-	-	5.73E+05
Vanadium	7440-62-2	Metal	7.50E-02	1.88E+04	-	-	1.88E+04
1,4-Dioxane	123-91-1	VOC/SVOC	1.72E+01	1.12E+07	-	-	1.12E+07
Thyroid							
Cobalt	7440-48-4	Metal	1.72E-01	1.07E+05	-	-	1.07E+05
Cyanide	57-12-5	CN	3.44E-01	8.59E+04	4.00E-01	2.19E+02	2.18E+02
Urinary							
Benzaldehyde	100-52-7	VOC	5.73E+01	3.13E+06	1.09E-01	-	3.13E+06
1,1-Biphenyl	92-52-4	SVOC	2.86E+02	6.18E+05	2.41E-01	1.81E+02	1.81E+02
Fluoranthene	206-44-0	SVOC	2.29E+01	1.13E+04	-	-	1.13E+04
Pyrene	129-00-0	SVOC	1.72E+01	1.31E+04	4.69E-02	-	1.31E+04
Toluene	108-88-3	VOC	4.58E+01	3.37E+05	3.58E-01	1.53E+06	2.76E+05
1,4-Dioxane	123-91-1	VOC/SVOC	1.72E+01	1.12E+07	-	-	1.12E+07
Sources			CALC	CALC	CALC	CALC	CALC

Appendix E-5, Table D1
Final Remedial Goal Calculations
(Recreational User / Fish and Crab Ingestion), Exposure Assumptions

Description	Variable	Value
Target cancer risk (unitless)	TR	1.00E-06
Target hazard quotient (unitless)	THQ	1
Averaging time - noncancer (days)	AT_{nc,rec_fish}	9490
Averaging time - cancer (days)	ATc	25550
Lifetime (yr)	LTc	70
Exposure duration (yr)	ED_{rec_fish}	26
Exposure frequency (days/yr)	EF_{rec_fish}	32
Body weight (kg)	BW_{rec_fish}	80
Fish Ingestion Rate (mg/day)	IRF	230,000

Notes:

(a) The weight of cooked fish ingested by an adult is 8 ounces/meal or 0.23 kg/meal (wet weight) (2016 Offshore Investigation, EA).

(b) Fish and crab ingestion assumed at 16 meals/yr from the Sparrows Point Area (2016 Offshore Investigation, EA).

Appendix E-5, Table D2
Final Remedial Goal Calculations
Recreational User / Fish and Crab Ingestion, Carcinogenic Calculations

			Parameter Specific Data									Fish Ingestion SL (mg/kg in fish)	Fish Ingestion RBSL in SW (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo $(mg/kg*day)^{-1}$	BCF (L/kg)	IUR $(ug/m^3)^{-1}$	Cancer	Cancer
Cyanide	57-12-5	CN	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1		NA		-	-
Antimony	7440-36-0	Metal	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15		1.0E+02		-	-
Arsenic	7440-38-2	Metal	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1.5E+00	3.0E+02	4.3E-03	7.12E-03	0.023736529
Chromium VI	18540-29-9	Metal	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	5.0E-01	2.0E+02	8.4E-02	2.14E-02	0.106814381
Cobalt	7440-48-4	Metal	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1		3.0E+02	9.0E-03	-	-
Iron	7439-89-6	Metal	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1		2.0E+02		-	-
Manganese	7439-96-5	Metal	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04		4.0E+02		-	-
Nickel	7440-02-0	Metal	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04		1.0E+02	2.6E-04	-	-
Thallium	7440-28-0	Metal	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1		1.0E+04		-	-
Vanadium	7440-62-2	Metal	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026		NA		-	-
PCBs (total) ˜	1336-36-3	PCB	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E+00	9.1E+03	5.7E-04	5.34E-03	0.000584132
1,1-Biphenyl	92-52-4	SVOC	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	8.0E-03	4.4E+02		1.34E+00	3.055331272
2,4-Dimethylphenol	105-67-9	SVOC	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1		1.5E+01		-	-
2,6-Dinitrotoluene	606-20-2	SVOC	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1.5E+00	2.2E+01		7.12E-03	0.323679943
2-Butanone (MEK)	78-93-3	SVOC	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1		3.2E+00		-	-
2-Methylnaphthalene	91-57-6	SVOC	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1		7.5E+01		-	-
2-Methylphenol	95-48-7	SVOC	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1		1.1E+01		-	-
Acenaphthene	83-32-9	SVOC	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1		7.6E+02		-	-
Benz[a]anthracene	56-55-3	SVOC	2.0E+00	3.2E+00	8.5E+00	5.5E-01	2.3E+02	1	1.0E-01	2.6E+02	6.0E-05	1.07E-01	0.410799332
Benzo[a]pyrene	50-32-8	SVOC	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1.0E+00	5.1E+03	6.0E-04	1.07E-02	0.002075275
Benzo[b]fluoranthene	205-99-2	SVOC	2.7E+00	2.5E+00	1.1E+01	4.2E-01	2.5E+02	1	1.0E-01	3.0E+03	6.0E-05	1.07E-01	0.035322216
Benzo[k]fluoranthene	207-08-9	SVOC	2.7E+00	4.2E+00	1.2E+01	6.9E-01	2.5E+02	1	1.0E-02	5.0E+03	6.0E-06	1.07E+00	0.213928262
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	1.4E-02	5.9E+02	2.4E-06	7.63E-01	1.297550793
Chrysene	218-01-9	SVOC	2.0E+00	3.5E+00	8.5E+00	6.0E-01	2.3E+02	1	1.0E-03	3.2E+03	6.0E-07	1.07E+01	3.374861967
Dibenz[a,h]anthracene	53-70-3	SVOC	3.8E+00	6.1E+00	1.7E+01	9.5E-01	2.8E+02	1	1.0E+00	9.6E+03	6.0E-04	1.07E-02	0.00111265
Fluoranthene	206-44-0	SVOC	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1		3.6E+03		-	-
Fluorene	86-73-7	SVOC	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1		5.3E+02		-	-
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7E+00	7.9E+00	1.7E+01	1.2E+00	2.8E+02	1	1.0E-01	1.2E+04	6.0E-05	1.07E-01	0.008769654
Naphthalene	91-20-3	SVOC	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1.2E-01	8.5E+01	3.4E-05	8.90E-02	1.053291266
Pentachlorophenol	87-86-5	SVOC	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	4.0E-01	6.0E+02	5.1E-06	2.67E-02	0.044809463
Pyrene	129-00-0	SVOC	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1		1.5E+03		-	-
Pyridine	110-86-1	SVOC	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1		3.2E+00		-	-
Styrene	100-42-5	SVOC	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1		1.4E+01		-	-
4-Chloroaniline	106-47-8	VOC	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	2.0E-01	7.0E+00		5.34E-02	7.651459976
Benzaldehyde	100-52-7	VOC	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	4.0E-03	4.4E+00		2.67E+00	606.8998936
Benzene	71-43-2	VOC	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	5.5E-02	4.3E+00	7.8E-06	1.94E-01	45.52679099
Ethylbenzene	100-41-4	VOC	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1.1E-02	5.6E+01	2.5E-06	9.71E-01	17.46474514
Methylene Chloride	75-09-2	VOC	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	2.0E-03	2.3E+01	1.0E-08	5.34E+00	231.1999595
Toluene	108-88-3	VOC	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1		8.3E+00		-	-
Xylenes	1330-20-7	VOC	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1		1.4E+01		-	-
1,4-Dioxane	123-91-1	VOC / SVOC	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1.0E-01	5.0E-01	5.0E-06	1.07E-01	213.6140082
Sources			EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAIS	RTAP RSL	CALC	CALC

Notes:
(a) PCBs (total) using Aroclor 1254 values

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Appendix E-5, Table D3
Final Remedial Goal Calculations
Recreational User / Fish and Crab Ingestion, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data								Fish Ingestion SL (mg/kg in fish)	Fish Ingestion RBSL in SW (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	RfD (mg/kg*day)	BCF (L/kg)	Noncancer	Noncancer
Body weight														
2-Methylphenol	95-48-7	SVOC	100%	1	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	5.0E-02	7.5E+01	1.98E+02	2656.898976
Naphthalene	91-20-3	SVOC	100%	1	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	2.0E-02	8.5E+01	7.93E+01	938.9339288
Nickel	7440-02-0	Metal	100%	1	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	2.0E-02	1.0E+02	7.93E+01	793.4782609
Xylenes	1330-20-7	VOC	100%	1	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	2.0E-01	1.4E+01	7.93E+02	56275.05396
Cardiovascular														
Arsenic	7440-38-2	Metal	100%	1.0	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	3.0E-04	3.0E+02	1.19E+00	3.967391304
Dermal														
Arsenic	7440-38-2	Metal	100%	1	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	3.0E-04	3.0E+02	1.19E+00	3.967391304
Thallium	7440-28-0	Metal	100%	1	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1	1.0E-05	1.0E+04	3.97E-02	0.003967391
Vanadium	7440-62-2	Metal	100%	1	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	5.0E-03		2.00E+01	--
PCBs (total) ˜	1336-36-3	PCB	100%	1	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E-05	9.1E+03	7.93E-02	0.008678533
Developmental														
2-Butanone (MEK)	78-93-3	SVOC	100%	1.00	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	6.0E-01	3.2E+00	2.38E+03	753302.1464
Benzo[a]pyrene	50-32-8	SVOC	100%	1.00	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	3.0E-04	5.1E+03	1.19E+00	0.231244879
Ethylbenzene	100-41-4	VOC	100%	1.00	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	5.0E-02	5.6E+01	1.98E+02	3567.797936
Gastrointestinal														
Benzaldehyde	100-52-7	VOC	100%	1.00	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1.0E-01	4.4E+00	3.97E+02	90167.98419
Chromium VI	18540-29-9	Metal	100%	1.00	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	3.0E-03	2.0E+02	1.19E+01	59.51086957
Iron	7439-89-6	Metal	100%	1.00	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1	7.0E-01	2.0E+02	2.78E+03	13885.86957
Hematologic														
Antimony	7440-36-0	Metal	100%	1	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	4.0E-04	1.0E+02	1.59E+00	15.86956522
2,4-Dimethylphenol	105-67-9	SVOC	100%	1	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	2.0E-02	1.5E+01	7.93E+01	5189.52427
Fluorene	86-73-7	SVOC	100%	1	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1	4.0E-02	5.3E+02	1.59E+02	302.1099496
Styrene	100-42-5	SVOC	100%	1	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	2.0E-01	1.4E+01	7.93E+02	58776.16747
Hepatic														
Acenaphthene	83-32-9	SVOC	100%	1.00	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1	6.0E-02	7.6E+02	2.38E+02	315.2893752
1,1-Biphenyl	92-52-4	SVOC	100%	1.00	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	5.0E-01	4.4E+02	1.98E+03	4539.349318
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	100%	1.00	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	2.0E-02	5.9E+02	7.93E+01	134.9452825
Ethylbenzene	100-41-4	VOC	100%	1.00	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	5.0E-02	5.6E+01	1.98E+02	3567.797936
Fluoranthene	206-44-0	SVOC	100%	1.00	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	4.0E-02	3.6E+03	1.59E+02	43.70841203
Methylene Chloride	75-09-2	VOC	100%	1.00	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	6.0E-03	2.3E+01	2.38E+01	1030.491248
Pentachlorophenol	87-86-5	SVOC	100%	1.00	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	5.0E-03	6.0E+02	1.98E+01	33.28702954
Pyridine	110-86-1	SVOC	100%	1.00	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1	1.0E-03	3.2E+00	3.97E+00	1255.503577
Styrene	100-42-5	SVOC	100%	1.00	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	2.0E-01	1.4E+01	7.93E+02	58776.16747
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1.00	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	3.0E-02	5.0E-01	1.19E+02	238027.0377
Immune														
4-Chloroaniline	106-47-8	VOC	100%	1.00	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	5.0E-04	7.0E+00	1.98E+00	284.1970848
Benzene	71-43-2	VOC	100%	1.00	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	4.0E-03	4.3E+00	1.59E+01	3720.189207
2,6-Dinitrotoluene	606-20-2	SVOC	100%	1.00	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	3.0E-04	2.2E+01	1.19E+00	54.10079051
PCBs (total) ˜	1336-36-3	PCB	100%	1.00	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E-05	9.1E+03	7.93E-02	0.008678533
Musculoskeletal														
2-Butanone (MEK)	78-93-3	SVOC	100%	1.00	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	6.0E-01	3.2E+00	2.38E+03	753302.1464
Nervous														
2,4-Dimethylphenol	105-67-9	SVOC	100%	1.000	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	2.0E-02	1.5E+01	7.93E+01	5189.52427

Appendix E-5, Table D3
Final Remedial Goal Calculations
Recreational User / Fish and Crab Ingestion, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data								Fish Ingestion SL (mg/kg in fish)	Fish Ingestion RBSL in SW (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	RfD (mg/kg*day)	BCF (L/kg)	Noncancer	Noncancer
Manganese	7439-96-5	Metal	100%	1.000	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04	2.4E-02	4.0E+02	9.52E+01	238.0434783
2-Methylphenol	95-48-7	SVOC	100%	1.000	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	5.0E-02	1.1E+01	1.98E+02	18539.2117
Styrene	100-42-5	SVOC	100%	1.000	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	2.0E-01	1.4E+01	7.93E+02	58776.16747
Toluene	108-88-3	VOC	100%	1.000	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	8.0E-02	8.3E+00	3.17E+02	38158.82771
Xylenes	1330-20-7	VOC	100%	1.000	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	2.0E-01	1.4E+01	7.93E+02	56275.05396
Ocular														
PCBs (total) ˜	1336-36-3	PCB	100%	1.00	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E-05	9.1E+03	7.93E-02	0.008678533
Reproductive														
Cyanide	57-12-5	CN	100%	1.00	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	6.0E-04		2.38E+00	--
Respiratory														
Antimony	7440-36-0	Metal	100%	1	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	4.0E-04	1.0E+02	1.59E+00	15.86956522
Chromium VI	18540-29-9	Metal	100%	1	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	3.0E-03	2.0E+02	1.19E+01	59.51086957
Cobalt	7440-48-4	Metal	100%	1	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	3.0E-04	3.0E+02	1.19E+00	3.967391304
2-Methylnaphthalene	91-57-6	SVOC	100%	1	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1	4.0E-03	7.5E+01	1.59E+01	212.5519181
Naphthalene	91-20-3	SVOC	100%	1	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	2.0E-02	8.5E+01	7.93E+01	938.9339288
Nickel	7440-02-0	Metal	100%	1	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	2.0E-02	1.0E+02	7.93E+01	793.4782609
Vanadium	7440-62-2	Metal	100%	1	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	5.0E-03		2.00E+01	--
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	3.0E-02	5.0E-01	1.19E+02	238027.0377
Thyroid														
Cobalt	7440-48-4	Metal	100%	1.00	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	3.0E-04	3.0E+02	1.19E+00	3.967391304
Cyanide	57-12-5	CN	100%	1.00	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	6.0E-04		2.38E+00	--
Urinary														
Benzaldehyde	100-52-7	VOC	100%	1.000	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1.0E-01	4.4E+00	3.97E+02	90167.98419
1,1-Biphenyl	92-52-4	SVOC	100%	1.000	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	5.0E-01	4.4E+02	1.98E+03	4539.349318
Fluoranthene	206-44-0	SVOC	100%	1.000	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	4.0E-02	3.6E+03	1.59E+02	43.70841203
Pyrene	129-00-0	SVOC	100%	1.000	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1	3.0E-02	1.5E+03	1.19E+02	78.99985458
Toluene	108-88-3	VOC	100%	1.000	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	8.0E-02	8.3E+00	3.17E+02	38158.82771
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1.000	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	3.0E-02	5.0E-01	1.19E+02	238027.0377
Sources					EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAIS	CALC	CALC

Notes:
(a) PCBs (total) using Aroclor 1254 values

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Appendix E-5, Table E1
Final Remedial Goal Calculations
Resource Restoration - Industrial Non-Potable Water User, Exposure Assumptions

Description	Variable	Value
Target cancer risk (unitless)	TR	1.00E-06
Target hazard quotient (unitless)	THQ	1
Averaging time - noncancer (days) - Ind Non-Potable Water User	ATnc,rr	9125
Averaging time - cancer (days)	ATc	25550
Lifetime (yr)	LTc	70
Exposure duration (yr) - Ind Non-Potable Water User	EDrr	25
Exposure frequency (days/yr) - Ind Non-Potable Water User	EFrr	150
Exposure Time (hours/day) - Ind Non-Potable Water User	ETrr	4
Body weight (kg) - Ind Non-Potable Water User	BWrr	80
Skin surface area (cm2) - Ind Non-Potable Water User	SArr	2550
Fraction of floor contaminant can enter (unitless)	F	1
Average wind speed in the mixing zone (m/s)	Uair	4.69
Ambient Air Mixing Zone Height (m)	dair	2
Length of source parallel to wind direction (m)	L	0.6096
Work Area Width (m)	W	6.096
Groundwater Extraction Rate (L/s)	Qgw	0.31542

Appendix E-5, Table E2
Final Remedial Goal Calculations
Resource Restoration - Industrial Non-Potable Water User, Carcinogenic Calculations

			Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
													DA (ug/cm^2 * event)	Final RG (ug/L)	C_{air} (ug/m^3)	Final RG (ug/L)	Industrial Non-Potable Water User Final RG (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo $(mg/kg*day)^{-1}$	FA (unitless)	HLC (atm*m3/ mole)	IUR $(ug/m^3)^{-1}$	Cancer	Cancer	Cancer	Cancer	Cancer
Cyanide	57-12-5	CN	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1		0.01	1.0E-04		-	-	-	-	-
Antimony	7440-36-0	Metal	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15		1 *			-	-	-	-	-
Arsenic	7440-38-2	Metal	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1.5E+00	1 *		4.3E-03	1.43E-04	3.56E+01	-	-	3.56E+01
Chromium VI	18540-29-9	Metal	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	5.0E-01	1 *		8.4E-02	1.07E-05	1.34E+00	-	-	1.34E+00
Cobalt	7440-48-4	Metal	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1		1 *		9.0E-03	-	-	-	-	-
Iron	7439-89-6	Metal	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1		1 *			-	-	-	-	-
Manganese	7439-96-5	Metal	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04		1 *			-	-	-	-	-
Nickel	7440-02-0	Metal	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04		1 *		2.6E-04	-	-	-	-	-
Thallium	7440-28-0	Metal	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1		1 *			-	-	-	-	-
Vanadium	7440-62-2	Metal	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026		1 *			-	-	-	-	-
PCBs (total) ~	1336-36-3	PCB	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	2.0E+00	0.5	2.8E-04	5.7E-04	1.07E-04	1.93E-02	7.16E-02	12.978902	1.93E-02
1,1-Biphenyl	92-52-4	SVOC	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	8.0E-03	1 *	3.1E-04		2.67E-02	5.77E+01	-	-	5.77E+01
2,4-Dimethylphenol	105-67-9	SVOC	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1		1	9.5E-07		-	-	-	-	-
2,6-Dinitrotoluene	606-20-2	SVOC	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1.5E+00	1	7.5E-07		1.43E-04	6.24E+00	-	-	6.24E+00
2-Butanone (MEK)	78-93-3	SVOC	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1		1	5.7E-05		-	-	-	-	-
2-Methylnaphthalene	91-57-6	SVOC	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1		1 *	5.2E-04		-	-	-	-	-
2-Methylphenol	95-48-7	SVOC	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1		1	1.2E-06		-	-	-	-	-
Acenaphthene	83-32-9	SVOC	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1		1 *	1.8E-04		-	-	-	-	-
Benz[a]anthracene	56-55-3	SVOC	2.0E+00	3.2E+00	8.5E+00	5.5E-01	2.3E+02	1	1.0E-01	1	1.2E-05	6.0E-05	2.14E-03	4.97E-01	6.81E-01	123.51588	4.95E-01
Benzo[a]pyrene	50-32-8	SVOC	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1.0E+00	1	4.6E-07	6.0E-04	2.14E-04	3.31E-02	-	-	3.31E-02
Benzo[b]fluoranthene	205-99-2	SVOC	2.7E+00	2.5E+00	1.1E+01	4.2E-01	2.5E+02	1	1.0E-01	1	6.6E-07	6.0E-05	2.14E-03	5.60E-01	-	-	5.60E-01
Benzo[k]fluoranthene	207-08-9	SVOC	2.7E+00	4.2E+00	1.2E+01	6.9E-01	2.5E+02	1	1.0E-02	1 *	5.8E-07	6.0E-06	2.14E-02	3.41E+00	-	-	3.41E+00
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	1.4E-02	0.8	2.7E-07	2.4E-06	1.53E-02	7.60E-01	-	-	7.60E-01
Chrysene	218-01-9	SVOC	2.0E+00	3.5E+00	8.5E+00	6.0E-01	2.3E+02	1	1.0E-03	1	5.2E-06	6.0E-07	2.14E-01	4.56E+01	-	-	4.56E+01
Dibenz[a,h]anthracene	53-70-3	SVOC	3.8E+00	6.1E+00	1.7E+01	9.5E-01	2.8E+02	1	1.0E+00	0.6	1.4E-07	6.0E-04	2.14E-04	3.47E-02	-	-	3.47E-02
Fluoranthene	206-44-0	SVOC	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1		1	8.9E-06		-	-	-	-	-
Fluorene	86-73-7	SVOC	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1		1 *	9.6E-05		-	-	-	-	-
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	3.7E+00	7.9E+00	1.7E+01	1.2E+00	2.8E+02	1	1.0E-01	0.6	3.5E-07	6.0E-05	2.14E-03	2.79E-01	-	-	2.79E-01
Naphthalene	91-20-3	SVOC	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1.2E-01	1	4.4E-04	3.4E-05	1.78E-03	8.16E+00	1.20E+00	217.9692	7.86E+00
Pentachlorophenol	87-86-5	SVOC	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	4.0E-01	0.9	2.5E-08	5.1E-06	5.34E-04	4.55E-01	-	-	4.55E-01
Pyrene	129-00-0	SVOC	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1		1 *	1.2E-05		-	-	-	-	-
Pyridine	110-86-1	SVOC	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1		1 *	1.1E-05		-	-	-	-	-
Styrene	100-42-5	SVOC	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1		1	2.8E-03		-	-	-	-	-
4-Chloroaniline	106-47-8	VOC	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	2.0E-01	1 *	1.2E-06		1.07E-03	4.28E+01	-	-	4.28E+01
Benzaldehyde	100-52-7	VOC	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	4.0E-03	1 *	2.7E-05		5.34E-02	2.92E+03	-	-	2.92E+03
Benzene	71-43-2	VOC	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	5.5E-02	1	5.6E-03	7.8E-06	3.89E-03	5.87E+01	5.24E+00	950.12215	5.53E+01
Ethylbenzene	100-41-4	VOC	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1.1E-02	1	7.9E-03	2.5E-06	1.94E-02	9.10E+01	1.64E+01	2964.3811	8.83E+01
Methylene Chloride	75-09-2	VOC	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	2.0E-03	1	3.3E-03	1.0E-08	1.07E-01	6.58E+03	4.09E+03	741095.28	6.52E+03
Toluene	108-88-3	VOC	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1		1	6.6E-03		-	-	-	-	-

Appendix E-5, Table E2
Final Remedial Goal Calculations
Resource Restoration - Industrial Non-Potable Water User, Carcinogenic Calculations

			Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
													DA (ug/cm^2 * event)	Final RG (ug/L)	C_{air} (ug/m^3)	Final RG (ug/L)	Industrial Non-Potable Water User Final RG (ug/L)
Chemical	CAS	Parameter Group	Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	Sfo (mg/kg*day)$^{-1}$	FA (unitless)	HLC (atm*m3/mole)	IUR $(ug/m^3)^{-1}$	Cancer	Cancer	Cancer	Cancer	Cancer
Xylenes	1330-20-7	VOC	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1		1	6.6E-03		-	-	-	-	-
1,4-Dioxane	123-91-1	VOC / SVOC	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1.0E-01	1	4.8E-06	5.0E-06	2.14E-03	1.39E+03	-	-	1.39E+03
Sources			EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RTAP RSL	RAGSE	EPA CS	RTAP RSL	CALC	CALC	CALC	CALC	CALC

Notes:
(a) Chromium uses Chromium (III), Insoluble Salts values for RfD.
XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.
(b) PCBs (total) using Aroclor 1254 values
* FA <1 applies to a limited number of organic compounds. An FA of 1 was utilized for inorganics and for organic analytes not listed on RAGSE Exhibit B-3.

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

Appendix E-5, Table E3
Final Remedial Goal Calculations
Resource Restoration - Industrial Non-Potable Water User, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
															DA (ug/cm^2 * event)	Final RG (ug/L)	C_{air} (ug/m^3)	Final RG (ug/L)	Industrial Non-Potable Water User Final RG (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	HLC (atm*m3 / mole)	RfC (mg/m^3)	Noncancer	Noncancer	Noncancer	Noncancer	Noncancer
Body weight																			
2-Methylphenol	95-48-7	SVOC	100%	1	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.2E-06	6.0E-01	3.82E+00	9.60E+04	-	-	9.60E+04
Naphthalene	91-20-3	SVOC	100%	1	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	4.4E-04	3.0E-03	1.53E+00	6.19E+03	4.38E+01	7940.3065	3.48E+03
Nickel	7440-02-0	Metal	100%	1	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02		1.0E-05	6.11E-02	7.63E+04	-	-	7.63E+04
Xylenes	1330-20-7	VOC	100%	1	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	6.6E-03	1.0E-01	1.53E+01	6.71E+04	1.46E+03	264676.88	5.35E+04
Cardiovascular																			
Arsenic	7440-38-2	Metal	100%	1	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04		1.5E-05	2.29E-02	5.73E+03	-	-	5.73E+03
Dermal																			
Arsenic	7440-38-2	Metal	100%	1	2.8E-01	3.3E-03	6.6E-01	1.0E-03	7.5E+01	1	1	3.0E-04		1.5E-05	2.29E-02	5.73E+03	-	-	5.73E+03
Thallium	7440-28-0	Metal	100%	1	1.5E+00	5.5E-03	3.5E+00	1.0E-03	2.0E+02	1	1	1.0E-05			7.63E-04	1.91E+02	-	-	1.91E+02
Vanadium	7440-62-2	Metal	100%	1	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03		1.0E-04	1.00E-02	2.50E+03	-	-	2.50E+03
PCBs (total) ˜	1336-36-3	PCB	100%	1	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	2.8E-04		1.53E-03	2.76E-01	-	-	2.76E-01
Developmental																			
2-Butanone (MEK)	78-93-3	SVOC	100%	1.000	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	5.7E-05	5.0E+00	4.58E+01	1.03E+07	7.30E+04	13233844	5.78E+06
Benzo[a]pyrene	50-32-8	SVOC	100%	1.000	2.7E+00	4.4E+00	1.2E+01	7.1E-01	2.5E+02	1	1	3.0E-04	4.6E-07	2.0E-06	2.29E-02	3.55E+00	-	-	3.55E+00
Ethylbenzene	100-41-4	VOC	100%	1.000	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	7.9E-03	1.0E+00	3.82E+00	1.70E+04	1.46E+04	2646768.8	1.69E+04
Gastrointestinal																			
Benzaldehyde	100-52-7	VOC	100%	1.000	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	2.7E-05		7.63E+00	3.84E+05	-	-	3.84E+05
Chromium VI	18540-29-9	Metal	100%	1.000	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03		1.0E-04	5.73E-03	7.16E+02	-	-	7.16E+02
Iron	7439-89-6	Metal	100%	1.000	2.2E-01	2.9E-03	5.2E-01	1.0E-03	5.6E+01	1	1	7.0E-01			5.34E+01	1.34E+07	-	-	1.34E+07
Hematologic																			
Antimony	7440-36-0	Metal	100%	1	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04		3.0E-04	4.58E-03	1.15E+03	-	-	1.15E+03
2,4-Dimethylphenol	105-67-9	SVOC	100%	1	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.5E-07		1.53E+00	2.47E+04	-	-	2.47E+04
Fluorene	86-73-7	SVOC	100%	1	9.0E-01	5.5E-01	2.2E+00	1.1E-01	1.7E+02	1	1	4.0E-02	9.6E-05		3.05E+00	4.35E+03	-	-	4.35E+03
Styrene	100-42-5	SVOC	100%	1	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	2.8E-03	1.0E+00	1.53E+01	8.79E+04	1.46E+04	2646768.8	8.50E+04
Hepatic																			
Acenaphthene	83-32-9	SVOC	100%	1.000	7.7E-01	4.1E-01	1.8E+00	8.6E-02	1.5E+02	1	1	6.0E-02	1.8E-04		4.58E+00	8.99E+03	-	-	8.99E+03
1,1-Biphenyl	92-52-4	SVOC	100%	1.000	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	3.1E-04	4.0E-04	3.82E+01	7.02E+04	5.84E+00	1058.7075	1.04E+03
Bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	100%	1.000	1.6E+01	8.6E+00	7.3E+01	1.1E+00	3.9E+02	1	0.8	2.0E-02	2.7E-07		1.53E+00	7.60E+01	-	-	7.60E+01
Ethylbenzene	100-41-4	VOC	100%	1.000	4.1E-01	2.0E-01	9.9E-01	4.9E-02	1.1E+02	1	1	5.0E-02	7.9E-03	1.0E+00	3.82E+00	1.70E+04	1.46E+04	2646768.8	1.69E+04
Fluoranthene	206-44-0	SVOC	100%	1.000	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	8.9E-06		3.05E+00	1.51E+03	-	-	1.51E+03
Methylene Chloride	75-09-2	VOC	100%	1.000	3.1E-01	1.3E-02	7.5E-01	3.5E-03	8.5E+01	1	1	6.0E-03	3.3E-03	6.0E-01	4.58E-01	2.71E+04	8.76E+03	1588061.3	2.67E+04
Pentachlorophenol	87-86-5	SVOC	100%	1.000	3.3E+00	8.0E-01	1.3E+01	1.3E-01	2.7E+02	1	0.9	5.0E-03	2.5E-08		3.82E-01	3.25E+02	-	-	3.25E+02
Pyridine	110-86-1	SVOC	100%	1.000	2.9E-01	5.2E-03	7.0E-01	1.5E-03	7.9E+01	1	1	1.0E-03	1.1E-05		7.63E-02	1.07E+04	-	-	1.07E+04
Styrene	100-42-5	SVOC	100%	1.000	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	2.8E-03	1.0E+00	1.53E+01	8.79E+04	1.46E+04	2646768.8	8.50E+04
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1.000	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	4.8E-06	3.0E-02	2.29E+00	1.42E+06	-	-	1.42E+06
Immune																			
4-Chloroaniline	106-47-8	VOC	100%	1.00	5.4E-01	2.2E-02	1.3E+00	5.0E-03	1.3E+02	1	1	5.0E-04	1.2E-06		3.82E-02	1.29E+03	-	-	1.29E+03
Benzene	71-43-2	VOC	100%	1.00	2.9E-01	5.1E-02	6.9E-01	1.5E-02	7.8E+01	1	1	4.0E-03	5.6E-03	3.0E-02	3.05E-01	4.48E+03	4.38E+02	79403.065	4.24E+03
2,6-Dinitrotoluene	606-20-2	SVOC	100%	1.00	1.1E+00	1.9E-02	2.6E+00	3.7E-03	1.8E+02	1	1	3.0E-04	7.5E-07		2.29E-02	4.46E+02	-	-	4.46E+02
PCBs (total) ˜	1336-36-3	PCB	100%	1.00	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	2.8E-04		1.53E-03	2.76E-01	-	-	2.76E-01
Musculoskeletal																			
2-Butanone (MEK)	78-93-3	SVOC	100%	1.0	2.7E-01	3.1E-03	6.4E-01	9.6E-04	7.2E+01	1	1	6.0E-01	5.7E-05	5.0E+00	4.58E+01	1.03E+07	7.30E+04	13233844	5.78E+06
Nervous																			
2,4-Dimethylphenol	105-67-9	SVOC	100%	1.000	5.1E-01	4.6E-02	1.2E+00	1.1E-02	1.2E+02	1	1	2.0E-02	9.5E-07		1.53E+00	2.47E+04	-	-	2.47E+04
Manganese	7439-96-5	Metal	100%	1.000	2.1E-01	2.9E-03	5.1E-01	1.0E-03	5.5E+01	0.04	1	2.4E-02		5.0E-05	7.33E-02	1.83E+04	-	-	1.83E+04
2-Methylphenol	95-48-7	SVOC	100%	1.000	4.2E-01	3.1E-02	1.0E+00	7.7E-03	1.1E+02	1	1	5.0E-02	1.2E-06	6.0E-01	3.82E+00	9.60E+04	-	-	9.60E+04
Styrene	100-42-5	SVOC	100%	1.000	4.0E-01	1.5E-01	9.7E-01	3.7E-02	1.0E+02	1	1	2.0E-01	2.8E-03	1.0E+00	1.53E+01	8.79E+04	1.46E+04	2646768.8	8.50E+04

Appendix E-5, Table E3
Final Remedial Goal Calculations
Resource Restoration - Industrial Non-Potable Water User, Non-Carcinogenic Calculations

			THQ =	1	Parameter Specific Data										Dermal Contact		Vapor Inhalation		Combined Dermal / Inhalation
															DA (ug/cm^2 * event)	Final RG (ug/L)	C_{air} (ug/m^3)	Final RG (ug/L)	Industrial Non-Potable Water User Final RG (ug/L)
Chemical	CAS	Parameter Group			Tevent (hr/event)	B (unitless)	t* (hr)	Kp (cm/hr)	MW (g/mol)	GIABS (unitless)	FA (unitless)	RfD (mg/kg*day)	HLC (atm*m3 / mole)	RfC (mg/m^3)	Noncancer	Noncancer	Noncancer	Noncancer	Noncancer
Toluene	108-88-3	VOC	100%	1.000	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	6.6E-03	5.0E+00	6.11E+00	4.31E+04	7.30E+04	13233844	4.30E+04
Xylenes	1330-20-7	VOC	100%	1.000	4.1E-01	2.0E-01	9.9E-01	5.0E-02	1.1E+02	1	1	2.0E-01	6.6E-03	1.0E-01	1.53E+01	6.71E+04	1.46E+03	264676.88	5.35E+04
Ocular																			
PCBs (total) ˜	1336-36-3	PCB	100%	1.0	7.1E+00	5.2E+00	3.1E+01	7.5E-01	3.3E+02	1	0.5	2.0E-05	2.8E-04		1.53E-03	2.76E-01	-	-	2.76E-01
Reproductive																			
Cyanide	57-12-5	CN	100%	1.0	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	1.0E-04	8.0E-04	4.58E-02	1.15E+04	1.17E+01	2117.4151	1.79E+03
Respiratory																			
Antimony	7440-36-0	Metal	100%	1.000	5.1E-01	4.2E-03	1.2E+00	1.0E-03	1.2E+02	0.15	1	4.0E-04		3.0E-04	4.58E-03	1.15E+03	-	-	1.15E+03
Chromium VI	18540-29-9	Metal	100%	1.000	2.1E-01	5.5E-03	4.9E-01	2.0E-03	5.2E+01	0.025	1	3.0E-03		1.0E-04	5.73E-03	7.16E+02	-	-	7.16E+02
Cobalt	7440-48-4	Metal	100%	1.000	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04		6.0E-06	2.29E-02	1.43E+04	-	-	1.43E+04
2-Methylnaphthalene	91-57-6	SVOC	100%	1.000	6.6E-01	4.2E-01	1.6E+00	9.2E-02	1.4E+02	1	1	4.0E-03	5.2E-04		3.05E-01	6.44E+02	-	-	6.44E+02
Naphthalene	91-20-3	SVOC	100%	1.000	5.5E-01	2.0E-01	1.3E+00	4.7E-02	1.3E+02	1	1	2.0E-02	4.4E-04	3.0E-03	1.53E+00	6.19E+03	4.38E+01	7940.3065	3.48E+03
Nickel	7440-02-0	Metal	100%	1.000	2.2E-01	5.9E-04	5.4E-01	2.0E-04	5.9E+01	0.04	1	2.0E-02		1.0E-05	6.11E-02	7.63E+04	-	-	7.63E+04
Vanadium	7440-62-2	Metal	100%	1.000	2.0E-01	2.7E-03	4.9E-01	1.0E-03	5.1E+01	0.026	1	5.0E-03		1.0E-04	1.00E-02	2.50E+03	-	-	2.50E+03
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1.000	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	4.8E-06	3.0E-02	2.29E+00	1.42E+06	-	-	1.42E+06
Thyroid																			
Cobalt	7440-48-4	Metal	100%	1.000	2.2E-01	1.2E-03	5.4E-01	4.0E-04	5.9E+01	1	1	3.0E-04		6.0E-06	2.29E-02	1.43E+04	-	-	1.43E+04
Cyanide	57-12-5	CN	100%	1.000	1.5E-01	2.0E-03	3.5E-01	1.0E-03	2.6E+01	1	0.01	6.0E-04	1.0E-04	8.0E-04	4.58E-02	1.15E+04	1.17E+01	2117.4151	1.79E+03
Urinary																			
Benzaldehyde	100-52-7	VOC	100%	1.000	4.1E-01	1.5E-02	9.9E-01	3.8E-03	1.1E+02	1	1	1.0E-01	2.7E-05		7.63E+00	3.84E+05	-	-	3.84E+05
1,1-Biphenyl	92-52-4	SVOC	100%	1.000	7.7E-01	4.5E-01	1.8E+00	9.4E-02	1.5E+02	1	1	5.0E-01	3.1E-04	4.0E-04	3.82E+01	7.02E+04	5.84E+00	1058.7075	1.04E+03
Fluoranthene	206-44-0	SVOC	100%	1.000	1.4E+00	1.7E+00	5.7E+00	3.1E-01	2.0E+02	1	1	4.0E-02	8.9E-06		3.05E+00	1.51E+03	-	-	1.51E+03
Pyrene	129-00-0	SVOC	100%	1.000	1.4E+00	1.1E+00	5.5E+00	2.0E-01	2.0E+02	1	1	3.0E-02	1.2E-05		2.29E+00	1.75E+03	-	-	1.75E+03
Toluene	108-88-3	VOC	100%	1.000	3.5E-01	1.1E-01	8.3E-01	3.1E-02	9.2E+01	1	1	8.0E-02	6.6E-03	5.0E+00	6.11E+00	4.31E+04	7.30E+04	13233844	4.30E+04
1,4-Dioxane	123-91-1	VOC/SVOC	100%	1.000	3.3E-01	1.2E-03	7.9E-01	3.3E-04	8.8E+01	1	1	3.0E-02	4.8E-06	3.0E-02	2.29E+00	1.42E+06	-	-	1.42E+06
Sources					EPA CS	EPA CS	EPA CS	EPA CS	EPA CS	RTAP RSL	RAGS	RTAP RSL	RAIS	RTAP RSL	CALC	CALC	CALC	CALC	CALC

Notes:
(a) PCBs (total) using Aroclor 1254 values

XX HLC < 1E-5 atm*m3/mol, therefore COPC does not meet criteria for volatility and vapor inhalation will not be assessed.

References:
EPA CS = EPA Chemical Specific Parameters Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAGSE = Risk Assessment Guidance for Superfund Volume I: Part E Exhibit B-3 (https://www.epa.gov/sites/production/files/2015-09/documents/part_e_final_revision_10-03-07.pdf)
RTAP RSL = EPA Resident Tapwater Table (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
RAIS = The Risk Assessment Information System (https://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chemspef)

APPENDIX E-6

Appendix E-6 - Historic Groundwater (2013 - 2016) Data Set Rationale
CPA Groundwater CMS

Sample Date	Client Sample ID	Existing?	Retain / Exclude	Rationale
12/13/2016	B18-007-PZ	No	Retain	B18 Phase II Sampling, no more recent results in vicinity
12/13/2016	B18-061-PZ	No	Retain	
12/14/2016	B18-070-PZ	No	Retain	
12/14/2016	B18-071-PZ	No	Retain	
12/14/2016	B18-072-PZ	No	Retain	
12/14/2016	B18-074-PZ	No	Retain	
12/14/2016	B18-075-PZ	No	Retain	
12/13/2016	B18-076-PZ	No	Retain	
6/10/2015	CO02-PZM006	Yes	Retain	Downgradient Cell 1 but minimal SVOC data in area
6/9/2015	CO02-PZM041	Yes	Retain	Downgradient Cell 1 but minimal SVOC data in area
6/10/2015	CO03-PZM005	No	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO04-PZM048	Yes	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO05-PZM006	No	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO07-PZM008	No	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO08-PZM005	No	Retain	Outside of Cells, minimal SVOC data in area.
6/11/2015	CO08-PZM036	No	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO09-PZM007	No	Retain	Outside of Cells, minimal SVOC data in area.
6/9/2015	CO101-PZM	Yes	Exclude	Cell 3 System Area, more recent (2020) data included
6/10/2015	CO102-PZM	Yes	Exclude	Cell 3 System Area, more recent (2020) data included
6/10/2015	CO103-PZM	Yes	Exclude	Cell 3 System Area, more recent (2020) data included
6/9/2015	CO104-PZM	Yes	Exclude	Cell 3 System Area, more recent (2020) data included
3/19/2014	CO107-PZM	No	Exclude	Within / adjacent to Cell 4 excavation.
6/11/2015	CO10-PZM006	No	Retain	Outside of Cells, minimal SVOC data in area.
9/29/2014	CO112-PZM	No	Exclude	Within / adjacent to Cell 4 excavation.
8/19/2013	CO113-PZM004	No	Exclude	Within / adjacent to Cell 4 excavation.
8/19/2013	CO114-PZM002	No	Exclude	Within / adjacent to Cell 4 excavation.
3/19/2014	CO118-PZM007	No	Exclude	Within / adjacent to Cell 4 excavation.
2/21/2013	CO120-PZM009	No	Exclude	Within / adjacent to Cell 4 excavation.
6/10/2015	CO121-PZM	Yes	Retain	Minimal SVOC data in area.
4/27/2015	CO126-WS14.3	No	Exclude	2015 sampling for vertical delineation at Cell 3. Cell 3 has now been operational for 9+ years and more current data is available.
4/28/2015	CO126-WS25	No	Exclude	
4/28/2015	CO126-WS35	No	Exclude	
4/28/2015	CO127-WS14	No	Exclude	
4/28/2015	CO127-WS25	No	Exclude	
4/28/2015	CO127-WS35	No	Exclude	
5/4/2015	CO128-W514.5	No	Exclude	
5/4/2015	CO128-W525	No	Exclude	
5/4/2015	CO128-W535	No	Exclude	
5/4/2015	CO129-W514.5	No	Exclude	
5/4/2015	CO129-W525	No	Exclude	
5/5/2015	CO129-W535	No	Exclude	
5/5/2015	CO130-W514.5	No	Exclude	
5/5/2015	CO130-W525	No	Exclude	
5/5/2015	CO130-W535	No	Exclude	
6/11/2015	CO13-PZM008	No	Exclude	Within / adjacent to Cell 4 excavation.
6/10/2015	CO13-PZM030	No	Exclude	Within / adjacent to Cell 4 excavation.
6/11/2015	CO15-PZM005	No	Retain	Minimal SVOC data in area.
6/11/2015	CO16-PZM006	Yes	Retain	Downgradient Cell 1 but minimal SVOC data in area

Appendix E-6 - Historic Groundwater (2013 - 2016) Data Set Rationale
CPA Groundwater CMS

Sample Date	Client Sample ID	Existing?	Retain / Exclude	Rationale
6/9/2015	CO18-PZM006	Yes	Retain	Cell 1 area but minimal SVOC data in area
6/10/2015	CO19-PZM004	Yes	Retain	Cell 6 area but minimal SVOC data in area.
6/10/2015	CO20-PZM004	No	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO23-PZM008	Yes	Retain	Outside of Cells, minimal SVOC data in area.
9/23/2015	CO23-PZM046	N/A	Exclude	REMOVE - mislabeled
6/10/2015	CO24-PZM007	Yes	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO25-PZM008	Yes	Exclude	Cell 4 excavation area, regularly sampled for BTEX+N with 2023 and 2024 results included
6/10/2015	CO26-PZM007	Yes	Retain	Downgradient of Cell 4/5, minimal SVOC data in area
6/10/2015	CO26-PZM032	Yes	Retain	Downgradient of Cell 4/5, minimal SVOC data in area
6/8/2015	CO27-PZM012	Yes	Exclude	Cell 2 System Area, regularly sampled for BTEX+N with 2023 and 2024 results included
6/8/2015	CO27-PZM046	Yes	Exclude	Cell 2 System Area, regularly sampled for BTEX+N with 2023 and 2024 results included
6/9/2015	CO28-PZM010	Yes	Retain	NW shoreline, minimal SVOC data in area
6/9/2015	CO28-PZM048	Yes	Retain	NW shoreline, minimal SVOC data in area
6/10/2015	CO29-PZM010	Yes	Retain	Outside of Cells, minimal SVOC data in area.
6/9/2015	CO29-PZM051	Yes	Retain	Outside of Cells, minimal SVOC data in area.
6/9/2015	CO30-PZM015	Yes	Exclude	Exclude all 2015 results, more recent 2024 and 2025 results included
6/9/2015	CO30-PZM060	Yes	Exclude	Exclude all 2015 results, more recent 2024 and 2025 results included
6/11/2015	CO32-PZM004	Yes	Retain	Outside of Cells, minimal SVOC data in area.
6/9/2015	CO32-PZM041	Yes	Retain	Outside of Cells, minimal SVOC data in area.
6/10/2015	CO34-PZM048	Yes	Retain	Minimal SVOC data in area.
6/11/2015	CO35-PZM013	Yes	Retain	Minimal SVOC data in area.
6/11/2015	CO35-PZM056	Yes	Retain	Minimal SVOC data in area.
6/8/2015	CO36-PZM008	Yes	Exclude	Cell 2 System Area, more recent 2023 BTEX+N results included
6/8/2015	CO36-PZM043	Yes	Exclude	Cell 2 System Area, more recent 2023 BTEX+N results included
6/11/2015	CO37-PZM038	Yes	Exclude	Cell 2 System Area, more recent 2023 and 2024 BTEX+N results included
6/8/2015	CO38-PZM006	Yes	Exclude	Cell 2 System Area, more recent 2023 BTEX+N results included
6/8/2015	CO38-PZM043	Yes	Exclude	Cell 2 System Area, more recent 2023 BTEX+N results included
6/8/2015	CO39-PZM007	Yes	Exclude	Cell 2 System Area, more recent 2023 BTEX+N results included
6/8/2015	CO39-PZM042	Yes	Exclude	Cell 2 System Area, more recent 2023 BTEX+N results included
6/9/2015	CO40-PZM008	Yes	Exclude	Cell 2 System Area, more recent 2023 BTEX+N results included
6/9/2015	CO41-PZM001	Yes	Retain	Minimal SVOC data in area.
6/9/2015	CO41-PZM036	Yes	Retain	Minimal SVOC data in area.
6/9/2015	CO42-PZM004	Yes	Retain	Minimal SVOC data in area.
6/11/2015	CO56-PZP001	Yes	Exclude	Cell 4 Excavation Area, more recent 2023 and 2024 BTEX+N results included

Appendix E-6 - Historic Groundwater (2013 - 2016) Data Set Rationale
CPA Groundwater CMS

Sample Date	Client Sample ID	Existing?	Retain / Exclude	Rationale
6/10/2015	CO57-PZP002	Yes	Retain	Minimal SVOC data in area.
6/10/2015	CO58-PZM001	Yes	Exclude	Exclude all 2015 results, more recent 2024 and 2025 results included
6/10/2015	CO59-PZP002	Yes	Retain	Minimal SVOC data in area.
6/10/2015	CO60-PZP001	Yes	Exclude	Adjacent well (CO203-MWS is approx 120 ft to northeast) sampled in Feb 2025
6/9/2015	CO79-PZM	Yes	Retain	Cell 1 area but minimal SVOC data in area
6/9/2015	CO88-PZM	Yes	Retain	Downgradient Cell 1 but minimal SVOC data in area
6/9/2015	CO93-PZM	Yes	Retain	Cell 6 area but minimal SVOC data in area
2/1/2016	SW-030-MWS	Yes	Retain	Outside of Cells, minimal data in area.
3/28/2016	SW13-PZM003	Yes	Retain	Outside of Cells, minimal data in area.
2/19/2016	SW13-PZM025	Unsure	Retain	Outside of Cells, minimal data in area.
12/9/2015	SW13-PZM111	Yes	Retain	Outside of Cells, minimal data in area.
3/31/2016	SW14-PZM004	No	Retain	Outside of Cells, minimal data in area.
6/11/2015	TS06-PPM008	Unsure	Retain	Outside of Cells, minimal SVOC data in area.

B18-070-PZ 12/14/2016
B18-071-PZ 12/14/2016
B18-072-PZ 12/14/2016
SW-030-MWS 2/1/2016
SW13-PZM025 2/19/2016
SW13-PZM111 12/9/2015
SW13-PZM003 3/28/2016
SW14-PZM004 3/31/2016
B18-061-PZ 12/13/2016
B18-074-PZ 12/14/2016
B18-076-PZ 12/13/2016
B18-007-PZ 12/13/2016
B18-075-PZ 12/14/2016
CO36-PZM043 6/8/2015
CO27-PZM046 6/8/2015
CO27-PZM012 6/8/2015
CO37-PZM038 6/11/2015
CO121-PZM 6/10/2015
CO36-PZM008 6/8/2015
CO39-PZM042 6/8/2015
CO39-PZM007 6/8/2015
CO42-PZM004 6/9/2015
CO38-PZM006 6/8/2015
CO40-PZM008 6/9/2015
CO38-PZM043 6/8/2015
CO03-PZM005 6/10/2015
CO28-PZM010 6/9/2015
CO41-PZM001 6/9/2015
CO28-PZM048 6/9/2015
CO41-PZM036 6/9/2015
CO15-PZM005 6/11/2015
CO79-PZM 6/9/2015
CO18-PZM006 6/9/2015
CO02-PZM041 6/9/2015
CO02-PZM006 6/10/2015
CO93-PZM 6/9/2015
CO19-PZM004 6/10/2015
CO04-PZM048 6/10/2015
CO05-PZM006 6/10/2015
CO20-PZM004 6/10/2015
CO10-PZM006 6/11/2015
CO09-PZM007 6/10/2015
CO16-PZM006 6/11/2015
CO08-PZM005 6/10/2015
CO07-PZM008 6/10/2015
CO08-PZM036 6/11/2015
CO24-PZM007 6/10/2015
CO29-PZM010 6/10/2015
CO29-PZM051 6/9/2015
CO130-W525 5/5/2015
CO130-W514.5 5/5/2015
CO129-W514.5 5/4/2015
CO129-W535 5/5/2015
CO130-W535 5/5/2015
CO34-PZM048 6/10/2015
CO60-PZP001 6/10/2015
CO126-WS25 4/28/2015
CO126-WS14.3 4/27/2015
CO103-PZM 6/10/2015
CO129-W525 5/4/2015
CO102-PZM 6/10/2015
CO23-PZM046 9/23/2015
CO23-PZM008 6/10/2015
CO25-PZM008 6/10/2015
CO104-PZM 6/9/2015
CO128-W514.5 5/4/2015
CO101-PZM 6/9/2015
CO56-PZP001 6/11/2015
CO26-PZM032 6/10/2015
CO26-PZM007 6/10/2015
CO13-PZM030 6/10/2015
CO13-PZM008 6/11/2015
CO113-PZM004 8/19/2013
CO107-PZM 3/19/2014
CO118-PZM007 3/19/2014
CO114-PZM002 8/19/2013
CO112-PZM 9/29/2014
CO120-PZM009 2/21/2013
CO59-PZP002 6/10/2015
CO58-PZM001 6/10/2015
CO127-WS25 4/28/2015
CO127-WS14 4/28/2015
CO30-PZM015 6/9/2015
CO32-PZM041 6/9/2015
CO32-PZM004 6/11/2015
TS06-PPM008 6/11/2015
CO57-PZP002 6/10/2015
CO35-PZM013 6/11/2015
CO35-PZM056 6/11/2015

LEGEND

Appendix E-7 - CPA CMS

- Excluded in Database
- Retained in Database
- Former COA IM Cell
- CPA-CMS-GAAs

Note: Historic groundwater data (2013-2016) was evaluated in Appendix E-7 to determine if it should be retained or excluded from the database. Retained data is generally from areas with minimal recent data. Excluded data is generally from within active remediation cells and / or more recent results are available.

Coke Point Area CMS
Historic Groundwater Data Set Rationale
June 11, 2025

Figure E-6

ARM Group LLC
Engineers and Scientists

0 95 190 380 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

E:\Projects\Coke Point\GIS\MXD\Historic GW Data Rationale\CPA CMS GW Data Rationale.mxd

APPENDIX E-7

Appendix E-7, Table A1
Soil Screening Level Calculations
Sitewide, CPA CMS

Chemical	CAS	Parameter Group	CPA CMS Final Remedial Goal - Sitewide (ug/L)	K_d (L/kg)	K_d Ref	H` (unitless)	K_{oc} (L/kg)	K_{oc} Ref	Kd	Cwater (mg/L)	Calculated SSL (mg/kg)
Arsenic	7440-38-2	Metal	40	2.9E+01	SSL				2.9E+01	4.00E-02	1.168
1,1-Biphenyl	92-52-4	SVOC	100			1.3E-02	5.1E+03	EPI	1.03E+01	1.00E-01	1.046
2-Methylnaphthalene	91-57-6	SVOC	400			2.1E-02	2.5E+03	EPI	4.96E+00	4.00E-01	2.063
Benz[a]anthracene	56-55-3	SVOC	1.0			4.9E-04	1.8E+05	EPI	3.54E+02	1.00E-03	0.354
Benzo[a]pyrene	50-32-8	SVOC	0.16			1.9E-05	5.9E+05	EPI	1.17E+03	1.60E-04	0.188
Benzo[b]fluoranthene	205-99-2	SVOC	1.0			2.7E-05	6.0E+05	EPI	1.20E+03	1.00E-03	1.199
bis(2-Ethylhexyl)phthalate	117-81-7	SVOC	1.0			1.1E-05	1.2E+05	EPI	2.39E+02	1.00E-03	0.239
Dibenz[a,h]anthracene	53-70-3	SVOC	0.16			5.8E-06	1.9E+06	EPI	3.82E+03	1.60E-04	0.612
Indeno[1,2,3-c,d]pyrene	193-39-5	SVOC	1.0			1.4E-05	2.0E+06	EPI	3.90E+03	1.00E-03	3.902
Naphthalene	91-20-3	SVOC	115			1.8E-02	1.5E+03	EPI	3.09E+00	1.15E-01	0.378
Benzene	71-43-2	VOC	100			2.3E-01	1.5E+02	EPI	2.92E-01	1.00E-01	0.051
Ethylbenzene	100-41-4	VOC	100			3.2E-01	4.5E+02	EPI	8.92E-01	1.00E-01	0.112
Toluene	108-88-3	VOC	10000			2.7E-01	2.3E+02	EPI	4.68E-01	1.00E+01	6.920
Xylenes	1330-20-7	VOC	1000			2.7E-01	3.8E+02	EPI	7.66E-01	1.00E+00	0.990

DAF	Dilution attenuation factor (unitless)	1
θ_w	water-filled soil porosity (L_{water}/L_{soil})	0.3
θ_a	air-filled soil porosity (L_{air}/L_{soil})	0.133962264
n	total soil porosity(L_{pore}/L_{soil})	0.433962264
ρ_s	soil particle density (kg/L)	2.65
ρ_b	dry soil bulk density (kg/L)	1.5
H'	Dimensionless Henry Law Constant (unitless)	Contaminant-specific
K_d	soil-water partition coefficient (L/kg)	= $K_{oc} \times f_{oc}$ for organics
K_{oc}	soil organic carbon/water partition coefficient (L/kg)	Contaminant-specific
f_{oc}	fraction organic carbon in soil (g/g)	0.002

The below USEPA equations are used to calculate the SSLs based on the previously calculated Final RGs.

$$SSL\left(\frac{mg}{kg}\right) = C_{water} * \left[K_d + \frac{(\theta_w + \theta_a) * H'}{\rho_b}\right]$$

Where:

$$C_{water} = Groundwater\ Target\ Value * DAF$$

$$\theta_a = n - \theta_w$$

$$n = 1 - \left(\frac{\rho_b}{\rho_s}\right)$$

Appendix E-7, Table A2
Soil Screening Level Calculations
Shoreline, CPA CMS

Chemical	CAS	Parameter Group	CPA CMS Final Remedial Goal - Shoreline (ug/L)	K_d (L/kg)	K_d Ref	H` (unitless)	K_{oc} (L/kg)	K_{oc} Ref	Kd	Cwater (mg/L)	Calculated SSL (mg/kg)
Iron	7439-89-6	Metal	22,500	2.5E+01	BAES				2.50E+01	2.25E+01	567
Benzo[a]pyrene	50-32-8	SVOC	0.16			1.9E-05	5.9E+05	EPI	1.17E+03	1.60E-04	0.19
Dibenz[a,h]anthracene	53-70-3	SVOC	0.16			5.8E-06	1.9E+06	EPI	3.82E+03	1.60E-04	0.61
Pyrene	129-00-0	SVOC	13.3			4.9E-04	5.4E+04	EPI	1.09E+02	1.33E-02	1.4481
Toluene	108-88-3	VOC	735			2.7E-01	2.3E+02	EPI	4.68E-01	7.35E-01	0.51

DAF	Dilution attenuation factor (unitless)	1
θ_w	water-filled soil porosity (L_{water}/L_{soil})	0.3
θ_a	air-filled soil porosity (L_{air}/L_{soil})	0.133962264
n	total soil porosity(L_{pore}/L_{soil})	0.433962264
ρ_s	soil particle density (kg/L)	2.65
ρ_b	dry soil bulk density (kg/L)	1.5
H'	Dimensionless Henry Law Constant (unitless)	Contaminant-specific
K_d	soil-water partition coefficient (L/kg)	= $K_{oc} \times f_{oc}$ for organics
K_{oc}	soil organic carbon/water partition coefficient (L/kg)	Contaminant-specific
f_{oc}	fraction organic carbon in soil (g/g)	0.002

The below USEPA equations are used to calculate the SSLs based on the previously calculated Final RGs.

$$SSL\left(\frac{mg}{kg}\right) = C_{water} * \left[K_d + \frac{(\theta_w + \theta_a) * H'}{\rho_b}\right]$$

Where:

$$C_{water} = Groundwater\ Target\ Value * DAF$$

$$\theta_a = n - \theta_w$$

$$n = 1 - \left(\frac{\rho_b}{\rho_s}\right)$$

APPENDIX F

APPENDIX F-1

ARM Group LLC
Engineers and Scientists

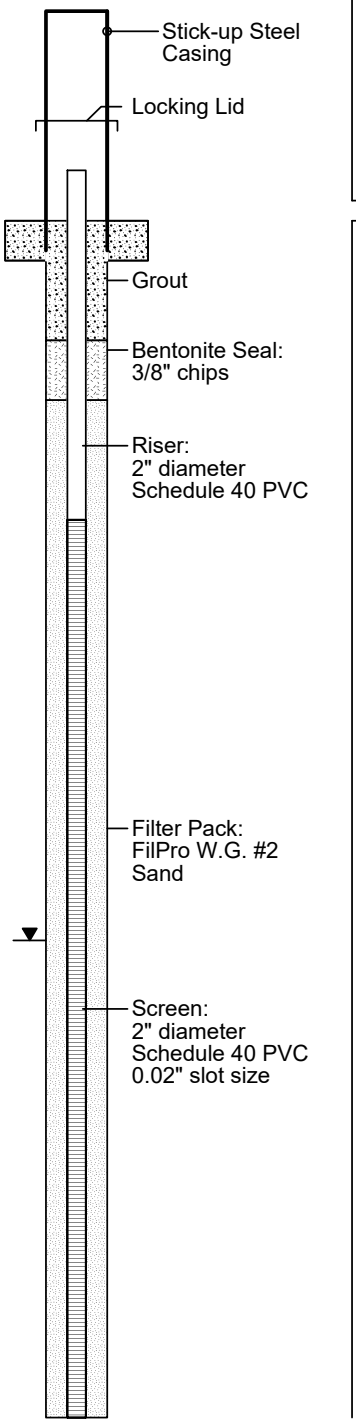
Well ID: B18-070R-PZ

(page 1 of 2)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM, Connely
Driller	: Jim, Kevin S.
Drilling Equipment	: Sonic Rig

Northing (ft)	: 563,850
Easting (ft)	: 1,458,070
Date/Time Completed	: 11/1/2024, 11/13/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 43" ags
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0hr: 11.36' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0–5	100	4.3, 0.7, 0.4, 4.9, 1.6	(0-5') FILL Dark brown to red brown SANDY GRAVEL SLAG with silt, no plasticity, no cohesion, loose (DRY)	Large metal piece observed at 4-5'
5–6		0.0	(5-6') No recovery	
6–10	80	0.0, 0.0, 0.0, -	(6-10') FILL Dark brown to red brown SANDY GRAVEL SLAG with silt, no plasticity, no cohesion, loose, intermittent 2" layers of brick (2) and concrete (1) (DRY)	Large metal piece observed at 6-7'
10–11		-	(10-11') No recovery	
11–15	80	-, -, -, -	(11-15') FILL Brown GRAVEL SLAG with sand, no plasticity, no cohesion, possible brick fragments observed, loose (WET)	Wet at 11.36' bgs Wet due to drillers adding water or potential perched water table, initial bore log recorded wet at 7.5' bge
15–20	100	1.2, 1.0, 0.8, 1.2	(15-20') FILL Gray CONCRETE, silt to gravel size fragments, loose (DRY)	



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 3-2' bgs
Filter pack: 5-3' bgs
Well riser: 1' abs - 3' bgs
Grout: 2-0' bgs
Well screen: 5-20' bgs

ARM Group LLC
Engineers and Scientists

Well ID: B18-070R-PZ

(page 2 of 2)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM, Connely
Driller	: Jim, Kevin S.
Drilling Equipment	: Sonic Rig

Northing (ft)	: 563,850
Easting (ft)	: 1,458,070
Date/Time Completed	: 11/1/2024, 11/13/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 43" ags
Total Well Depth (ft)	: 25' bgs
Depth to Water (ft)	: 0hr: 11.36' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20		1.4	(20-25') No recovery	
25			END of boring	

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 3-2' bgs
Filter pack: 5-3' bgs
Well riser: 1' abs - 3' bgs
Grout: 2-0' bgs
Well screen: 5-20' bgs

ARM Group LLC
Engineers and Scientists

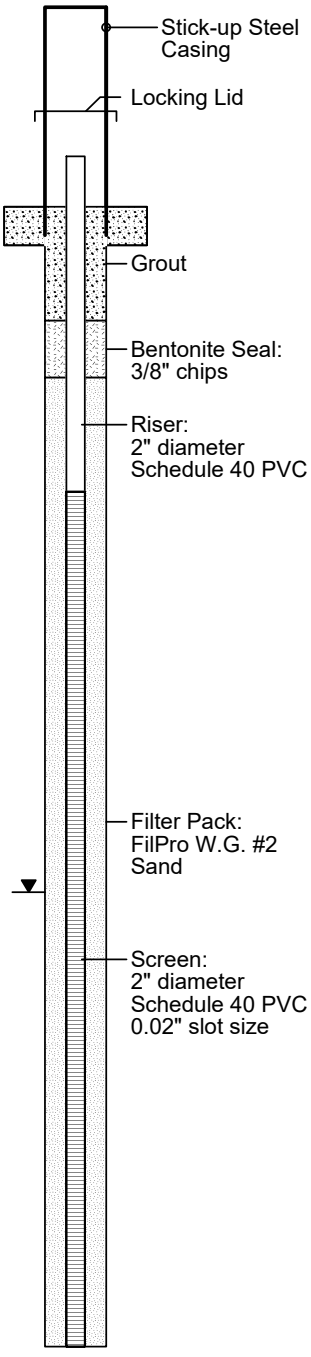
Well ID: COA-012-MWS

(page 1 of 1)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: Connelley
Driller	: Kevin
Drilling Equipment	: Sonic Rig

Northing (ft)	: 562,990
Easting (ft)	: 1,455,641
Date/Time Completed	: 11/14/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 23" ags
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0hr: 12.62' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0		1.4	(0-5') FILL Black SILITY-SANDY SLAG with minor clay and gravel, moderate cohesion, no plasticity, brick pieces and product observed (WET)	*No % recovery* Strong petroleum odor
1		1.3		
2		3.8		
3		4.4		
4		5.3		
5		8.0	(5-7') FILL Blue-gray SILTY-GRAVEL SLAG with sand, no plasticity, no cohesion, loose, possible concrete chunks (DRY)	
6		23.4		
7		36.6	(7-10') FILL Gray-blue GRAVEL SLAG with sand, no plasticity, no cohesion, loose, product observed (WET)	Strong petroleum odor
8		8.0		
9		9.1		
10		23.4	(10-18') FILL Blue-gray SANDY GRAVEL SLAG with minor silt, loose, product observed (WET)	Wet at 10' bgs
11		29.5		
12		38.8		
13		55.4		
14		114.4		
15		142.0		
16		374.1		
17		107.0		
18		331.8	(18-20') FILL Blue to blue/green SANDY SLAG with some gravel well sorted, no plasticity, no cohesion, loose (WET)	
19		41.9		
20			END fof boring	
21				



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 2 - 3' bgs
Filter pack: 3 - 5' bgs
Well riser: 1' abs - 5' bgs
Grout: 0 - 2' bgs
Well screen: 5 - 20' bgs

ARM Group LLC
Engineers and Scientists

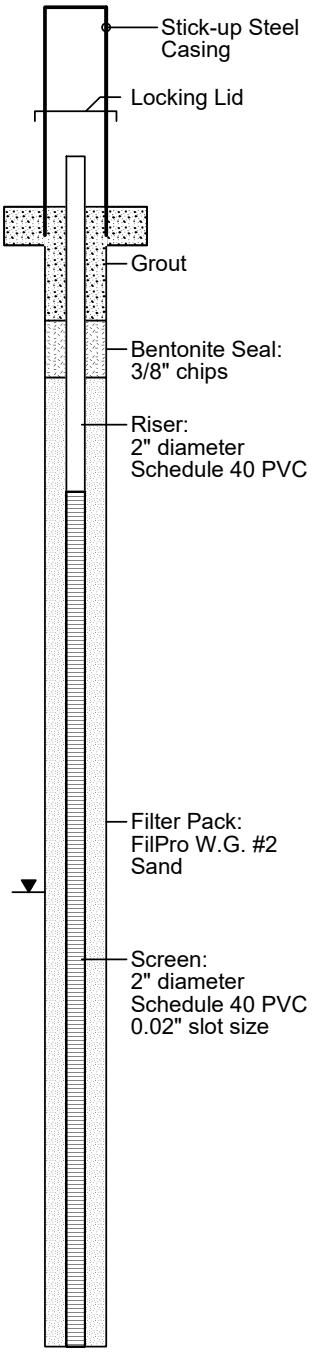
Well ID: COA-013-MWS

(page 1 of 1)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: Connelley
Driller	: Kevin
Drilling Equipment	: Sonic Rig

Northing (ft)	: 562,857
Easting (ft)	: 1,455,731
Date/Time Completed	: 11/14/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 15" ags
Total Well Depth (ft)	: 20' bgs
Depth to Water (ft)	: 0hr: 13.01' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0–5	100	2.0, 8.9, 3.0, 1.9, -	(0-5') FILL Black SILITY-SANDY SLAG with minor clay and gravel, moderate cohesion, no plasticity, brick pieces and product observed (WET)	*No % recovery* Strong petroleum odor
5–7	80	15.2, 43.5	(5-7') FILL Blue-gray SILTY-GRAVEL SLAG with sand, no plasticity, no cohesion, loose, possible concrete chunks (DRY)	
7–10	80	20.2, 253.1, 344.8	(7-10') FILL Gray-blue GRAVEL SLAG with sand, no plasticity, no cohesion, loose, product observed (WET)	Strong petroleum odor
10–15	100	-, -, 92.2, 336.6, 114.8	(10-18') FILL Blue-gray SANDY GRAVEL SLAG with minor silt, loose, product observed (WET)	Wet at 10' bgs
15–18	100	391.1, 106.7, 589.7		
18–20	100	105.6, 760.4	(18-20') FILL Blue to blue/green SANDY SLAG with some gravel well sorted, no plasticity, no cohesion, loose (WET)	
20			END fof boring	



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 2 - 3' bgs
Filter pack: 3 - 5' bgs
Well riser: 1' abs - 5' bgs
Grout: 0 - 2' bgs
Well screen: 5 - 20' bgs

ARM Group LLC
Engineers and Scientists

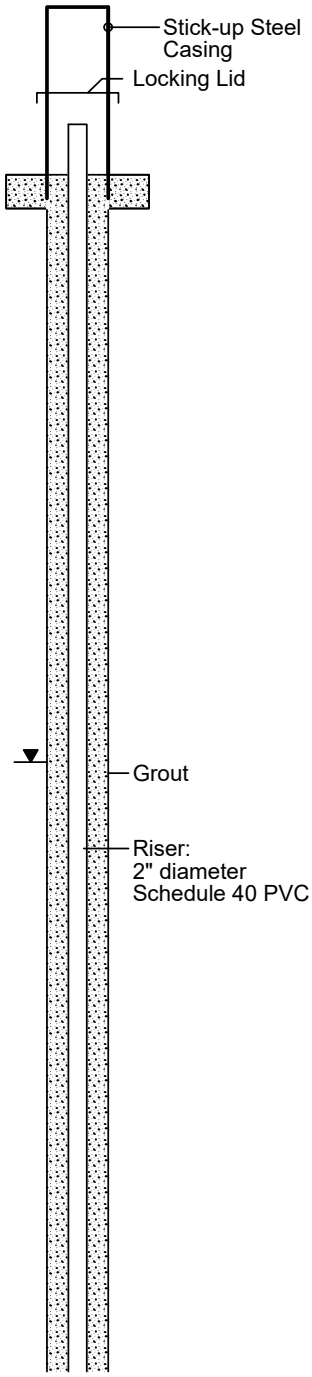
Well ID: COA-MWI-004

(page 1 of 2)

Project Name	: CT- Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: L. Parker G.I.T.
Checked by	: S. Lowe G.I.T.
Drilling Company	: Connelly
Driller	: Jarred
Drilling Equipment	: Sonic Rig

Northing (ft)	: 562090.82
Easting (ft)	: 1456251.72
Date/Time Completed	: 1/31/2024
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
PVC Stick-up (ft)	: 2.97' ags
Total Well Depth (ft)	: 41.92' TOC
Depth to Water (ft)	: 0 hr: 15.27' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0–5	75	10, 79.5, 158, 255	(0-4') FILL Brown GRAVEL SLAG with SAND and SILT, alternating dense and loose intervals, no plasticity, no cohesion (DAMP)	
4–5		-	(4-11.2') No Recovery	
5–10	0	- - - - - -		
10–15	90	78.8, 115, 296, 37.1, 73.5	(11.2-12') FILL Brown to light brown GRAVEL SLAG, with SILT and some SAND, moderately dense, no plasticity, no cohesion (WET) (12-16.5') FILL Brown to black GRAVEL SLAG, with SILT and SAND, loose, no plasticity, no cohesion (WET)	Wet at 11' bgs. Strong petroleum odor at 12' bgs. Strong petroleum odor from 15-20' bgs.
15–20	85	187, 1835, 907, 1496, 2452	(16.5-18') FILL Black SILTY SAND SLAG, with trace GRAVEL, loose, no plasticity, no cohesion (WET) (18-20') FILL Blue to gray-blue GRAVEL SLAG, with some SILTY SAND, loose, no plasticity, no cohesion (WET)	
20–25	0	- - - - -	(20-27.3') No Recovery	



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 27-29' bgs
Filter pack: 29-42' bgs
Well riser: 3' ags to 29' bgs
Well screen: 32-42' bgs
Grout: 0-27' bgs

ARM Group LLC
Engineers and Scientists

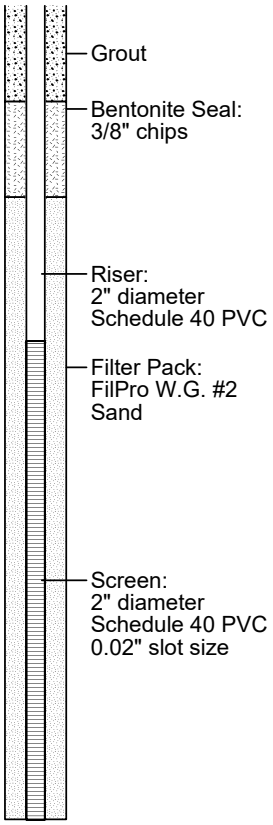
Well ID: COA-MWI-004

(page 2 of 2)

Project Name	: CT- Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: L. Parker G.I.T.
Checked by	: S. Lowe G.I.T.
Drilling Company	: Connelly
Driller	: Jarred
Drilling Equipment	: Sonic Rig

Northing (ft)	: 562090.82
Easting (ft)	: 1456251.72
Date/Time Completed	: 1/31/2024
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
PVC Stick-up (ft)	: 2.97' ags
Total Well Depth (ft)	: 41.92' TOC
Depth to Water (ft)	: 0 hr: 15.27' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION
25		1.6	
26		-	
27	55	22.7	(27.3-30') FILL Gray to gray-brown SILTY SAND SLAG, with GRAVEL, dense, no plasticity, no cohesion (WET)
28		-	
29		644.9	
30		18.0	(30-33') No Recovery
31		-	
32	50	-	
33		88.6	(33-38.7') FILL Blue-gray SILTY SAND, lenses of SILT, loose, no plasticity, no cohesion (WET)
34		237	
35		124	
36		69.3	
37	45	43.8	
38		63.5	
39		113.5	(38.7-40') NATIVE Very light brown gray SILT and very fine SAND, trace lenses of SILT throughout, dense, no plasticity, no cohesion (WET)
40		29.8	
41		-	(40-43') No Recovery
42	45	-	
43		13.6	(43-50') NATIVE Very light brown SAND, with some SILT, loose, no plasticity, no cohesion (WET)
44		9.7	
45		20.6	
46		6.5	
47	95	0.6	
48		0.4	
49		0.6	
50			



REMARKS

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Bentonite seal: 27-29' bgs
Filter pack: 29-42' bgs
Well riser: 3' ags to 29' bgs
Well screen: 32-42' bgs
Grout: 0-27' bgs

ARM Group LLC
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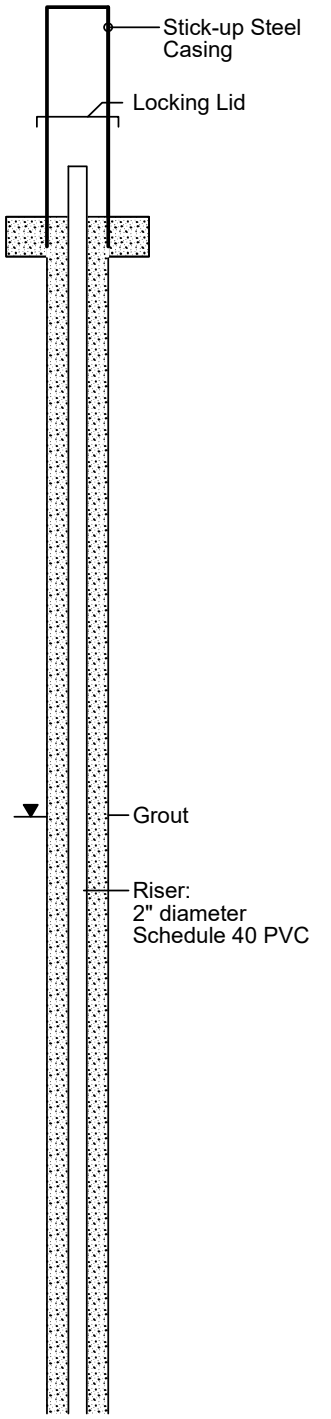
Well ID: COA-MWI-006

(page 1 of 3)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T., T. Palank G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 562,868
Easting (ft)	: 1,455,444
Date/Time Completed	: 10/29/2024 & 11/6/2024
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
PVC Stick-up (ft)	: 3.54 ags
Total Well Depth (ft)	: 45' bgs
Depth to Water (ft)	:
Borehole Diameter (in.):	6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0		-	(0-5') NOT SAMPLED	Blow Counts: 4 8 9 10
1		-		
2		-		
3		-		
4		-		
5		0.8	(5-7') FILL Black to light brown SILTY GRAVEL SLAG with minor sand, no plasticity, no cohesion, loose (DRY)	Minor benzene odor observed.
6		2.4		
7		4.8	(7-10') NOT SAMPLED	
8		-		
9		-		
10		5.4	(10-12') FILL Black, low density SANDY GRAVEL SLAG with minor silt, no plasticity, no cohesion (WET)	Wet at 10' bgs. Blow Counts: 6 4 5 6 Strong petroleum odor observed.
11		6.6		
12		4.8	(12-15') NOT SAMPLED	
13		-		
14		-		
15		2.6	(15-16') FILL Black, low density SANDY GRAVEL SLAG with minor silt, no plasticity, no cohesion (WET)	Blow Counts: 20 24 10 9 Drilling stopped due to high PID readings and resumes on 11/6/2024
16	50	52.9	(16-17') FILL Black firm SANDY GRAVEL SLAG with trace silt, loose (WET)	
17		1227		
18		-	(17-20') NOT SAMPLED	
19				
20				



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Bentonite seal: 23-21' bgs
Filter pack: 45-23' bgs
Well riser: 3' ags-25' bgs
Grout: 0-21' bgs
Well screen: 25-45' bgs

ARM Group LLC
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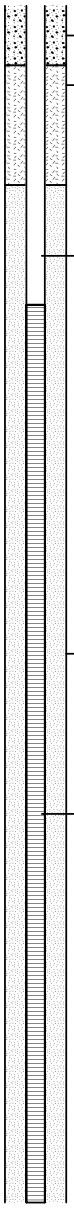
Well ID: COA-MWI-006

(page 2 of 3)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T., T. Palank G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 562,868
Easting (ft)	: 1,455,444
Date/Time Completed	: 10/29/2024 & 11/6/2024
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
PVC Stick-up (ft)	: 3.54 ags
Total Well Depth (ft)	: 45' bgs
Depth to Water (ft)	:
Borehole Diameter (in.):	6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20				
21	100	759.3	(20-21.5') NATIVE Black SILTY SAND, soft, no plasticity, no cohesion (WET)	
22		268.1	(21.5-22') NATIVE Black CLAY with SILT, moderate cohesion, moderate plasticity (WET)	
23		104.4	(22-25') NOT SAMPLED	
24		-		
25		-		
26	92	5.4	(25-27') NATIVE Red and light brown CLAY, high cohesion, moderate plasticity, very hard (WET)	
27		6.2		
28		75.7	(27-30') NOT SAMPLED	
29		-		
30		-		
31	75	4.5	(30-30.5') NATIVE Red and light brown CLAY, high cohesion, moderate plasticity, extremely hard (WET)	
32		7.5	(30.5-32') NATIVE Gray SAND, no plasticity, no cohesion (WET)	
33		12.0	(32-35') NOT SAMPLED	
34		-		
35		-		
36	83	16.5	(35-36.5') NATIVE Light brown SAND, no plasticity, no cohesion (WET)	
37		22.0	(36.5-37) NATIVE Gray, blue, light brown SAND, no plasticity, no cohesion (WET)	
38		14.0	(37-40') NOT SAMPLED	
39		-		
40		-		



TOC - Top of PVC Casing
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bgs - below ground surface

Bentonite seal: 23-21' bgs
Filter pack: 45-23' bgs
Well riser: 3' ags-25' bgs
Grout: 0-21' bgs
Well screen: 25-45' bgs

ARM Group LLC
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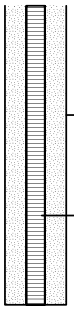
Well ID: COA-MWI-006

(page 3 of 3)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T., T. Palank G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 562,868
Easting (ft)	: 1,455,444
Date/Time Completed	: 10/29/2024 & 11/6/2024
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
PVC Stick-up (ft)	: 3.54 ags
Total Well Depth (ft)	: 45' bgs
Depth to Water (ft)	:
Borehole Diameter (in.):	6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
40				
41	50	7.8	(40-41') NATIVE Gray, blue, light brown SAND, no plasticity, no cohesion (WET)	
		10.9		
42			(41-42') NATIVE Light brown to brown SAND, no plasticity, no cohesion, fully saturated (WET)	
		9.1		
43			(42-43') NOT SAMPLED	
	100	6.1	(43-45') NATIVE Light brown to brown SAND, no plasticity, no cohesion, fully saturated (WET)	
44		4.3		
		9.3		
45			END OF BORING	
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 23-21' bgs
Filter pack: 45-23' bgs
Well riser: 3' ags-25' bgs
Grout: 0-21' bgs
Well screen: 25-45' bgs

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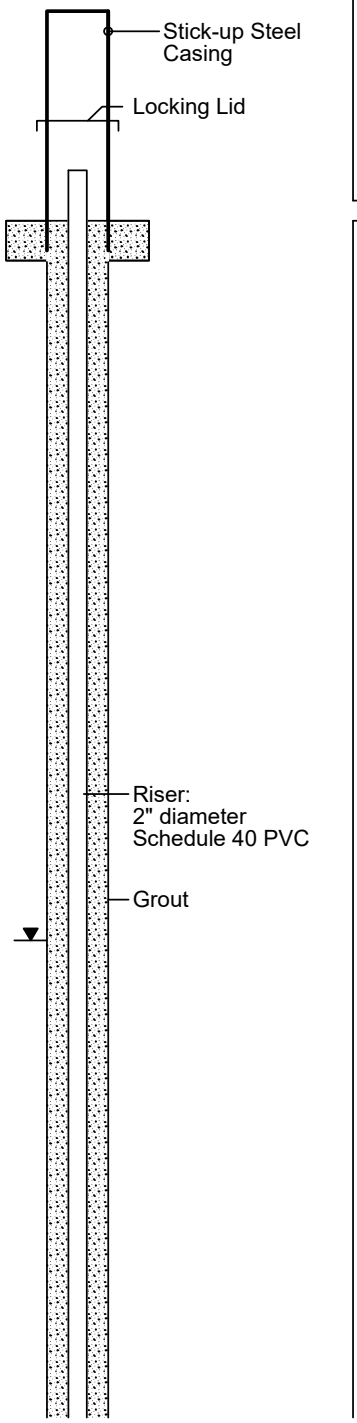
Well ID: COA-MWI-007

(page 1 of 3)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 563,300
Easting (ft)	: 1,455,522
Date/Time Completed	: 10/29/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 42.5" ags
Total Well Depth (ft)	: 47' bgs
Depth to Water (ft)	: 0hr: 10' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0–5		-	(0-5') Not Sampled	50/5
5–7	30	-	(5-7') FILL Brown SILTY-SANDY SLAG with minor gravel, no plasticity, no cohesion, loose, one large piece of slag (WET)	
7–10		-	(7-10') Not Sampled	
10–11	85	-	(10-10.5') FILL Dark brown with black SILTY GRAVEL SLAG, low cohesion, no plasticity, loose (WET)	15 19 18 23 Wet at 10' bgs
10.5–12		-	(10.5-12') FILL Black and white intermittent SANDY GRAVEL SLAG, no plasticity, no cohesion, loose (WET)	Hit refusal at 12' bgs, shifted west
12–15		-	(12-15') Not Sampled	
15–16	75	0.1	(15-17') FILL Blue gray with black SANDY GRAVEL SLAG with minor silt, moderately sorted, no plasticity, no cohesion (WET)	11 7 23 32
16–17		0.2		
17–18		0.1	(17-20') Not sampled	
18–20		-		



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 30-28' bgs
Filter pack: 30-32' bgs
Well riser: 1' abs - 32' bgs
Grout: 0 - 28' bgs
Well screen: 32-42' bgs

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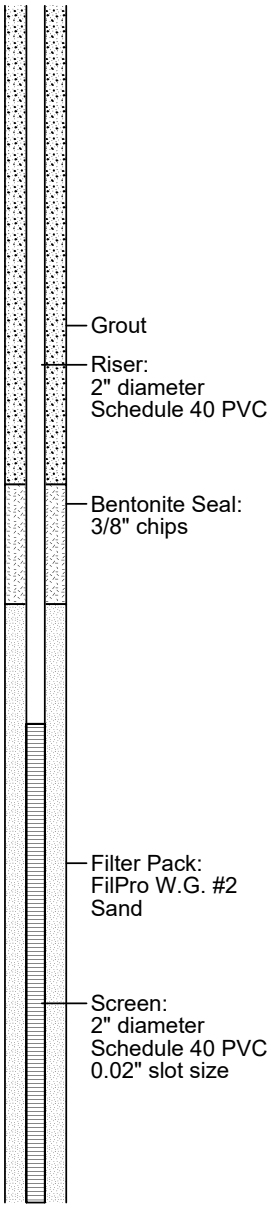
Well ID: COA-MWI-007

(page 2 of 3)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 563,300
Easting (ft)	: 1,455,522
Date/Time Completed	: 10/29/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 42.5" ags
Total Well Depth (ft)	: 47' bgs
Depth to Water (ft)	: 0hr: 10' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20				
21	55	0.2	(20-22') FILL Dark gray to black SILTY-SANDY GRAVEL SLAG with minor shells present near bottom, no plasticity, no cohesion (WET)	19 26 37 22
22		0.2		
23		0.2	(22-25') Not Sampled	
24		-		
25		-		
26	75	0.1	(25-26') NATIVE Brown to dark brown SILTY CLAY, low plasticity, moderate cohesion, firm (WET)	25 50/6
27		0.2	(26-27') NATIVE Light brown SILTY SAND, welll sorted, no plasticity, no cohesion (WET)	
28		0.2	(27-30') Not sampled	
29		-		
30		-		
31	100	0.4	(30-32') NATIVE Light brown to brown SAND with silt, well sorted, no plasticity, no cohesion, loose (WET)	16 31 34 43
32		0.3		
33		0.2	(32-35') Not Sampled	
34		-		
35		-		11 20 25 39
36	100	-	(35-37') NATIVE Brown to gray SAND with silt, well sorted, no plasticity, no cohesion, loose, small clay pieces in bottom 1-2 inches (WET)	
37		-		
38		-	(37-40') Not sampled	
39		-		
40		-		



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 30-28' bgs
Filter pack: 30-32' bgs
Well riser: 1' abs - 32' bgs
Grout: 0 - 28' bgs
Well screen: 32-42' bgs

ARM Group LLC
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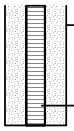
Well ID: COA-MWI-007

(page 3 of 3)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 563,300
Easting (ft)	: 1,455,522
Date/Time Completed	: 10/29/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 42.5" ags
Total Well Depth (ft)	: 47' bgs
Depth to Water (ft)	: 0hr: 10' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
40		0.2	(40-42') NATIVE Light brown to brown SAND with silt, well sorted, no plasticity, no cohesion, loose (WET)	20 50/5
41		0.2		
42		0.1	(42-45') Not sampled	
43		-		
44		-		
45		-	(45-45.7') NATIVE Light brown to brown SAND with silt, well sorted, no plasticity, no cohesion, loose (WET)	
46		-	(45.7-46) NATIVE Gray to black CLAYEY-SILT, no plsaticity, no cohesion, loose (WET)	
47		-	(46-47) NATIVE Light brown to brown SAND with silt, well sorted, no plasticity, no cohesion, loose (WET)	
48			END of boring	
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				



Filter Pack: FilPro W.G. #2 Sand

Screen: 2" diameter Schedule 40 PVC 0.02" slot size

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
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bgs - below ground surface

Bentonite seal: 30-28' bgs
Filter pack: 30-32' bgs
Well riser: 1' abs - 32' bgs
Grout: 0 - 28' bgs
Well screen: 32-42' bgs

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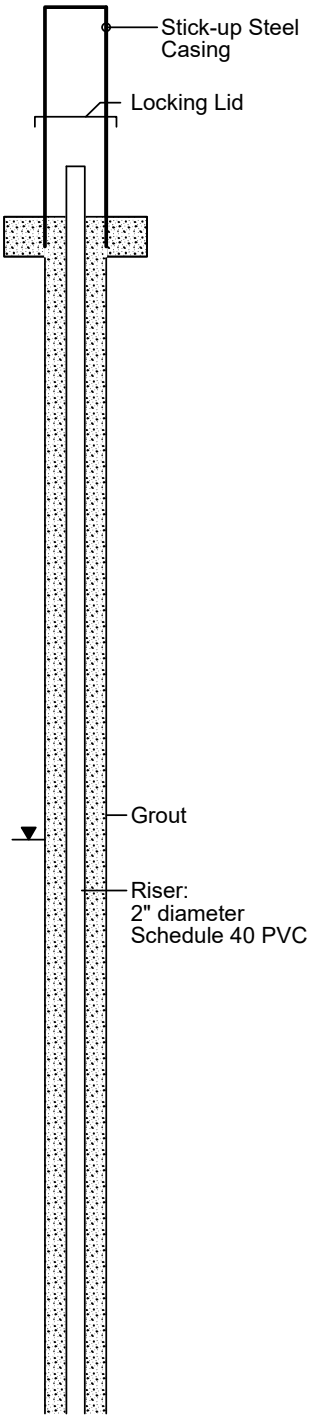
Well ID: COA-MWI-009

(page 1 of 3)

Project Name	: B10/Cell 6 - Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe, G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Split-Spoon Rig

Northing (ft)	: 561,978
Easting (ft)	: 1,454,383
Date/Time Completed	: 10/30/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 42.5" ags
Total Well Depth (ft)	: 57' TOC
Depth to Water (ft)	: 0 hr: 13.41' bgs
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0–5			(0-5') No Recovery	28 50/2 X X X
5–7	40	59.9 23.5	(5-7') FILL Dark brown to black SILTY GRAVEL SLAG, loose, no plasticity, no cohesion (DRY)	Benzene odor observed
7–10		4.3	(7-10') Not Sampled	
10–12	50	5.6 1.7	(10-12') FILL Light gray to black SILTY SANDY SLAG, no plasticity, no cohesion, loose (DRY)	11 17 12 10
12–15		0.8	(12-15') Not Sampled	
15–17	100	0.7 0.4	(15-17') FILL Dark brown to black SILTY-SANDY GRAVEL SLAG, loose for shallower half and firm for deeper half, no plasticity, no cohesion (WET)	Wet at 15' bgs 37 35 28 31
17–20		0.5	(17-20') Not Sampled	9 19 12 15



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 43 - 41' bgs
Filter pack: 43 - 45' bgs
Well riser: 3' ags to 5' bgs
Well screen: 45-55' bgs

ARM Group LLC
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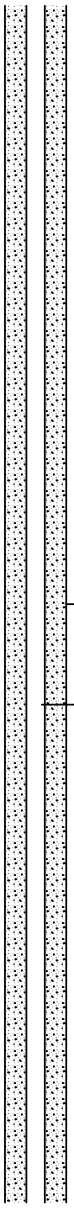
Well ID: COA-MWI-009

(page 2 of 3)

Project Name	: B10/Cell 6 - Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe, G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Split-Spoon Rig

Northing (ft)	: 561,978
Easting (ft)	: 1,454,383
Date/Time Completed	: 10/30/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 42.5" ags
Total Well Depth (ft)	: 57' TOC
Depth to Water (ft)	: 0 hr: 13.41' bgs
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20			(20-22') No recovery	9 19 12 15
21	0			No recovery logged due to miscommunication with drillers
22			(22-25') Not Sampled	
23				
24				
25			(25-25.5') FILL	12 14 10 13
		0.3	Black SILTY-SANDY SLAG with minor silt, no	
26	100		plasticity, no cohesion, loose (WET)	
		1.7	(25.5-27') FILL	
27			Black SANDY GRAVEL SLAG with minor silt, no	
		0.6	plasticity, no cohesion, loose (WET)	
28			(27-30') Not Sampled	
29				
30			(30-32') FILL	4 5 7 9
		3.6	Black SILTY-SANDY GRAVEL SLAG, larger gravel	
31	100		clasts in bottom 4", no p[lasticity, no cohesion, loose	
		4.1	(WET)	
32			(32-35') Not Sampled	
		0.9		
33				
34				
35			(35-36.5') FILL	7 4 6 7 10 (???)
		0.3	Black SILTY-SANDY GRAVEL SLAG, no plasticity,	
36	100		no cohesion, loose (WET)	
		1.3	(36.5-37) NATIVE	
37			White to light gray SILTY-SAND, well sorted,	
		0.2	fine-grained, no plasticity, no cohesion (WET)	
38			(37-40') Not Sampled	
39				
40				8 7 10 17 20



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 43 - 41' bgs
Filter pack: 43 - 45' bgs
Well riser: 3' ags to 5' bgs
Well screen: 45-55' bgs

ARM Group LLC
Engineers and Scientists

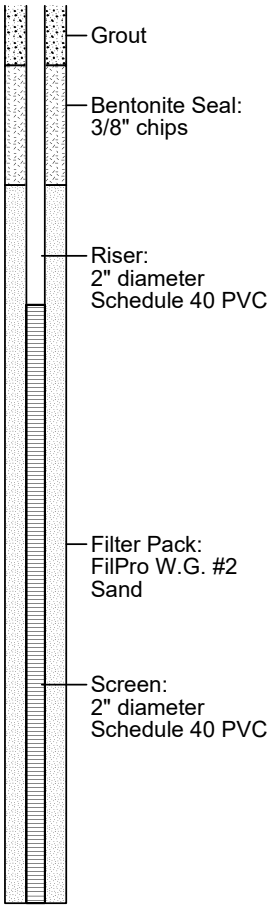
Well ID: COA-MWI-009

(page 3 of 3)

Project Name	: B10/Cell 6 - Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe, G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Split-Spoon Rig

Northing (ft)	: 561,978
Easting (ft)	: 1,454,383
Date/Time Completed	: 10/30/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 42.5" ags
Total Well Depth (ft)	: 57' TOC
Depth to Water (ft)	: 0 hr: 13.41' bgs
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
40				8 7 10 17 20
41	100	0.1	(40-41') NATIVE Black SILTY-SAND, no plasticity, no cohesion, loose, shells and larger gravel observed (WET)	Potentially fall in from overnight plug
42		0.1	(41-42) NATIVE White to light gray SILTY-SAND, well sorted, fine-grained, no plasticity, no cohesion (WET)	
43		0.1	(42-45') Not Sampled	
44				
45				27 41 44 48
46	100	0.2	(45-47') NATIVE Black SILTY-SAND, no plasticity, no cohesion, loose, shells and larger gravel observed (WET)	
47		0.3		
48		0.4	(47-50') Not Sampled	
49				
50				10 21 5 34 39 (?)
51	100	0.4	(50-50.25') NATIVE Black SILTY SAND, no porosity, no cohesion, loose, shells observed (WET)	Shell is potentially fall in from plug
52		0.1	(50.5-52') NATIVE White to light gray SILTY-SAND, well sorted, fine-grained, no plasticity, no cohesion (WET)	
53		0.1	(52-55') Not Sampled	
54				
55				31 41 50/4
56	100	0.6	(55-57') NATIVE White to light gray SILTY-SAND, well sorted, fine-grained, no plasticity, no cohesion (WET)	
57		0.4		
58		0.2	END of boring	
59				
60				



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 43 - 41' bgs
Filter pack: 43 - 45' bgs
Well riser: 3' ags to 5' bgs
Well screen: 45-55' bgs

ARM Group LLC
Engineers and Scientists

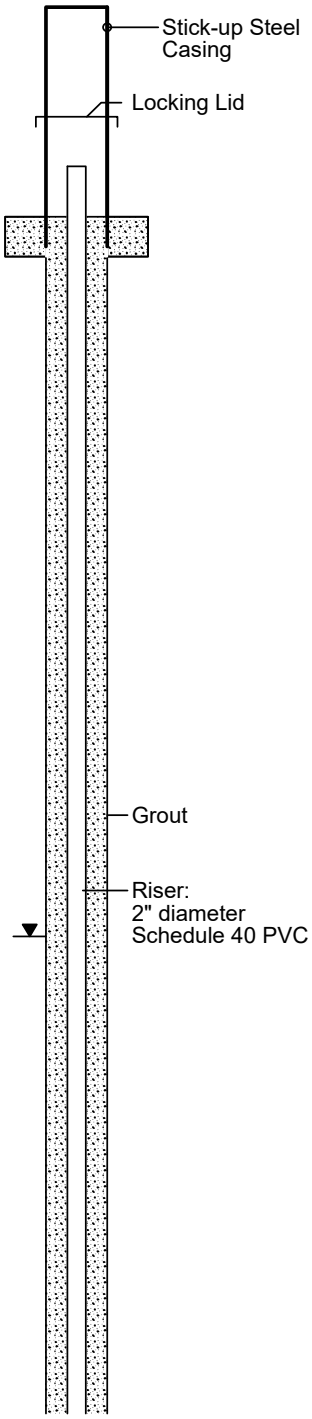
Well ID: COA-MWI-011

(page 1 of 2)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 561,655
Easting (ft)	: 1,454,349
Date/Time Completed	: 10/31/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 54" ags
Total Well Depth (ft)	: 37' bgs
Depth to Water (ft)	: 0hr: 15' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0–5		-	(0-5') Not Sampled	14 11 8 7
5–7	45	0.2 0.2	(5-7') FILL Brown SANDY SILTY SLAG with minor gravel, no plasticity, no cohesion, firm (DRY)	
7–10		0.1 -	(7-10') Not Sampled	
10–12	40	0.2 0.2	(10-12') FILL Brown SILTY SANDY SLAG with minor gravel, no plasticity, no cohesion, firm (DRY)	15 10 17 50/3
12–15		0.3 -	(12-15') Not Sampled	
15–17	35	0.1 0.1	(15-17') FILL Brown SILTY GRAVEL SLAG with minor sand, poorly to moderately sorted, no plasticity, no cohesion, loose (WET)	7 5 3 3 Wet at 15'bgs
17–20		0.1 -	(17-20') Not sampled	



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 25 - 23' bgs
Filter pack: 21 - 23' bgs
Well riser: 1' abs - 25' bgs
Grout: 0 - 21' bgs
Well screen: 25 - 35' bgs

ARM Group LLC
Engineers and Scientists

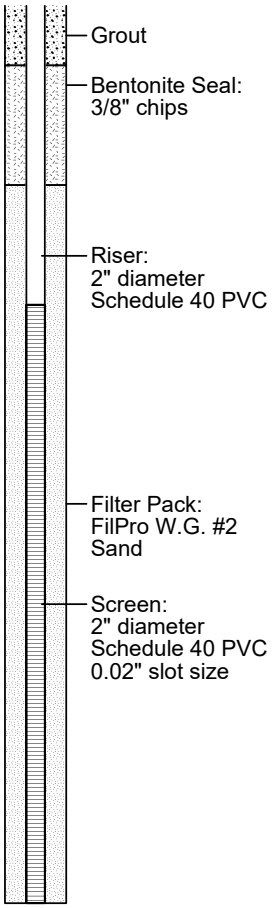
Well ID: COA-MWI-011

(page 2 of 2)

Project Name	: B10 Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: S. Lowe G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM
Driller	: Jim
Drilling Equipment	: Augar Rig

Northing (ft)	: 561,655
Easting (ft)	: 1,454,349
Date/Time Completed	: 10/31/2024
Surf. Elev. (ft AMSL)	: Not yet surveyed
TOC Elev. (ft AMSL)	: Not yet surveyed
PVC Stick-up (ft)	: 54" ags
Total Well Depth (ft)	: 37' bgs
Depth to Water (ft)	: 0hr: 15' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20				
21	40	0.2	(20-22') FILL Brown SILTY GRAVEL SLAG with minor sand, poorly to moderately sorted, no plasticity, no cohesion, loose (DRY)	2 5 10 20
22		0.1		
23		0.3	(22-25') Not Sampled	
24		-		
25		-		
26	35	0.1	(25-27') FILL Brown SILTY GRAVEL SLAG with minor sand, poorly to moderately sorted, no plasticity, no cohesion, loose (WET)	41 50/2
27		0.1		
28		0.1		
29		-		
30		-		
31	85	0.1	(30-30.5') FILL Brown SILTY GRAVEL SLAG with minor sand, poorly to moderately sorted, no plasticity, no cohesion, loose (WET)	5 4 3 4
32		0.2	(30.5-31.5') NATIVE Dark black to gray CLAYEY SILTY SLAG, low plasticity, low cohesion, firm (WET)	
33		0.4		
34		-	(31.5-32') NATIVE Dark black to gray CLAYEY SILTY SLAG, low plasticity, low cohesion, firm, shells present (WET)	
35		-	(32-35') Not Sampled	10 10 11 28
36	5	-	(35-37') NATIVE Black SILTY SANDY GRAVEL, no plasticity, no cohesion, loose (WET)	
37		-	END of boring	
38				
39				
40				



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 25 - 23' bgs
Filter pack: 21 - 23' bgs
Well riser: 1' abs - 25' bgs
Grout: 0 - 21' bgs
Well screen: 25 - 35' bgs

ARM Group LLC
Engineers and Scientists

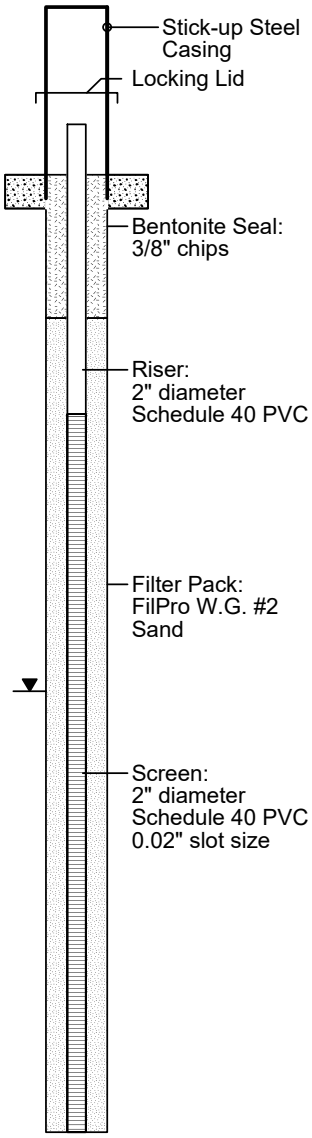
Well ID: COA-MWS-003

(page 1 of 1)

Project Name	: CT- Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: L. Parker G.I.T.
Checked by	: S. Lowe G.I.T.
Drilling Company	: Connelly
Driller	: Jarred
Drilling Equipment	: Sonic Rig

Northing (ft)	: 561966.03
Easting (ft)	: 1455791.40
Date/Time Completed	: 2/1/2024
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
PVC Stick-up (ft)	: 2.81' ags
Total Well Depth (ft)	: 22.71' TOC
Depth to Water (ft)	: 0 hr: 13.79' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION
0			
1		-	(0-4') No Recovery
2		-	
3	55	6.7	
4		10.2	
5		13.6	(4-5.25') FILL Brown SILTY SLAG,with some SAND and GRAVEL, loose to dense, no plasticity, no cohesion (DAMP)
6		21.0	(5.25-6.5') FILL Gray SILT SLAG, soft, no plasticity, no cohesion, metallic luster observed (DAMP)
7	70	9.9	
8		6.6	(6.5-10') FILL Brown GRAVEL SLAG, with some SILT and SAND, loose, no plasticity, no cohesion, lenses of yellow and gray material observed throughout (DAMP)
9		7.2	
10		4.0	
11		2.4	(10-11') No Recovery
12		4.2	(11-20') FILL Black to brown GRAVEL SLAG, with SILT and SAND, loose, no plasticity, no cohesion, intervals of blue-gray and yellow observed (DAMP/WET)
13	90	6.1	
14		1.2	
15		0.7	
16		8.5	
17		4.2	
18	90	2.8	
19		0.7	
20		1.1	
21		-	(20-20.6') No Recovery
22		3.3	(20.6-25') FILL Black to brown GRAVEL SLAG , with SILT and some SAND, loose, no plastcity, no cohesion (WET)
23	85	2.9	
24		10.6	
25		42.7	



REMARKS

Wet at 13' bgs.

TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 0-3' bgs
Filter pack: 3-20' bgs
Well riser: 3' ags to 5' bgs
Well screen: 5-20' bgs

ARM Group LLC
Engineers and Scientists

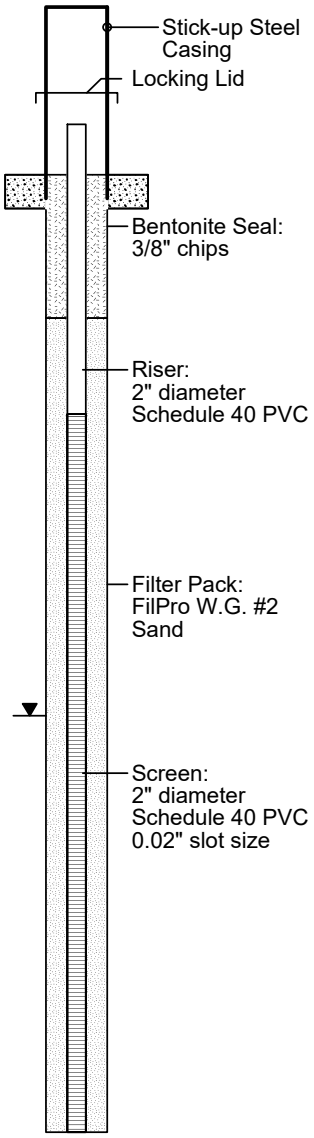
Well ID: COA-MWS-004

(page 1 of 1)

Project Name	: CT- Well Install
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	: Container Terminal
ARM Representative	: T. Palank G.I.T.
Checked by	: S. Lowe G.I.T.
Drilling Company	: Connelly
Driller	: Jarred
Drilling Equipment	: Sonic Rig

Northing (ft)	: 562092.94
Easting (ft)	: 1456245.76
Date/Time Completed	: 1/30/2024
Surf. Elev. (ft AMSL)	:
TOC Elev. (ft AMSL)	:
PVC Stick-up (ft)	: 3' ags
Total Well Depth (ft)	: 23.02' TOC
Depth to Water (ft)	: 0 hr: 14.30' TOC
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0–5	90		(0-1') FILL Dark brown SANDY GRAVEL SLAG, with trace SILT, loose, no plastciity, no cohesion (DRY) (1-3.5') FILL Dark brown SANDY GRAVEL SLAG, with trace SILT, loose, no plasticity, no cohesion (DRY) (3.5-5') FILL Dark brown to brown SANDY GRAVEL SLAG, loose, no plasticity, no cohesion (DRY)	
5–10	75		(5-10') FILL Light gray to brown SILTY GRAVEL SLAG, with SAND, loose, no plastcity, no cohesion (DRY/DAMP)	
10–15	75		(10-11.6') FILL Dark brown SILTY GRAVEL SLAG, loose, no plasticity, low cohesion (WET) (11.6-15') FILL Black to dark grey SANDY GRAVEL SLAG, loose, tar or oil staining observed, minor sheen, strong petroleum odor, no plasticity, no cohesion (WET)	Wet at 11' bgs. Strong petroleum odor at 12' bgs.
15–20	85		(15-17.25') FILL Black to dark grey SANDY GRAVEL SLAG, oil/ tar staining observed, strong petroleum odor, no plasticity, no cohesion (WET) (17.25-20') FILL Black to dark grey SANDY GRAVEL SLAG, with some SILT, strong petroleum odor, no plasticity, no cohesion (WET)	Strong petroleum odor from 15-20' bgs. Staining observed at 15-17' bsg.
20–25	100		(20-25') NATIVE Gray to light brown CLAY, with trace SILT, firm, high plastcity, high cohesion (WET)	



TOC - Top of PVC Casing
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

Bentonite seal: 0-3' bgs
Filter pack: 3-20' bgs
Well riser: 3' ags to 5' bgs
Well screen: 5-20' bgs

APPENDIX F-2

ARM Group LLC
Engineers and Scientists

Well ID: B10-023-SB

(page 1 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: T. Palank , G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 562,742
Easting (ft)	: 1,455,335
Date/Time Completed	: 12/2/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-20') FILL SLAG - Detailed logging was not conducted.	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10	0			
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-023-SB

(page 2 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: T. Palank , G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig
Northing (ft)	: 562,742
Easting (ft)	: 1,455,335
Date/Time Completed	: 12/2/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20				
21		1.0	(20-22') NATIVE White to light grey CLAY, soft, moderate plasticity, moderate cohesion (WET)	
22		3.1		
23	100		(22-27') NATIVE White CLAY, no cohesion, no plasticity, hard (WET)	
24		8.5		
25		11.0		
26				
27	100		(27-30') NATIVE Red to brown CLAY with SILT, no plasticity, no cohesion, hard (WET)	
28		0.0		
29				
30			END OF BORING	
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-024-SB

(page 1 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 562,705
Easting (ft)	: 1,454,850
Date/Time Completed	: 12/4/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
1		0.0	(0-5') FILL Black to dark brown SILTY GRAVEL SLAG with minor SAND, loose, No plasticity, no cohesion (DRY)	
2	100	0.0		
3		0.0		
4		0.6		
5		0.5	(5-5.5') NO RECOVERY	
6			(5.3-6') FILL Light brown SILTY SANDY SLAG with some GRAVEL, loose, no plasticity, no cohesion (DRY)	
7	90	0.0	(6-10') FILL Dark brown SILTY SANDY SLAG with minor GRAVEL, loose, no plastcity, no cohesion (DAMP)	
8		3.9		
9		1.1		
10		0.3	(10-12') NO RECOVERY	
11				
12	60		(12-18') FILL Black SILTY SANDY GRAVEL SLAG, firm to loose, no plasticity, no cohesion (WET)	Wet at 12' bgs.
13		101.9		
14		139.9		Minor petroleum odor observed from 12-20' bgs.
15		224.4		
16		29.8		
17	100	43.4		
18		79.7	(18-20') FILL Black SANDY SLAG with trace SILT, loose, low density, no plasticity, no cohesion (WET)	
19		228.4		
20				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-024-SB

(page 2 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 562,705
Easting (ft)	: 1,454,850
Date/Time Completed	: 12/4/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20		80.3	(20-20.5') NO RECOVERY	
21		2.6	(20.5-23') NATIVE Grey SAND with SILT near (22-23'), fine grained, well sorted, loose, no plasticity, no cohesion (WET)	
22	90	20.4		
23		7.9	(23-24') NATIVE Red to orange-brown SILTY SAND, loose, moderately sorted, no plasticity, no cohesion (WET)	
24		4.2	(24-25') NATIVE Red to orange-brown CLAYEY SILT, firm, high cohesion, low plasticity (WET)	
25		8.1		
26		11.7	(25-27') NATIVE Yellow to orange-brown SAND with minor GRAVEL and SILT, no plastcity, no cohesion, loose (WET)	
27	100	17.6	(27-30') NATIVE Black to dark grey SAND, fine grained, well sorted, no plasticity, no cohesion, loose (WET)	
28		17.0		
29		913.9		
30			END OF BORING	
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-025-SB

(page 1 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,075
Easting (ft)	: 1,454,650
Date/Time Completed	: 12/4/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
1		0.0	(0-0.5') FILL White to light grey SILTY GRAVEL SLAG, loose, no plasticity, no cohesion (DRY)	
2	100	0.0	(0.5-7') FILL Brown SILTY GRAVEL SLAG with minor SAND, loose, no plasticity, no cohesion (DRY)	
3		0.0		
4		0.6		
5		0.5		
6		0.0		
7	100	0.0	(7-7.5') FILL Black SILTY GRAVEL SLAG, no plasticity, no cohesion, loose (DRY)	
8		0.0	(7.5-10') FILL Black to dark grey SILTY GRAVEL SLAG, loose, moderately sorted, no plasticity, no cohesion (DRY)	
9		2.0		
10		129.4	(10-15') FILL Black SILTY SANDY GRAVEL SLAG, coursens downwards, loose, no plasticity, no cohesion (WET)	Wet at 11' bgs.
11		0.4		
12	100	3.4		
13		0.5		
14		0.2		Wood observed from 14-15' bgs.
15		0.4	(15-16') FILL Black SANDY SLAG with minor GRAVEL pieces, loose, low density, no plasticity, no cohesion (WET)	
16		2.1	(16-18') FILL Black to dark grey SILTY GRAVEL SLAG with minor SAND, loose, no plasticity, no cohesion (WET)	
17	100	0.2		
18		0.1	(18-20') FILL Black SANDY GRAVEL SLAG, trace SILT observed from (19-20'), loose, no plasticity, no cohesion (WET)	
19		7.0		
20				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-025-SB

(page 2 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,075
Easting (ft)	: 1,454,650
Date/Time Completed	: 12/4/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20		22.4	(20-21') NO RECOVERY	
21			(21-22') FILL Black SANDY SLAG with minor GRAVEL pieces, loose, low density, no plasticity, no cohesion (WET)	
22	80	7.1	(22-25') FILL Black SANDY GRAVEL SLAG with trace SILT, loose, no plasticity, no cohesion (WET)	
23		3.6		
24		6.9		
25		14.7	(25-27') FILL Black SILTY SANDY GRAVEL SLAG, loose to firm, larger pieces of gravel observed near 25' bgs, no plasticity, no cohesion (WET)	
26		5.3		
27	100	4.6	(27-30') FILL Black SANDY GRAVEL SLAG with trace SILT, loose, no plasticity, no cohesion , coursens downwards (WET)	
28		26.2		
29		3.5		
30			END OF BORING	
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-026-SB

(page 1 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,118
Easting (ft)	: 1,455,041
Date/Time Completed	: 12/3/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
1	100	0.0	(0-5') FILL Black to dark brown SANDY GRAVEL SLAG, loose, no plasticity, no cohesion (DAMP)	
2				
3				
4				
5	100	0.0 0.0	(5-10') FILL SANDY GRAVEL SLAG with trace SILT, no plasticity, no cohesion, organic material observed (phragmites) (DAMP/WET)	
6				
7				
8				
9				
10	100	4.0 5.0	(10-20') FILL Blue- grey SANDY GRAVEL SLAG, loose, no plasticity, no cohesion (WET)	Wet at 10' bgs.
11				
12				
13				
14		10.0		
15	100	3.0 8.1		
16				
17				
18				
19				
20				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-026-SB

(page 2 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,118
Easting (ft)	: 1,455,041
Date/Time Completed	: 12/3/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20				
21				
22	100		(20-24') NATIVE Light brown to grey SAND, no plasticity, no cohesion, loose (WET)	
23		8.1		
24		31.0	(24-26') NATIVE Blue - grey CLAY, high plasticity, high cohesion, soft (WET)	
25				
26				
27	100	25.0	(26-30') NATIVE Light brown to grey SAND, no plasticity, no cohesion, loose (WET)	Petroleum odor observed.
28				
29		55.0		
30			END OF BORING	
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-027-SB

(page 1 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,005
Easting (ft)	: 1,455,058
Date/Time Completed	: 12/4/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
1		0.0	(0-1.5') FILL Brown SILTY GRAVEL SLAG, no plasticity, no cohesion, loose (DRY)	
2			(1.5-2') BRICK	
3	100	0.0	(2-2.5') FILL Light brown to orange-brown SILTY SLAG with some SAND, firm (DAMP)	
4		0.0	(2.5-7') FILL Brown SILTY GRAVEL SLAG, no plasticity, no cohesion, loose (DRY)	
5		0.0		
6		0.0		
7		0.0		
8	90	0.0	(7-7.5') FILL Light brown to orange brown SANDY SLAG, firm, fine grained,no plasticity, no cohesion (DAMP)	
9		0.0	(7.5-8') FILL Light brown to brown SANDY GRAVEL SLAG, firm, no plasticity, no cohesion (DAMP)	
10		0.3	(8-9.5') FILL Light brown to orange-brown SANDY GRAVEL SLAG, poorly sorted, firm, no plasticity, no cohesion (DAMP)	
11				Wet at 11' bgs.
12		0.0	(9.5-14') FILL Blue-grey SANDY GRAVEL SLAG, loose, poorly sorted, no plasticity, no cohesion (DAMP/WET)	
13	80	0.0		
14		0.0		
15		0.2	(14-15') NO RECOVERY	
16		0.0	(15-20') FILL Blue-grey SANDY GRAVEL SLAG with some SILT, loose, no plasticity, no cohesion, fines downwards (WET)	
17		0.0		
18	100	0.0		
19		0.0		
20		0.0		

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-027-SB

(page 2 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,005
Easting (ft)	: 1,455,058
Date/Time Completed	: 12/4/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20		1.4	(20-22') NATIVE Light brown to brown SAND, fine-grained, no plasticity, no cohesion, loose (WET)	
21		1.7		
22	100	4.4	(22-24.5') NATIVE Light brown to brown CLAY with minor SILT, high cohesion, moderate plasticity, firm (WET)	
23		10.8		
24		396.6		
25		42.2	(24.5-25') NATIVE Light brown to brown SAND, fine-grained, no plasticity, no cohesion, loose (WET)	
26		16.8	(25-30') NATIVE Light brown to orange brown SAND with trace SILT, no plasticity, no cohesion, loose (WET)	
27	100	81.8		
28		79.4		
29		61.5		
30			END OF BORING	
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-028-SB

(page 1 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: T. Palank , G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,275
Easting (ft)	: 1,455,252
Date/Time Completed	: 12/3/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
1	100	0.0	(0-5') FILL Grey SANDY GRAVEL SLAG, loose, no plasticity, no cohesion (DAMP)	
2		0.1		
3				
4				
5	100	0.2	(5-10') FILL Black to dark grey SANDY GRAVEL SLAG, no plasticity, no cohesion (DAMP)	
6		0.5		
7				
8				
9				
10	20	5.5	(10-15') FILL Black GRAVEL SLAG with SAND, loose, no plasticity, no cohesion (WET)	Wet at 10' bgs.
11				
12				
13				
14		0.8		
15	100	1.9	(15-20') FILL Blue- grey SANDY GRAVEL SLAG, loose, no plasticity, no cohesion (WET)	
16				
17				
18				
19				
20				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-028-SB

(page 2 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: T. Palank , G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,275
Easting (ft)	: 1,455,252
Date/Time Completed	: 12/3/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20		9.0	(20-20.5') NATIVE Dark grey SAND, fine grained, no plasticity, no cohesion (WET)	
21		2.0	(20.5-23.5') NATIVE Grey CLAY with interbedded layers of fine grained SAND and SILT, soft, moderate plasticity, moderate cohesion (WET)	
22	100	2.2		
23		8.5		
24		9.0	(23.5-26') FILL White to light grey SAND, soft, no plasticity, no cohesion (WET)	
25				
26		5.5	(26-27') NATIVE Light brown to brown SAND and SILT, no plasticity, no cohesion, soft/ loose (WET)	Petroleum odor observed.
27	100	10.0	(27-28') NATIVE White to light grey CLAY, moderate plasticity, moderate cohesion, soft (WET)	
28		8.5		
29		10	(28-30') NATIVE Black to brown SAND, medium grained, no plasticity, no cohesion, loose (WET)	
30			END OF BORING	
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-029-SB

(page 1 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: T. Palank , G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,102
Easting (ft)	: 1,455,338
Date/Time Completed	: 12/2/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-20') NOT LOGGED	
1				
2	100			
3		0.1		
4		0.3		
5				
6		0.0		
7	100	0.0		
8		0.0		
9				
10				
11		4.0		
12	100	7.0		
13		8.0		
14				
15				
16		40		
17	100			
18		60		
19				
20				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: B10-029-SB

(page 2 of 2)

Project Name	: B10 AOC B Alternatives
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: T. Palank , G.I.T.
Checked by	: S. Lowe
Drilling Company	: Connelley
Driller	:
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,102
Easting (ft)	: 1,455,338
Date/Time Completed	: 12/2/2024

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20				
21		25	(20-22') NATIVE White to light grey CLAY, soft, moderate plasticity, moderate cohesion (WET)	
22	100	30	(22-27') NATIVE White CLAY, no cohesion, no plasticity, hard (WET)	
23		10		
24		25		
25				
26				
27	100	10	(27-30') NATIVE Red to brown CLAY with SILT, no plasticity, no cohesion, hard (WET)	
28				
29				
30		25	END OF BORING	
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				

Total Boring Depth: 30' bgs
AMSL - Above Mean Sea Level
ags - above ground surface
bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: COA-MWI-005

(page 1 of 4)

Project Name	: B10/Cell 6
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, J. Barna
Checked by	: C. Norris
Drilling Company	: KIM Engineering
Driller	: Jim
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,087
Easting (ft)	: 1,455,788
Date/Time Completed	: 10/30/2024 &11/4/2024
PVC Stick-up (ft)	: 2.95' ags
Total Well Depth (ft)	: 72' TOC
Depth to Water (ft)	: 0 hr: 13.03' TOC
Borehole Diameter (in.)	: 2

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
1			(0-5') NOT SAMPLED	Blow Counts: 19 50/4 X X
2		0.1		
3				
4				
5				
6	30	2.4	(5-7') FILL Brown to dark brown SILTY SLAG with minimal GRAVEL, no cohesion, no plasticity, loose in top half, firm on bottom half (DRY)	
7				
8			(7-10') NOT SAMPLED	
9		0.5		
10				Blow Counts: 8 5 8 16
11	50		(10-11') NO RECOVERY	Petroleum odor observed.
12			(11- 12') FILL Black GRAVEL SLAG with SILT and SAND, no plasticity, no cohesion (WET)	Minor sheen observed near 12'
13			(12-15') NOT SAMPLED	
14		19.8		
15				Blow Counts: 2 9 50/5 X X
16	10	33.5	(15-15.2') NO RECOVERY (15.2-17') FILL Black GRAVEL SLAG with SILT and SAND, no plasticity, no ochesion (WET)	
17				
18			(17-20') NO RECOVERY	
19				
20		1.3		Blow Counts: 2 2 3 2

bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: COA-MWI-005

Project Name	: B10/Cell 6
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, J. Barna
Checked by	: C. Norris
Drilling Company	: KIM Engineering
Driller	: Jim
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,087
Easting (ft)	: 1,455,788
Date/Time Completed	: 10/30/2024 &11/4/2024
PVC Stick-up (ft)	: 2.95' ags
Total Well Depth (ft)	: 72' TOC
Depth to Water (ft)	: 0 hr: 13.03' TOC
Borehole Diameter (in.)	: 2

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20		0.7	(20-22') FILL Black fine-grained SILTY SAND with traceGRAVEL, no plasticity, no cohesion, well graded (WET)	Blow Counts: 2 2 3 2
21	100			
22		20.5		
23		0.1	(22-25') NOT SAMPLED	
24		0.1		
25		12.8		Blow Counts: 1 3 2 2
26	100	8.0	(25-27') NATIVE Light gray CLAYEY SILT with trace SAND, firm, lo cohesion, low plasticity (WET)	
27			(27-30') NOT SAMPLED	
28				
29		10.1		
30				Blow Counts: 2 2 3 3
31	100	3.9	(30-32') NATIVE Brown CLAYEY SILT, no cohesion, no plasticity, hard (WET)	
32			(32-35') NOT SAMPLED	
33				
34		2.0		
35				Blow Counts: 2 2 2 4
36	100	0.9	(35-37') NATIVE Brown CLAYEY SILT, firm, no plasticity, no cohesion (WET)	
37			(37-40') NOT SAMPLED	
38				
39		2.7		
40				Blow Counts: 2 1 3 3

bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: COA-MWI-005

(page 3 of 4)

Project Name	: B10/Cell 6
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, J. Barna
Checked by	: C. Norris
Drilling Company	: KIM Engineering
Driller	: Jim
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,087
Easting (ft)	: 1,455,788
Date/Time Completed	: 10/30/2024 &11/4/2024
PVC Stick-up (ft)	: 2.95' ags
Total Well Depth (ft)	: 72' TOC
Depth to Water (ft)	: 0 hr: 13.03' TOC
Borehole Diameter (in.)	: 2

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
40				
41	100	-	(40-42') NATIVE Gray CLAYEY SILT, low cohesion, low plasticity, firm (WET)	Blow Counts: 2 1 3 3
42			(42-45') NOT SAMPLED	
43				
44				
45				Blow Counts: 3 2 1 1
46	100	-	(45-46.5') NATIVE Light gray SAND with minimal SILT, loose (WET)	
47			(46.5-47') NATIVE LIght gray SANDY SILT, low plasticity, low cohesion, firm (WET)	
48			(47-50') NOT SAMPLED	
49		-		
50				Blow Counts: 1 1 1 1
51	100		(50-51') NATIVE Gray SAND SILT, no plasticity, no cohesion, soft (WET)	
52			(51-51.5') NATIVE Gray SAND SILT, no plasticity, no cohesion, medium soft (WET)	
53		-	(51.5-52') NATIVE Gray SANDY SILT, no plasticity, no cohesion, soft (WET)	
54			(52-55') NOT SAMPLED	
55				Blow Counts: 13 12 8 10
56		-	(55-56') NATIVE Gray SANDY SILT, no plasticity, no ochesion, soft (WET)	
57			(56-57') NATIVE Light brown SAND with trace SILT, fine grained, loose (WET)	
58	100		(57-60') NOT SAMPLED	
59		-		
60				

bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: COA-MWI-005

(page 4 of 4)

Project Name	: B10/Cell 6
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, J. Barna
Checked by	: C. Norris
Drilling Company	: KIM Engineering
Driller	: Jim
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,087
Easting (ft)	: 1,455,788
Date/Time Completed	: 10/30/2024 &11/4/2024
PVC Stick-up (ft)	: 2.95' ags
Total Well Depth (ft)	: 72' TOC
Depth to Water (ft)	: 0 hr: 13.03' TOC
Borehole Diameter (in.)	: 2

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
60				
61	75	-	(60-67') NATIVE Interbedded white and brown SAND and CLAY, clay layer exhibited high plasticity (WET)	
62				
63				
64	100	-		
65				
66				
67				
68	100	-	(67-72') NATIVE Red CLAY, high plasticity, soft (WET)	
69				
70				
71	50	-		
72			END OF BORING	
73				
74				
75				
76				
77				
78				
79				
80				

bgs - below ground surface

ARM Group LLC
Engineers and Scientists

Well ID: COA-MWI-008

(page 1 of 3)

Project Name	: B10/Cell 6
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM Engineering
Driller	: Jim
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,087
Easting (ft)	: 1,455,788
Date/Time Completed	: 10/28/2024
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
1		0.1	(0-5') No Recovery	25 50/3
2				
3				
4				
5		0.2	(5-5.3') CONCRETE	
6	55		(5.3-7') FILL Brown, SILTY SAND SLAG with GRAVEL, no plasticity, no cohesion, loose (DRY)	
7		0.1		
8			(7-10') Not Sampled	
9				
10				Wet at 10' logs
11	20	5.2	(10-12') FILL Brown SILTY GRAVEL SLAG, no plasticity, no cohesion, loose, poorly sorted (WET)	50/3
12		2.2		Minor sheen observed near 12'
13		17.5	(12-15') Not Sampled	
14		2.2		
15		1.6		3 5 4 4
16	100		(15-17') FILL Gray-blue SANDY GRAVEL SLAG, no plasticity, no cohesion, loose, moderately sorted (WET)	
17				Moderate petroleum odor
18		2.1	(17-20') Not Sampled	
19		0.7		
20		0.9		44 45 36 35

bgs - below ground surface
Note: Well was planned, but not installed due to presence of clay

ARM Group LLC
Engineers and Scientists

Well ID: COA-MWI-008

(page 2 of 3)

Project Name	: B10/Cell 6
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM Engineering
Driller	: Jim
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,087
Easting (ft)	: 1,455,788
Date/Time Completed	: 10/28/2024
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
20			(20-20.25') FILL Dark gray GRAVEL SLAG with SILT, no plasticity, no cohesion, loose (WET)	44 45 36 35
21	85			
22			(20.25-22') FILL Dark gray to black SANDY SLAG with minor silt, no plasticity, no cohesion, fine-grained, firm (WET)	Minor petroleum odor
23				
24			(22-25') Not Sampled	
25				2 2 2 2
26	100	1.3 0.9	(25-27') NATIVE Light gray to light brown CLAY, some mottling observed, firm (WET)	
27		0.7	(27-30') Not Sampled	
28				
29		0.3		
30		0.5	(30-32') NATIVE Light gray to light brown CLAY, some mottling observed, firm (WET)	2 1 1 1
31	100	0.4		
32			(32-35') Not Sampled	
33				
34				
35		0.3		2 2 2 2
36	100	0.5 0.3	(35-36.5') NATIVE Light gray to light brown SILT, low plasticity, low cohesion, some mottling observed, firm (WET)	
37			(36.5-37') NATIVE Brown to dark brown SILT, low plasticity, moderate cohesion (WET)	
38			(37-40') Not Sampled	
39				
40				3 2 2 5

bgs - below ground surface
Note: Well was planned, but not installed due to presence of clay

ARM Group LLC
Engineers and Scientists

Well ID: COA-MWI-008

(page 3 of 3)

Project Name	: B10/Cell 6
Project Number	: 20010210
Client	: Tradepoint Atlantic
Site	: Sparrows Point
Borehole Location	:
ARM Representative	: S. Lowe, G.I.T.
Checked by	: C. Norris
Drilling Company	: KIM Engineering
Driller	: Jim
Drilling Equipment	: Auger Rig

Northing (ft)	: 563,087
Easting (ft)	: 1,455,788
Date/Time Completed	: 10/28/2024
Borehole Diameter (in.)	: 6

Depth (ft.)	%Recovery	PID (ppm)	DESCRIPTION	REMARKS
40				
41	100	0.5	(40-42') NATIVE Brown to dark brown SILT, low plasticity, moderate cohesion (WET)	3 2 2 5
42				
43			(42-45') Not Sampled	
44				
45		0.3		
46	100	0.3	(45-47') NATIVE Dark gray CLAY with minor silt, moderate cohesion, low plasticity, firm (WET)	2 1 2 3
47		0.2		
48			(47-50') Not Sampled	
49				
50				
51	100		(50-52') NATIVE Dark gray CLAY with minor silt, moderate cohesion, low plasticity, firm (WET)	2 2 3 4
52				
53			(52-55') Not Sampled	
54				
55				
56	100		(55-56') NATIVE Brown to dark brown SILT, low plasticity, moderate cohesion, some mottling (WET)	4 7 6 6
57			(56-57') NATIVE Dark gray CLAY with minor silt, moderate cohesion, moderate plasticity, firm (WET)	
58			END of boring	
59				
60				

bgs - below ground surface
Note: Well was planned, but not installed due to presence of clay

APPENDIX F-3

EA Engineering, Science, and Technology, Inc., PBC

225 Schilling Circle, Suite 400
Hunt Valley, Maryland 21031
Telephone: 410-584-7000
Fax: 443-646-8067
www.eaest.com

21 March 2025

MEMORANDUM

TO: **Pete Haid, Tradepoint Atlantic, Senior Vice President, Environmental**

FROM: **Jamie Beaver, PE,**
Frank Barranco, PhD, PE, PG, CMQ/OE

SUBJECT: **Sediment Hydraulic Conductivity Analysis**
Sparrows Point Container Terminal, Baltimore, Maryland

EA Engineering, Science, and Technology, Inc., PBC (EA) conducted sampling and testing of sediment from the proposed Sparrows Point Channel improvements (deepening and widening) for the Sparrows Point Container Terminal (EA 2025). A portion of the dredged sediments from the channel are proposed for placement in an onsite Dredged Material Containment Facility (DMCF) located at the Coal Pier Channel basin. The sediment characterization for the channel improvements included analytical testing and physical properties testing for 28 planned dredging units. Representative samples were prepared by compositing cores collected for the full depth of planned dredging and over-depth allowance (-52 ft Mean Lower Low Water) within each dredging unit. Physical property testing included gradation analysis from grain size distribution curves that plot relative proportions of clay, silt, and sand fractions. Permeability/hydraulic conductivity information was identified as useful for understanding groundwater flow and potential chemical transport following placement of material in the unlined Coal Pier Basin DMCF. Permeability is an intrinsic property related to the geometry and connectivity of pore spaces, while hydraulic conductivity is a measure of how easily a fluid can move through a saturated or nearly saturated porous material. The two terms are inter-related and often used interchangeably when water is the only fluid considered.

EA conducted a desktop hydraulic conductivity analysis using Hazen's approximation together with selected grain size distribution curves from the project dredging units. Hazen's approximation is a well-established empirically derived equation for estimating hydraulic conductivity that was developed in 1911 (Fetter, 1994). The approximation is an equation that requires the D10 particle size from a grain size distribution curve. Additionally, a proportionality constant based on the shape of the curve is used; this is related to the size and sorting of the particles. The D10, which is the particle size that 10% of the sample is smaller than, is determined directly from the respective grain size distribution curve. The D10 is used in the equation because the finer particle sizes of the gradation will control hydraulic conductivity as compared to larger particle sizes. Finally, the equation is based on hydraulic conductivity being observed to be proportional to the D10 size squared.

The following dredging unit samples were selected based on the laboratory grain size results to represent the overall range of finer grained and coarser grained composite samples for the project area. The associated grain size characteristics are summarized as follows:

SPCT24-DU-21

- Gravel = 0.0%
- Sand = 4.4%
- Silt and Clay = 95.6%
- D10 = 0.0003 mm

SPCT24-DU-27

- Gravel = 2.0%
- Sand = 35%
- Silt and Clay = 63%
- D10 = 0.0006 mm

From the equation for Hazen's approximation using these D10's and a mid-range value for the proportionality constant, the estimated hydraulic conductivity values are as follows:

- For SPCT24-DU-21 (a finer grained material): **~9 x 10(-8) cm/sec**
- For SPCT24-DU-27 (a coarser grained material): **~4 x 10(-7) cm/sec**

These estimated hydraulic conductivity values from Hazen's approximation are consistent with the expectations for a predominately fine-grained sediment.

References

EA. 2025. *Evaluation of Dredged Material for Upland Placement: Sparrows Point Container Terminal, Sparrows Point Channel, North and South Channel Segments, Patapsco River, Baltimore County, Maryland.* Draft. January.

Fetter, C.W. 1994. Applied Hydrogeology. Third Edition. Macmillan College Publishing Company, Inc.

APPENDIX G

Appendix G - GAA A Statistically Signifiant Trends
CPA Groundwater CMS

Zone	Well ID	Parameter Name	Statistical Trend	Final RG (ug/L)	Final RG Exceedance?
Shallow	CP05-PZM008	Benzene	Downward	100	no, most recent result is 4.9 ug/L
		Benzo[a]pyrene	Downward	0.16	no, and last 3 results ND
	CP09-PZM010	Benzene	Downward	100	no, and last 4 results ND
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
		Naphthalene	Downward	115	no, most recent result is 0.19 ug/L
	CP11-PZM010	Benzene	Downward	100	no, most recent result is 5.5 ug/L
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results all ND
		Naphthalene	Downward	115	no, most recent result is 13 ug/L
	CP15-PZM020	Benzene	Downward	100	no, most recent result is 5.3 ug/L
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results all ND
		Naphthalene	Downward	115	no, most recent result is 32 ug/L
Intermediate	CP05-PZM019	Benzo[a]pyrene	Downward	0.16	no, and last 2 results ND
	CP05-PZM028	Benzo[a]pyrene	Downward	0.16	no, and last 2 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results all ND
	CP09-PZM047	Benzene	Downward	100	no, and last 4 results all ND
		Benzo[a]pyrene	Downward	0.16	no, and last 3 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results all ND
		Naphthalene	Downward	115	no, most recent result is 0.15 ug/L
	CP15-PZM042	Benzene	Upward	100	no, most recent result is 4.2 ug/L
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results all ND

Trend identified AND recent result is above Final RGs
Trend identified but recent results are all ND

Notes:

(a) Trend testing was conducted for all COCs for GAA A where an exceedance of the applicable Final Remedial Goals (RGs) was identified in the groundwater database (E-Attachment #1B).

(b) GAA A COCs include bis(2-Ethylhexyl)phthalate and naphthalene. Benzene and benzo[a]pyrene were also included in the trend analysis.

(c) If the result of the testing was that no upward or downward trend was identified for a parameter at a particular well, it was not included in this table.

CP24-MWI
CP24-MWS
CP25-MWS
CP25-MWI
Groundwater Assessment Area A
B
CP05-PZM028
CP05-PZM008
CP05-PZM019
CP10-PZM008
N
N
CP09-PZM010
CP09-PZM047
B, N
CP15-PZM020
CP15-PZM042
B
B, N
CP11-PZM010

LEGEND

- Groundwater Monitoring Location (Shallow)
- Groundwater Monitoring Location (Intermediate)
- CPA CMS GAAs
- COA IM Cell

Note:
- Not sufficient results for trend analysis
- No trend indicated
- Decreasing trend
- Increasing trend

No final RG exceedances for wells with observed trends.

TREND LEGEND:
B = Benzene
B[a]p = Benzo[a]pyrene
Bis = Bis(2-ethylhexyl)phthalate
E = Ethylbenzene
N = Naphthalene
X = Xylenes

Coke Point Area CMS
Final Remedial Goal
Exceedances Trends - GAA A
June 12, 2025

Appendix
G

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Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 21010306

Appendix G - GAA E Statistically Signifiant Trends
CPA Groundwater CMS

Zone	Well ID	Parameter Name	Statistical Trend	Final RG (ug/L)	Final RG Exceedance?
Shallow	CO23-PZM008	Benzene	Downward	100	YES, recent results from 320 to 840 ug/L
		Ethylbenzene	Downward	100	no, most recent result 21 ug/L
	CO24-PZM007	Ethylbenzene	Downward	100	no, most recent result 2.9 J ug/L
		Naphthalene	Downward	115	YES, recent results from 1,200 to 2,000 ug/L
		Xylenes	Downward	1000	no, recent results from ND to 250 ug/L
	CO26-PZM007	Benzene	Downward	100	YES, recent results from 39 to 240 ug/L
		Ethylbenzene	Downward	100	no, most recent result 5.7 ug/L
		Xylenes	Downward	1000	no, most recent result 120 ug/L
	CO55-PZM000	Benzene	Downward	100	no, most recent result 1.4 ug/L
		Ethylbenzene	Downward	100	no, most recent result 1.6 ug/L
		Naphthalene	Downward	115	recent results range from ND to 130 ug/L (4 of previous 6 results below FRGs)
		Xylenes	Downward	1000	no, most recent result 21 ug/L
	CO56-PZP001	Benzene	Downward	100	YES, recent results from 94 to 230 ug/L
		Ethylbenzene	Downward	100	no, most recent result 5.4 ug/L
		Naphthalene	Downward	115	YES, recent results from 1,200 to 1,900 ug/L
		Xylenes	Downward	1000	no, most recent result 110 ug/L
	CO57-PZP002	Benzene	Downward	100	recent results range from ND to 270 ug/L (5 of previous 6 results below FRGs)
		Ethylbenzene	Downward	100	no, recent results from ND to 6.3 ug/L
		Naphthalene	Downward	115	recent results range from ND to 220 ug/L (5 of previous 6 results below FRGs)
		Xylenes	Downward	1000	no, recent results from ND to 130 ug/L
	CO58-PZM001	Benzene	Downward	100	recent results range from ND to 150 ug/L (4 of previous 6 results below FRGs)
		Ethylbenzene	Downward	100	no, most recent result 8 ug/L
		Naphthalene	Downward	115	YES, recent results from 170 to 1,700 ug/L
		Xylenes	Downward	1000	no, most recent result 140 ug/L
	CO59-PZP002	Benzene	Downward	100	recent results range from ND to 300 ug/L (5 of previous 6 results below FRGs)
		Ethylbenzene	Downward	100	no, most recent result 1.0 ug/L
		Naphthalene	Downward	115	recent results range from ND to 130 ug/L (5 of previous 6 results below FRGs)
		Xylenes	Downward	1000	no, most recent result 15 ug/L

Trend identified AND recent result is above Final RGs
Trend identified but recent results are all ND

Notes:

(a) Trend testing was conducted for all COCs for GAA E where an exceedance of the applicable Final Remedial Goals (RGs) was identified in the groundwater database (E-Attachment #1B).

(b) GAA E COCs include benzene, benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, bis(2-Ethylhexyl)phthalate, and naphthalene. However, there were not sufficient results for PAH trend data. Ethylbenzene and xylenes were also included in the trend analysis.

(c) Trend analysis was conducted on the following locations where sufficient sampling data was available: CO206R-MWS, CO23-PZM008, CO24-PZM007, CO25-PZM008, CO26-PZM007, CO55-PZM000, CO56-PZP001, CO57-PZP002, CO58-PZM001, and CO59-PZP002.

(d) If the result of the testing was that no upward or downward trend was identified for a parameter at a particular well, it was not included in this table.


CT-037-GW-41
CT-037-GW-12.5
E, X, N
CO24-PZM007
CO203-MWS
CO34-PZM048
CO60-PZP001
CO25-PZM008
CO205-MWS
CO23-PZM046
CO23-PZM008
B, E
CO204-MWS
B, E, X, N
CO72-PZM005
CO26-PZM032
CO26-PZM007
B, E, X
CO56-PZP001
CO71-PZM006
CO70-PZM005
CO206R-MWS
CO69-PZM005
CO68-PZM005
CO67-PZM006
B, E, X, N
B, E, X, N
CO207-MWS
CO66-PZM005
CO59-PZP002
CO55-PZM000
CO65-PZM005
CO64-PZM006
CO63-PZM007
CO62-PZM007
CO61-PZM007
B, E, X, N
CO58-PZM001
B, E, X, N
CO208-MWS
CO57-PZP002
CO35-PZM056
CO35-PZM013
SW18-PZM008
SW18-PZM053
Groundwater Assessment Area F
CP17-MWI
CP17-PZM013
CP26-MWS
CP26-MWI
LEGEND
Groundwater Monitoring Location (Shallow)
Groundwater Monitoring Location (Intermediate)
CPA CMS GAAs
COA IM Cell
Note:
Not sufficient results for trend analysis
No trend indicated
Decreasing trend
Increasing trend
Highlight and star indicates parameter exceeds Final RGs.
TREND LEGEND:
B = Benzene
B[a]p = Benzo[a]pyrene
Bis = Bis(2-ethylhexyl)phthalate
E = Ethylbenzene
N = Naphthalene
X = Xylenes
Coke Point Area CMS
Final Remedial Goal
Exceedances Trends - GAA E
June 12, 2025
Appendix
G
ARM Group LLC
Engineers and Scientists
0 40 80 160
Feet
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306

Appendix G - GAA F Statistically Signifiant Trends
CPA Groundwater CMS

Zone	Well ID	Parameter Name	Statistical Trend	Final RG (ug/L)	Final RG Exceedance?
Shallow	CP02-PZM007	Benzene	Downward	100	no, most recent result 0.16 J ug/L
		Benzo[a]pyrene	Downward	0.16	no, 3 of last 4 results ND
		Naphthalene	Downward	115	no, most recent result 0.06 J ug/L
	CP07-PZM006	Benzene	Downward	100	YES, most recent result 360 ug/L
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
	CP08R-PZM008	Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
	CP12-PZM012	Benzene	Downward	100	no, most recent result ND
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		Naphthalene	Downward	115	no, most recent result ND
	CP14-PZM009	Benzene	Downward	100	no, most recent result 50 ug/L
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
	CP16-PZM008	Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
		Naphthalene	Upward	115	no, most recent result 8.6 ug/L
	CP18R-PZM009	Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
	CP19R-PZM008	bis(2-Ethylhexyl)phthalate	Upward	1.0	YES, 18 ug/L in April 2023, ND (at 3.0 U) for last 3 events
	CP20-PZM011	Benzene	Downward	100	no, most recent result 3.5 ug/L
		Benzo[a]pyrene	Downward	0.16	no, most recent result 0.07 J ug/L
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
		Naphthalene	Downward	115	no, most recent result 8.4 ug/L
	CP21-PZM004	Benzene	Upward	100	no, most recent result 9.4 ug/L
		Benzo[a]pyrene	Downward	0.16	no, and last 3 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
Intermediate	CP02-PZM026	Benzene	Downward	100	no, and last 4 results ND
		Benzo[a]pyrene	Downward	0.16	no, most recent result 0.04 ug/L
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
		Naphthalene	Downward	115	no, and last 4 results ND
	CP08R-PZM034	Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
	CP12-PZM052	Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
		Naphthalene	Downward	115	no, most recent result 9.5 ug/L
	CP14-PZM062	Benzene	Downward	100	no, and last 4 results ND
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND
		bis(2-Ethylhexyl)phthalate	Upward	1.0	no, and last 4 results ND
		Naphthalene	Downward	115	no, most recent result 0.17 ug/L
	CP16-PZM035	Benzene	Downward	100	YES, most recent result 110 ug/L
		Benzo[a]pyrene	Downward	0.16	no, and last 4 results ND

Trend identified AND recent result is above Final RGs
Trend identified but recent results are all ND

Notes:
(a) Trend testing was conducted for all COCs for GAA F where an exceedance of the applicable Final Remedial Goals (RGs) was identified in the groundwater database (E-Attachment #1B).

(b) GAA F COCs include benzene, bis(2-Ethylhexyl)phthalate, and naphthalene. Benzo[a]pyrene was also included in the trend analysis.

(c) If the result of the testing was that no upward or downward trend was identified for a parameter at a particular well, it was not included in this table.


Groundwater Assessment Area E
B[a]p
CP02-PZM026
CP02-PZM007
B, B[a]p, N
B
CP21-PZM004
B11-026-PZ
B
CP07-PZM006
CP08R-PZM034
CP08R-PZM008
CP20-PZM011
B, B[a]p
bis
CP19R-PZM008
CP18R-PZM009
B, N
CP12-PZM012
CP12-PZM052
N
N
CP16-PZM008
CP16-PZM035
B
B
CP14-PZM009
CP14-PZM062
N
LEGEND
Groundwater Monitoring Location (Shallow)
Groundwater Monitoring Location (Intermediate)
Abandoned NAPL Well
CPA CMS GAAs
COA IM Cell
Note:
Not sufficient results for trend analysis
No trend indicated
Decreasing trend
Increasing trend
Highlight and star indicates parameter exceeds Finals RGs.
TREND LEGEND:
B = Benzene
B[a]p = Benzo[a]pyrene
Bis = Bis(2-ethylhexyl)phthalate
E = Ethylbenzene
N = Naphthalene
X = Xylenes
Coke Point Area CMS
Final Remedial Goal
Exceedance Trends - GAA F
June 12, 2025
Appendix
G
ARM Group LLC
Engineers and Scientists
Tradepoint Atlantic
Sparrows Point
Baltimore County, MD
ARM Project 21010306

Appendix G - GAA B (Cell 1) Statistically Signifiant Trends
CPA Groundwater CMS

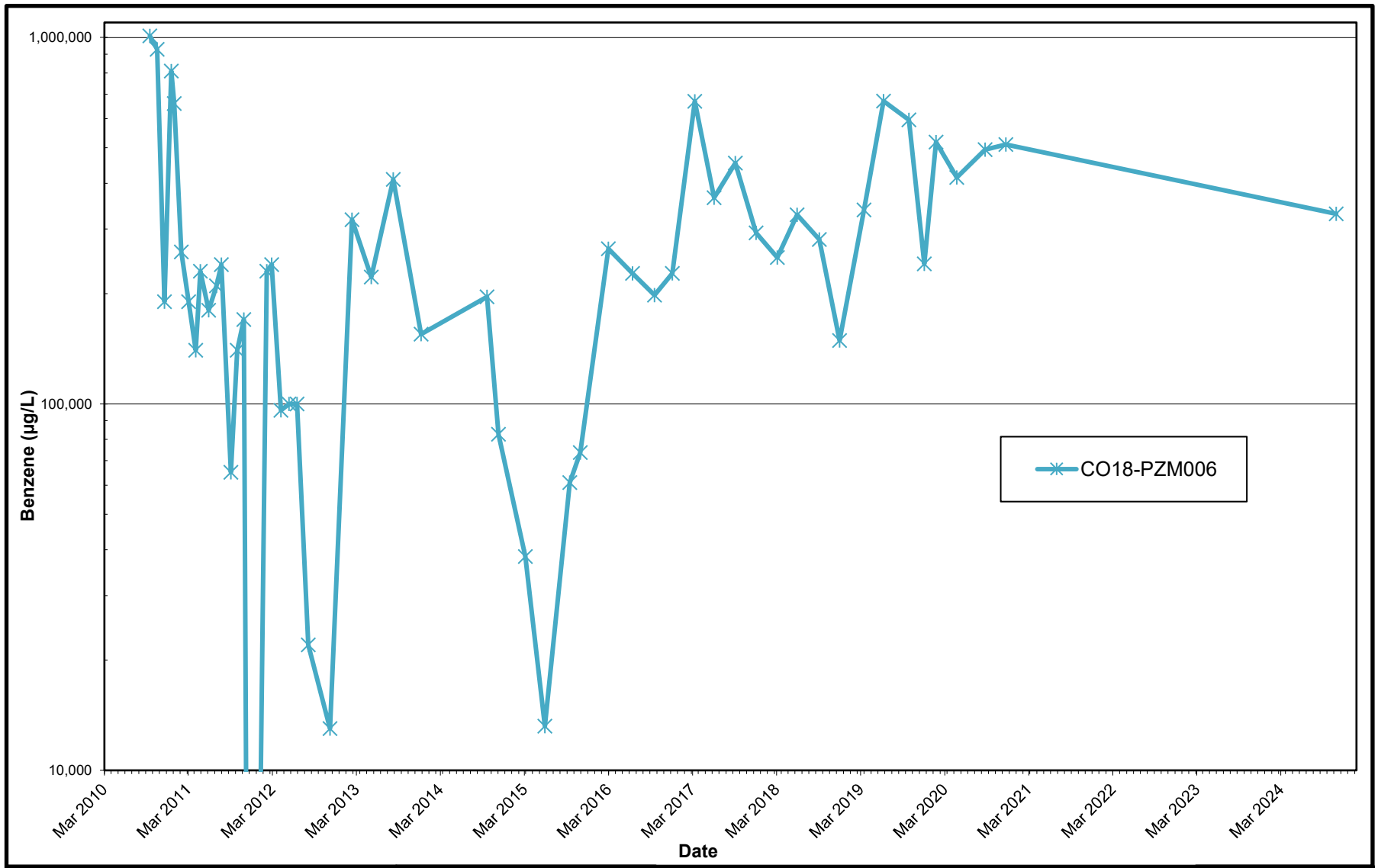
Zone	Well ID	Parameter Name	Statistical Trend	Final RG (ug/L)	Notes
Shallow	CO93-PZM	Benzene	Downward	100	
	CO190-MWS	Naphthalene	Upward	115	2024 average concentration was 160 ug/L, slightly above the Final RG of 115 ug/L.
	CO191-MWS	Benzene	Downward	100	
	CO02-PZM006	Benzene	Downward	100	
		Naphthalene	Downward	115	
	CO18-PZM006	Benzene	Upward	100	Not sampled regularly in recent years, significant decrease since initial 2010 sampling.

Notes:

(a) Trend testing was conducted for benzene only for the following five wells within the Cell 1 vicinity: CO93-PZM, CO190-MWS, CO191-MWS, CO02-PZM006, and CO18-PZM006.

(b) If the result of the testing was that no upward or downward trend was identified for a parameter at a particular well, it was not included in this table.

Date	Benzene (ug/L)	Percent Reduction	Date	Naphthalene (ug/L)	Percent Reduction
CO93-PZM					
2010 Average	235,500	**34%**	2013 Average	9,695	**82%**
2024 Average	156,000		2024 Average	1,740	
CO190-MWS					
2019 Average	368,000	**18%**	2019 Average	135	**41%**
2024 Average	301,500		2024 Average	80	
CO191-MWS					
5/5/2021	107,000	**68%**	5/5/2021	377	**50%**
6/7/2024	34,000		6/7/2024	190	
CO02-PZM006					
2010 Average	486,525	**72%**	2013 Average	491	**48%**
2020 Average	137,750		2020 Average	253	
CO18-PZM006					
2010 Average	734,500	**55%**	2013 Average	299.5	**76%**
2020 Average	503,403		2020 Average	287	
11/4/2024	331,342		11/4/2024	71	



ARM Group LLC
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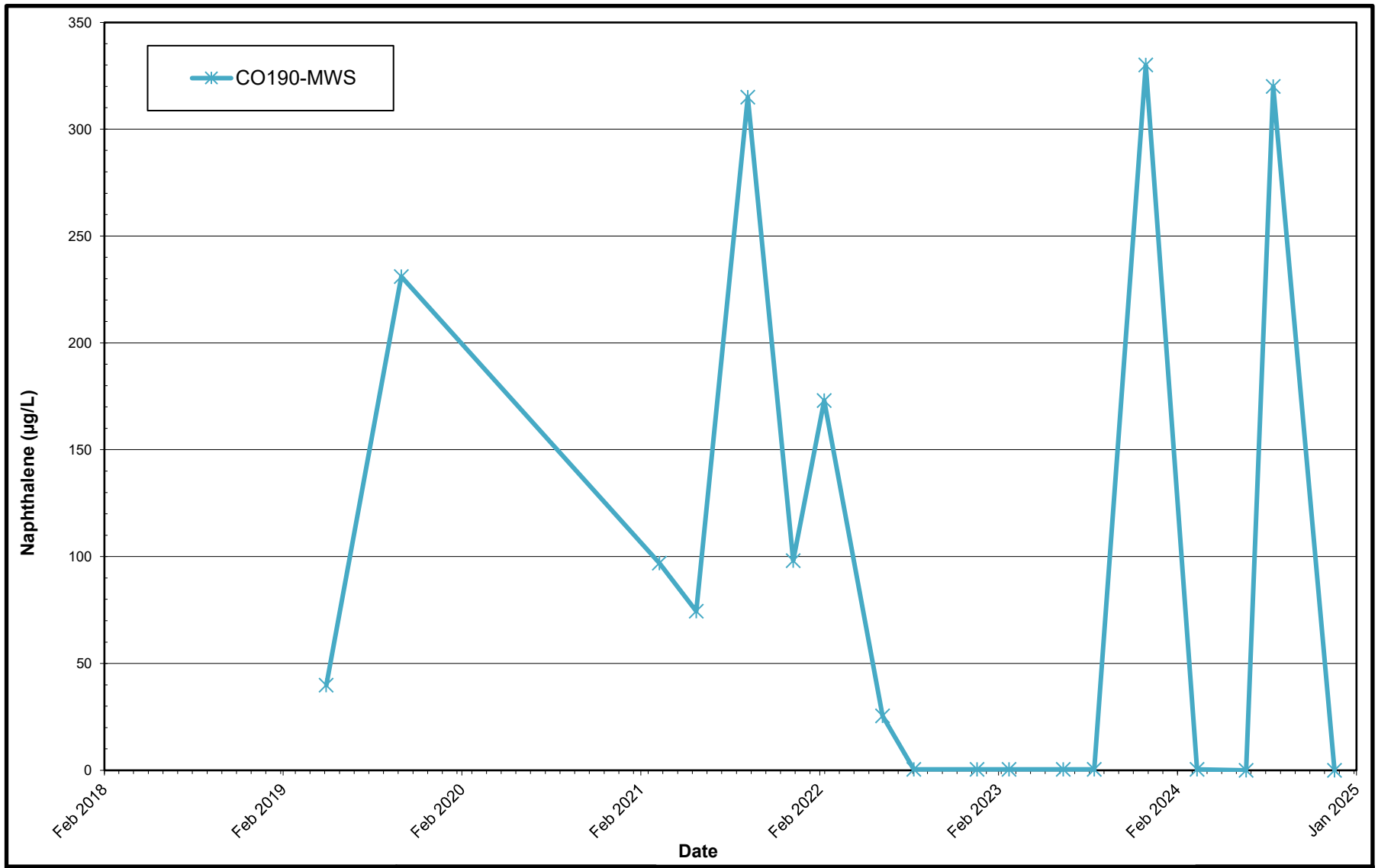
Former Coke Oven Area
Tradepoint Atlantic

Sparrows Point, Maryland

Benzene in Groundwater
Cell 1 Shallow Zone

June, 2025

Appendix G



ARM Group LLC
Engineers and Scientists

Former Coke Oven Area
Tradepoint Atlantic

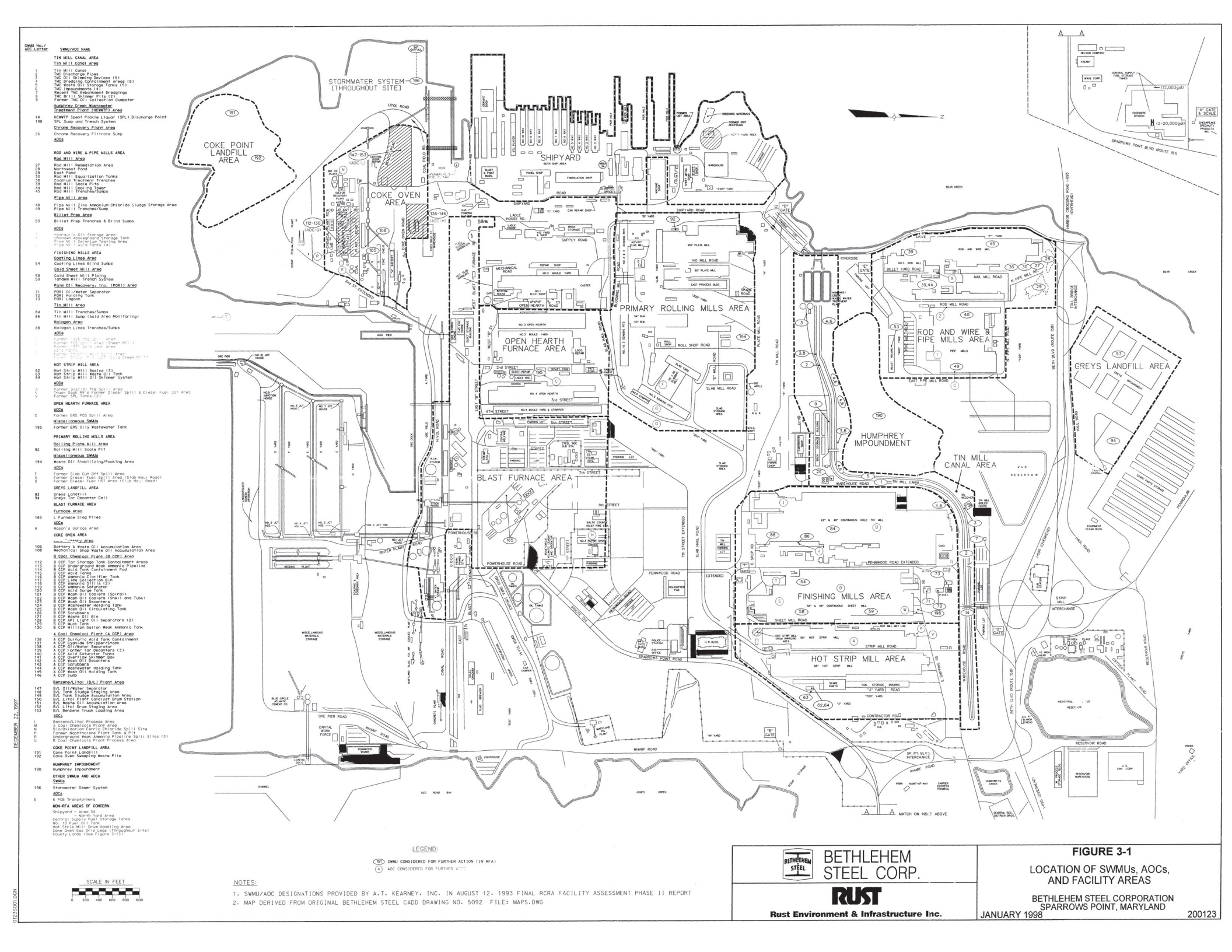
Sparrows Point, Maryland

Naphthalene in Groundwater
Cell 1 Shallow Zone

June2025

Appendix G

APPENDIX H-1


SWMU No./ AOC Letter
SWMU/AOC NAME
TIN MILL CANAL AREA
Tin Mill Canal Area
1 Tin Mill Canal
2 TMC Discharge Pipes
3 TMC Oil Sampling Devices (5)
4 TMC Dredging Containment Areas (5)
5 TMC Waste Oil Storage Tanks (5)
6 TMC Impoundments (4)
7 Recent TMC Embankment Dredgings
8 TMC Oil Skimmer Pits (2)
9 Former TMC Oil Collection Dumpster
Humphrey Creek Wastewater Treatment Plant (HCWTP) Area
14 HCWTP Spent Pickle Liquor (SPL) Discharge Point
198 SPL Sump and Trench System
Chrome Recovery Plant Area
26 Chrome Recovery Filtrate Sump
AOCs
ROD AND WIRE & PIPE MILLS AREA
Rod Mill Area
27 Rod Mill Remediation Area
28 Northwest Pond
29 East Pond
30 Rod Mill Equalization Tanks
38 Cadmium Treatment Trenches
39 Rod Mill Scale Pits
44 Rod Mill Cooling Tower
45 Rod Mill Trenches/Sumps
Pipe Mill Area
48 Pipe Mill Zinc Ammonium Chloride Sludge Storage Area
49 Pipe Mill Trenches/Sump
Billet Prep Area
53 Billet Prep Trenches & Blind Sumps
AOCs
Hydraulic Oil Storage Area
Unknown Aboveground Storage Tank
Pipe Mill Selenium Testing Area
Pipe Mill Acid Tanks (4)
FINISHING MILLS AREA
Coating Lines Area
54 Coating Lines Blind Sumps
Cold Sheet Mill Area
58 Cold Sheet Mill Piping
59 Tandem Mill Trench System
Palm Oil Recovery, Inc. (PORI) Area
71 PORI Oil/Water Separator
72 PORI Holding Tank
73 PORI Lagoon
Tin Mill Area
84 Tin Mill Trenches/Sumps
86 Tin Mill Sump (Acid Area Monitoring)
Halogen Area
88 Halogen Lines Trenches/Sumps
AOCs
Former 1986 PCB Spill Area
Former 1988 Spill Area (Sheet Mill)
Former 1991 AOC Area
Former Chrome Leaks (3) Area
Former Sheet Mill Spill Area
HOT STRIP MILL AREA
62 Hot Strip Mill Basins (3)
63 Hot Strip Mill Waste Oil Tank
64 Hot Strip Mill Oil Skimmer System
AOCs
A Former 3/21/91 PCB Spill Area
V Truck Dock #5 & Former Diesel Spill & Diesel Fuel UST Area
V Former SPL Tanks (2)
OPEN HEARTH FURNACE AREA
AOCs
C Former ERS PCB Spill Area
Miscellaneous SWMUs
195 Former ERS Oily Wastewater Tank
PRIMARY ROLLING MILLS AREA
Rolling Plate Mill Area
92 Rolling Mill Scale Pit
Miscellaneous SWMUs
194 Waste Oil Stabilizing/Packing Area
AOCs
F Former Slab Cut Off Spill Area
G Former Diesel Fuel Spill Area (Slab Haul Road)
Q Former Diesel Fuel UST Area (5th & Mcl. Road)
GREYS LANDFILL AREA
93 Greys Landfill
94 Greys Tar Decanter Cell
BLAST FURNACE AREA
Furnace Area
165 L Furnace Slag Piles
AOCs
H Mason's Garage Area
COKE OVEN AREA
105 Battery A Waste Oil Accumulation Area
108 Mechanical Shop Waste Oil Accumulation Area
B Coal Chemical Plant (B CCP) Area
112 B CCP Tar Storage Tank Containment Areas
113 B CCP Underground Weak Ammonia Pipeline
114 B CCP Acid Tank Containment Pad
115 B CCP Acid Tanks
116 B CCP Ammonia Clarifier Tank
117 B CCP Lime Collection Bin
118 B CCP Lime Silo #2
119 B CCP Ammonia Saturator
120 B CCP Acid Surge Tank
121 B CCP Wash Oil Coolers (Spiral)
122 B CCP Wash Oil Coolers (Shell and Tube)
123 B CCP Wash Oil Decanters
124 B CCP Wastewater Holding Tank
125 B CCP Wash Oil Circulating Tank
126 B CCP Scrubbers
127 B CCP Lime Silo Bin
128 B CCP API Light Oil Separators (2)
129 B CCP Muck Tank
130 B CCP Million Gallon Weak Ammonia Tank
A Coal Chemical Plant (A CCP) Area
136 A CCP Sulfuric Acid Tank Containment
137 A CCP Cyanide Stripper/Stack
138 A CCP Oil/Water Separator
139 A CCP Former Tar Decanters (3)
140 A CCP Acid Saturator Tanks
141 A CCP Acid Crystallizers
142 A CCP Wash Oil Decanters
143 A CCP Scrubbers
144 A CCP Wastewater Holding Tank
145 A CCP Wash Oil Holding Tank
146 A CCP Sump
Benzene/Litol (B/L) Plant Area
147 B/L Oil/Water Separator
148 B/L Tank Sludge Staging Area
149 B/L Tank Sludge Accumulation Area
150 B/L Litol Plant Catalyst Drum Station
151 B/L Waste Oil Accumulation Area
152 B/L Litol Drum Staging Area
153 B/L Benzene Truck Loading Area
AOCs
L Benzene/Litol Process Area
W A Coal Chemicals Plant Area
N Bio-Oxidation Ferric Chloride Spill Site
P Former Naphthalene Plant Tank & Pit
R Underground Weak Ammonia Pipeline Spill Sites (3)
U B Coal Chemicals Process Area
COKE POINT LANDFILL AREA
191 Coke Point Landfill
192 Coke Oven Sweeping Waste Pile
HUMPHREY IMPOUNDMENT
190 Humphrey Impoundment
OTHER SWMUs AND AOCs
SWMUs
196 Stormwater Sewer System
AOCs
E 6 PCB Transformers
NON-RFA AREAS OF CONCERN
Shipyard - Area 34
- North Yard Area
Central Supply Fuel Storage Tanks
No. 10 Fuel Oil Tank
Hot Strip Mill Drum Handling Area
Coke Oven Gas Drip Legs (Throughout Site)
County Lands (See Figure 3-13)
STORMWATER SYSTEM (THROUGHOUT SITE)
196
COKE POINT LANDFILL AREA
192
191
COKE OVEN AREA
SHIPYARD
PRIMARY ROLLING MILLS AREA
OPEN HEARTH FURNACE AREA
BLAST FURNACE AREA
ROD AND WIRE & PIPE MILLS AREA
HUMPHREY IMPOUNDMENT
TIN MILL CANAL AREA
GREYS LANDFILL AREA
FINISHING MILLS AREA
HOT STRIP MILL AREA
LITOL ROAD
SHIPYARD ROAD
BEAR CREEK
SPARROWS POINT BLVD (ROUTE 151)
BETH BLVD (ROUTE 151)
HARBOR CROSSING ROAD 1-695 (OVERHEAD)
TOLL BRIDGE TELEPHONE
RIVERSIDE DRIVE
BILLET YARD ROAD
NAIL MILL ROAD
ROD MILL ROAD
EAST PIPE MILL ROAD
PLATE MILL ROAD
TIN MILL ROAD
TIN MILL CANAL
WAREHOUSE ROAD
PENNWOOD ROAD
PENNWOOD ROAD EXTENDED
SLAB HAUL ROAD
SHEET MILL ROAD
STRIP MILL ROAD
STRIP MILL INTERCHANGE
RESERVOIR ROAD
WHARF ROAD
ORE PIER ROAD
POWERHOUSE ROAD
SINTER PLANT ROAD
CONTRACTOR RD
SP. PT. BLVD. INTERCHANGE
MATCH ON INSET ABOVE
A A
NELSON COMPANY
VACANT
WAVE CORP
CENTRAL SUPPLY FUEL STORAGE TANKS
(12,000gal)
(12-20,000gal)
EDGEMERE DIVISION
"A" GATE & SCALE
CHESAPEAKE SPECIALITY PRODUCTS INC.
LEGEND:
(151) SWMU CONSIDERED FOR FURTHER ACTION (IN RFA)
(A) AOC CONSIDERED FOR FURTHER ACTION
SCALE IN FEET
0 200 400 600 800 1000
NOTES:
1. SWMU/AOC DESIGNATIONS PROVIDED BY A.T. KEARNEY, INC. IN AUGUST 12, 1993 FINAL RCRA FACILITY ASSESSMENT PHASE II REPORT
2. MAP DERIVED FROM ORIGINAL BETHLEHEM STEEL CADD DRAWING NO. 5092 FILE: MAPS.DWG
BETHLEHEM STEEL CORP.
RUST
Rust Environment & Infrastructure Inc.
FIGURE 3-1
LOCATION OF SWMUs, AOCs, AND FACILITY AREAS
BETHLEHEM STEEL CORPORATION
SPARROWS POINT, MARYLAND
JANUARY 1998
200123
DECEMBER 22, 1997
012350010DGN

Parcel B4

Parcel B5

Parcel B18

Cell 2

Cell 6

Cell 1

Parcel B10

Cell 3

Cell 5

Parcel B11

Parcel B12

PATAPSCO RIVER

LEGEND

Former COA IM Cell

Parcel Boundary

Coke Point Area CMS
5000 Set
January 7, 2025

Figure
16

ARM Group LLC
Engineers and Scientists

0 62.5 125 250 Feet

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

Source: E

P:\Environmental\Arm Group\160443M EAC TPA Redevelopment\GIS\CPA CMS Set.mxd



Coke Point Area CMS
5100 Set
January 7, 2025

Figure 16

ARM Group LLC
Engineers and Scientists

Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

Source: Esri

Parcel B4

Parcel B5

Parcel B18

Cell 2

Cell 6

Cell 1

Parcel B10

Cell 3

Cell 5

Parcel B11

Parcel B12

PATAPSCO RIVER

LEGEND

Former COA IM Cell

Parcel Boundary

Coke Point Area CMS
5500 Drawing Set
January 7, 2025

Figure 16

ARM Group LLC
Engineers and Scientists

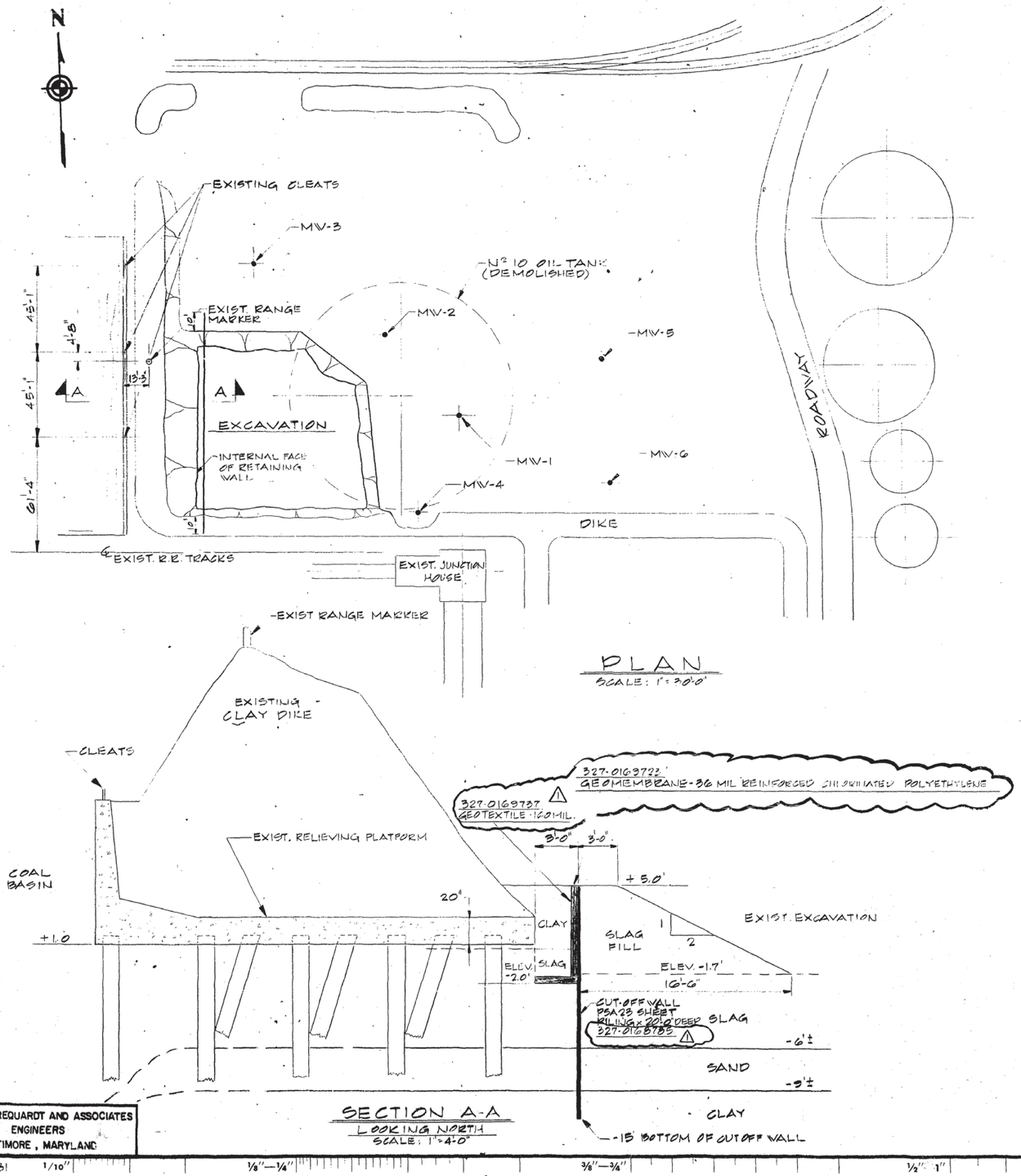
Tradepoint Atlantic
Sparrows Point

Baltimore County, MD
ARM Project 20010210

Source: Esri

P:\Environmental\Active Groups\190943M EAG_TPA Redevelopment\GIS\CPA CMS Grid.mxd

192463



PLAN

SCALE: 1" = 30'-0"

SECTION A-A

LOOKING NORTH

SCALE: 1" = 4'-0"

GENERAL NOTES:

1) SITE PREPARATION WILL BE REQUIRED ALONG THE SHEET PILE LINE AT THE NORTH AND SOUTH ENDS OF THE EXISTING EXCAVATION AND TO LOWER THE GRADE BETWEEN THE SHEET PILING AND THE RELIEVING PLATFORM FOR INSTALLATION OF THE GEOMEMBRANE.

2) THE CUTOFF WALL WILL CONSIST OF APPROXIMATELY 115 FEET OF PSA 23, ASTM A 328 SHEET PILING, 20 FEET IN LENGTH.

3) A FLEXIBLE GEOMEMBRANE, SUCH AS 36 MIL. POLYETHYLENE, SHALL BE PLACED IN CONTACT WITH THE FACE OF THE SHEET PILES. A PROTECTIVE LATER OF 160 MIL NON-WOVEN GEOTEXTILE SHALL BE PLACED OVER THE GEOMEMBRANE. GEOMEMBRANE AND GEOTEXTILE ARE TO COVER APPROXIMATELY 98 FEET OF THE CUT OFF WALL LENGTH (TOP OF BANK TO TOP OF BANK OF EXISTING EXCAVATION) 20 FOOT WIDTHS ARE PREFERRED AND WIDTHS ARE TO BE OVERLAPPED TO REDUCE SEEPAGE.

4) SLAG FILL WILL BE REQUIRED TO CONSTRUCT A WORKING PLATFORM FOR CONSTRUCTION EQUIPMENT. THIS WORKING PLATFORM SLAG FILL IS TO BECOME PART OF THE FILL EAST OF THE SHEET PILING AS SHOWN ON SECTION A-A.

5) PORTIONS OF THE EXISTING CLAY DIKE ON THE RELIEVING PLATFORM ARE TO BE USED (IN LIEU OF SLAG) IN THE UPPER AREA BETWEEN THE RELIEVING PLATFORM AND THE SHEET PILES. CARE MUST BE TAKEN SO AS NOT TO DISTURB THE EXISTING RANGE MARKER.

WHITMAN, REQUARDT AND ASSOCIATES
ENGINEERS
BALTIMORE, MARYLAND

REVISION				
Number	Date	DESCRIPTION	Coordinate	Initial
P	5/31/89	FIRST ISSUE		JJP
P	6/15/89	ADDED EXCAVATION NOS. REV. NOTE 3		JJP

FINISHES ON THIS DRAWING CONFORM TO A. I. S. E. STANDARDS

DEPT: COKE OVENS
SECTION OR AREA: COAL DOCK BASIN
JOB: N° 10 TANK REMEDIATION
PART: PLAN & SECTION
CHECKED BY: H.W.B. 5113 5-31-89
DRAWN BY: P.L.L. SCALE AS SHOWN = 1 ft.
APPROVED:
PLANT: SPARROWS POINT
DRAWING NO.: 192463

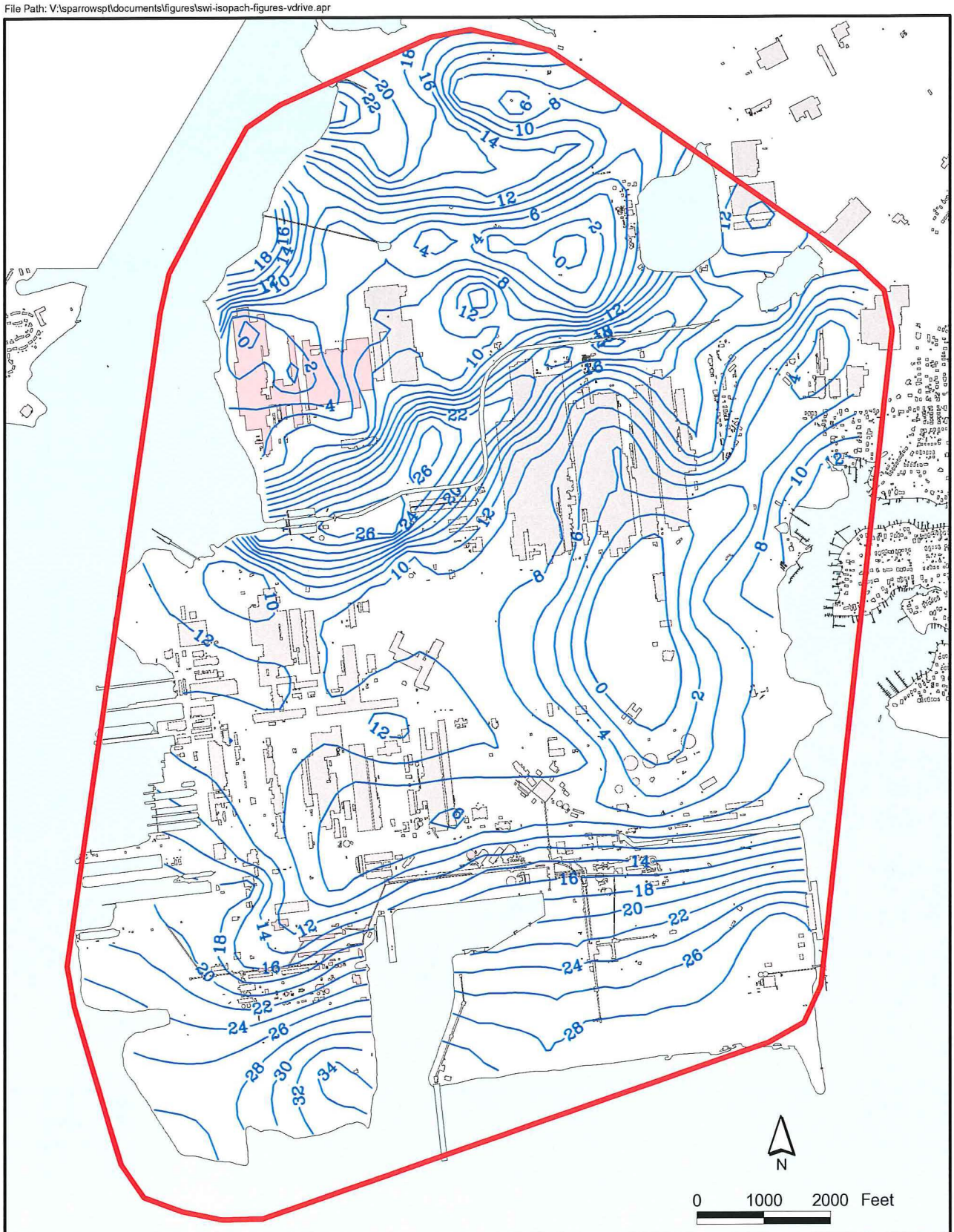
42762 COAL DOCK BULKHEAD
DRAWING NO. REFERENCE

W/O 11781 1/10" 1/8"—1/4" 3/8"—3/4" 1/2"—1"

AC AB AA Z X W U T S R Q P N M L K H G F E D C B A
No. Pcs. Req'd. ML.
9P11-001-2100 Acctg. Charge/E. W. O.

01 91 (MA) TS SM MS PA BR LU

File Path: V:\sparrowspt\documents\figures\swi-isopach-figures-vdrive.apr



LEGEND

- Model Boundary
- Water Bodies
- Existing Buildings
- Demolished Buildings
- Equal Thickness Contour
- 10 = Thickness in feet

Figure 2.2-6
Slag Fill Isopach Map

Bethlehem Steel Corp. - Sparrows Point Facility

CH2MHILL

APPENDIX H-2

ARM Group LLC
Engineers and Scientists

Well ID: CW1

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
	40	0	(0-10') FILL Black SLAG with light brown and red SAND, no placticity, no cohesion (DRY)	
2		0		
		0		
4		0		
		0		
6	40	0		
		0		
8		0		Wet @ 8' bgs
		0		
10		0	(10-11') FILL Black SLAG with CLAY, no plasticity, no cohesion (WET)	Sheen observed @ 10' bgs
		0	(11-15') FILL Dark grey SAND, well sorted, no plasticity, no cohesion (WET)	
12	40	0		
		0		
14		0		
		0		
16	95	0	(15-18') NATIVE Dark grey CLAYEY SAND, staining observed, no plasticity, no cohesion (WET)	
		0		
18		0	(18-20') NATIVE Grey grading to light brown CLAY, no plasticity, no cohesion (WET)	
		0		
20			END OF BORING	

Total Borehole Depth: 20' bgs
Boring terminiated after taking geotech sample of clay.

03-13-2025 P:\EnviroAnalytics Group\20010218 EAG Parcel B18\B18 Cutoff Wall Borings\2_bor logs\CW1_B18_Cutoff_Wall_Borings.bor

ARM Group LLC
Engineers and Scientists

Well ID: CW2

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: Allied
Driller	: T. NIbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
	50	0	(0-5') FILL Dark grey-black GRAVEL SLAG with SAND, no plasticity, no cohesion (DRY)	
2		0		
		0		
4		0		
	50	0	(5-12') FILL Light brown broken up CONCRETE, no plasticity, no cohesion (DAMP/ WET)	
6		0		
		0		
8		0		Wet @ 9' bgs
		0		
10	80	0		
		0		
12		0	(12-15') NATIVE Green and grey SILTY SAND with GRAVEL, no plasticity, no cohesion (WET)	
		0		
14		0		
	100	0	(15-18') NATIVE Dark grey SAND, no plasticity, no cohesion (WET)	Staining observed @ 17-18' bgs
16		0		
		0		
18		0	(18-20') NATIVE Light brown CLAY, no plasticity, no cohesion (WET)	
		0		
20			END OF BORING	

Total Borehole Depth: 20' bgs
Boring terminiated after taking geotech. sample of clay.

03-13-2025 P:\EnviroAnalytics Group\20010218 EAG Parcel B18\B18 Cutoff Wall Borings\2_bor logs\CW2_B18_Cutoff_Wall_Borings.bor

ARM Group LLC
Engineers and Scientists

Well ID: CW3

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: Allied
Driller	: T. NIbblett
Drilling Equipment	: Geoprobe 7822DT

Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
		0	(0-1') FILL Brown organic topsoil, no plasticity, no cohesion (DRY)	
		0	(1-6') FILL Dark grey CLAY with SILT and GRAVEL, no plasticity, no cohesion (DRY)	
2	75	0		
		0		
4		0		No groundwater observed
		0		
6	50	0	(6-7') FILL Light grey SANDY CLAY, no plasticity, no cohesion (DAMP)	
		0	(7-7.5') FILL CONCRETE (DRY)	Hit refusal @ 7.5' bgs
8			END OF BORING	
10				

Total Borehole Depth: 7.5' bgs
Boring terminiated after hitting refusal at 7.5' bgs.

03-13-2025 P:\EnviroAnalytics Group\20010218 EAG Parcel B18\B18 Cutoff Wall Borings\2_bor logs\CW3_B18_Cutoff_Wall_Borings.bor

ARM Group LLC
Engineers and Scientists

Well ID: CW4

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
		0	(0-5') FILL Dark grey to brown GRAVEL SLAG, no plasticity, no cohesion (DRY)	
2	10	0		
		0		
4		0		
		0		
		0	(5-7.5') FILL Dark grey to brown GRAVEL SLAG, no plasticity, no cohesion (DRY)	
6		0		
	10	0		
		0	(7.5-10') FILL Dark grey to brown GRAVEL SLAG, no plasticity, no cohesion (WET)	Wet @ 7.5' bgs
8		0		
		0		
10		-	(10-15') NO RECOVERY	
		-		
12	0	-		
		-		
14		-		
		-		
		-	(15-18') FILL DNAPL with FILL (WET)	
16		1.1		
		-		
18		-	(18-20') NATIVE Brown CLAY, medium plasticity, medium cohesion (WET)	Recovery not opened due to NAPL content.
		-		
20			END OF BORING	

Total Borehole Depth: 20' bgs
Boring terminiated after taking geotech. sample of clay.

03-13-2025 P:\EnviroAnalytics Group\20010218 EAG Parcel B18\B18 Cutoff Wall Borings\2_bor logs\CW4_B18_Cutoff_Wall_Borings.bor

ARM Group LLC
Engineers and Scientists

Well ID: CW5

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
2	50	0 0 0 0 0	(0-5') FILL Brown to black SILTY GRAVEL SLAG with SAND, no plasticity, no cohesion (DRY)	
4				
6	0	-	(5-10') NO RECOVERY	Wet in "No Recovery" region, somewhere between 5-10' bgs.
8		-		
10		-	(10-14') FILL SAND with GRAVEL, no plasticity, no cohesion (WET)	
12		0.5 -		
14		0.2 -	(14-16') FILL Grey GRAVEL with SAND, DNAPL prsent, no plasticity, no cohesion (WET)	
16		- 0.3	(16-18') NATIVE Dark grey CLAY, medium plasticity, medium cohesion (WET)	
18		- -	(18-20') NATIVE Light brown CLAY, no plasticity, no cohesion (WET)	
20		-	END OF BORING	

Total Borehole Depth: 20' bgs
Boring terminiated after taking geotech. sample of clay.

ARM Group LLC
Engineers and Scientists

Well ID: CW6

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
		0	(0-5') FILL Dark brown GRAVEL SLAG with SAND and SILT, no plasticity, no cohesion (WET)	
2	5	0		Wet somewhere between 0-5' bgs.
		0		
4		0		
		0		
		0	(5-9') FILL Dark grey GRAVEL SLAG with SAND and SILT, no plasticity, no cohesion (WET)	
6	60	0		
		0		
8		0		
		0	(9-13') FILL Black SLAG with NAPL, no plasticity, no cohesion (WET)	
10		1.5		
		-		
12		0.6		13' bgs getotech sample taken.
		-	(13-14.5') FILL Black SAND with NAPL, no plasticity, no cohesion (WET)	
14		0.3	(14.5-20') NATIVE Light brown CLAY, NAPL infused, no plasticity, no cohesion (WET)	
		0		
16		0		17' bgs geotech sample taken.
		0		
18		0		
		0		
20		-	(20-20.5') NATIVE Light brown CLAYEY SAND, no plasticity, no cohesion (WET)	
		-	(20.5-22.5') NATIVE Light brown CLAY, no plasticity, no cohesion (WET)	
22		-	(22.5-25') NATIVE Light grey SAND, no plasticity, no cohesion (WET)	
		-		
24		-		DRC sample @ 24' bgs.
			END OF BORING	
26				

Total Borehole Depth: 25' bgs

03-13-2025 P:\EnviroAnalytics Group\20010218 EAG Parcel B18\B18 Cutoff Wall Borings\2_bor logs\CW6_B18_Cutoff_Wall_Borings.bor

ARM Group LLC
Engineers and Scientists

Well ID: CW7

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. NIbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0	10		(0-3') FILL Dark grey SLAG, no plasticity, no cohesion (DRY)	Hit refusal @ 3' bgs on top of concrete platform.
2			END OF BORING	
4				
6				
8				
10				
12				
14				
16				
18				
20				

Total Borehole Depth: 3' bgs

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Well ID: CW8

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT

Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
		0	(0-5') FILL Brown GRAVEL SLAG, no plasticity, no cohesion (WET)	
		0		
2	5	0		Wet between 0-5' bgs.
		0		
4		0		
		0		
6		0	(6-9') FILL Black GRAVEL SLAG with SILT and SAND, no plasticity, no cohesion (WET)	
	60	0		
8		0		
		0.5	(9-12') FILL Black GRAVEL SLAG with SILT and SAND, no plasticity, no cohesion, NAPL observed (WET)	NAPL oberved from 9-14' bgs.
10		-		
		0.9		
12	50	0.5	(12-14') NATIVE Black SAND, no plasticity, no cohesion (WET)	
		-		
14		0	(14-15') NATIVE Light grey SANDY CLAY grading to CLAY, no plasticity, no cohesion (WET)	
			END OF BORING	
16				
18				
20				

Total Borehole Depth: 15' bgs
Boring terminiated after taking geotech. sample.

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ARM Group LLC
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Well ID: CW9

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0		-	(0-3') NATIVE Grey to brown SANDY CLAY, no plasticity, no cohesion (DRY)	
2		-		Hit refusal @ 3' bgs.
		-	END OF BORING	
4				
6				
8				
10				
12				
14				
16				
18				
20				

Total Borehole Depth: 3' bgs
Boring terminiated after hitting refusal @ 3 ft.

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ARM Group LLC
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Well ID: CW10

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT

Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
		0	(0-4.5') FILL Light grey GRAVEL with SAND, no plasticity, no cohesion (WET)	
		0		
2	10	0		Wet somewhere between 0-5' bgs.
		0		
4		0.3		NAPL observed from 4.5-15' bgs.
		0.2	(4.5-6') FILL Balck SLAG with CLAY and peat, no plasticity, no cohesion (WET)	
6		0.3	(6-8') FILL Black GRAVEL SLAG, no plasticity, no cohesion (WET)	
	50	0.3		
8		0.3	(8-15') FILL Black SAND with GRAVEL and peat, no plasticity, no cohesion (WET)	
		0.3		
10		-		
		0.3		
12	5	-		
		0.3		
14		-		
		0	(15-16') NATIVE Grey CLAYEY SAND, no plasticity, no cohesion (WET)	
16		0	(16-20') NATIVE Grey graded to light brown CLAY, medium plasticity, medium cohesion (WET)	
	100	0		
18		0		
		0		
20			END OF BORING	

Total Borehole Depth: 20' bgs

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Well ID: CW11

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-1') FILL Dark grey SLAG GRAVEL with SAND AND SILT, no plasticity, no cohesion (DRY)	Hit refusal @ 1' bgs.
			END OF BORING	

Total Borehole Depth: 1' bgs

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Well ID: CW12

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0				
	30	0	(0-9') FILL Light grey and white GRAVEL SLAG and SAND, no plasticity, no cohesion (DRY)	
2		0		
		0		
4		0		
		0		
6	30	0		
		0		
8		0		
		0	(9-15') FILL Black stained GRAVEL SLAG and SAND, no plasticity, no cohesion (WET)	Wet @ 9' bgs.
10	30	0		
		0		
12		0		
		0		
14		0		
	90	0	(15-17') NATIVE Black stained peat, NAPL infused, medium plasticity, medium cohesion (WET)	
16		1.2		
		0.8		
18		0	(18-20') NATIVE Grey grading to light brown CLAY, high plasticity, no cohesion (WET)	
		0		
20			END OF BORING	

Total Borehole Depth: 20' bgs
Boring terminiated after taking geotech. sample of clay.

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Well ID: CW13

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: Kim Engineering
Driller	: T. NIbblett
Drilling Equipment	: Auger
Date Completed	: 4/15/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-15') FILL Black GRAVEL SLAG with SAND and SILT (DRY)	Wet @ 9' bgs.
2				
4				
6				
8				
10				
12				
14				
16			(15-18') FILL Black GRAVEL SLAG with SAND and SILT, NAPL sheen (DRY)	
18			(18-20') NATIVE CLAY (WET)	
20				

Total Borehole Depth: 20' bgs
Boring terminiated after taking geotech. sample of clay.

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Well ID: CW14

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: Kim Engineering
Driller	: T. NIbblett
Drilling Equipment	: Auger
Date Completed	: 4/15/2022
Weather	:
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-11') FILL GRAVEL SLAG with SAND and SILT (DRY)	
2				
4				
6				
8				
10				
11			(11-16') FILL GRAVEL SLAG with SAND and SILT, NAPL sheen (WET)	Wet @ 11' bgs.
12				
14				
16			(16-17') NATIVE Grey CLAY (WET)	
17			(17-18') NATIVE Brown SAND (WET)	
18			(18-20') NATIVE Brown CLAY (WET)	
20				

Total Borehole Depth: 20' bgs
Boring terminiated after taking geotech sample of clay.

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Well ID: CW15

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT

Date Completed	: 4/15/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-5') FILL SLAG GRAVEL with SAND and SILT (DRY)	
2				
			END OF BORING	
4				
6				
8				
10				
12				
14				
16				
18				
20				

Total Borehole Depth: 5' bgs

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Well ID: CW16

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/15/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-7') FILL SLAG GRAVEL with SAND and SILT (DRY)	
2				
4				
6				
			END OF BORING	
8				
10				
12				
14				
16				
18				
20				

Total Borehole Depth: 5' bgs

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Well ID: CW17

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/15/2022
Weather	:
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-6') FILL SLAG GRAVEL with SAND and SILT (DRY)	
6			END OF BORING	

Total Borehole Depth: 6' bgs

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Well ID: CW18

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/15/2022
Weather	:
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-14.5') FILL SLAG GRAVEL with SAND and SILT (DRY)	
2				
4				
6				
8				
10				
12				
14				
			END OF BORING	
16				
18				
20				

Total Borehole Depth: 14.5' bgs

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Well ID: CW19

(page 1 of 1)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/18/2022
Weather	:
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	DESCRIPTION	REMARKS
0			(0-6') FILL SLAG GRAVEL with SAND and SILT (DRY)	
6			END OF BORING	

Total Borehole Depth: 6' bgs

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Well ID: CW20

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. Nlbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 50's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	Blow Count	DESCRIPTION	REMARKS
0				(0-2) FILL Black SLAG GRAVEL with SILT and SAND, loose, no plasticity, no cohesion (DRY)	
2				(2-3') FILL Grey CLAYEY SILT, low plsaticity, no cohesion, damp (DRY)	
4				(3-7') FILL Black SLAG GRAVEL with SILT and SAND, loose, no plasticity, no cohesion (DRY)	
6	50	- 9.3	1/1/3/2		
8				(7-7.1') FILL Very light beige SANDY GRAVEL, no plasticity, no cohesion (DRY) (7.1-12') FILL Black to dark grey graded SLAG GRAVEL with SILT and SAND, loose (DRY)	
10	50	- 3.6	10/30/24/50/3		Wet @ 10 ft bgs
12				(12-16') FILL Black SLAG GRAVEL with SILT and SAND, loose (WET)	(50 blows to go 3")
14					
16	92	20.6 2.7	4/17/12/12	(16-21.5') NATIVE Light grey to dark grey graded SAND, well sorted, loose, no plasticity, no cohesion (WET)	
18					
20					

Total Borehole Depth: 30' bgs
Boring terminiated after taking geotech. sample of clay.
Hole pressure grouted

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Well ID: CW20

(page 2 of 2)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: GSI
Driller	: T. NIbblett
Drilling Equipment	: Geoprobe 7822DT
Date Completed	: 4/14/2022
Weather	: 50's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	Blow Count	DESCRIPTION	REMARKS
20	25	-	1/2/2/2		
		1.6		(21.5-23.8') NATIVE Brown CLAY, low plasticity, no cohesion (WET)	
22	100	1	3/4/2		
		0			
24	100	1.7	1/1/2/2	(23.8-24') NATIVE Light brown to brown SILTY CLAY with SAND, no plasticity, no cohesion (WET)	
		0.9		(24-30') NATIVE Light brown to brown graded CLAY, low plasticity, high cohesion (WET)	
26	100	0	1/1/1/1		
		0			
28	74	0	1/1/1/1		
		0			
30				END OF BORING	
32					
34					
36					
38					
40					

Total Borehole Depth: 30' bgs
Boring terminiated after taking geotech. sample of clay.
Hole pressure grouted

03-17-2025 P:\EnviroAnalytics Group\20010218 EAG Parcel B18\B18 Cutoff Wall Borings\2_bor logs\CW20_B18_Cutoff_Wall_Borings.bor

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Engineers and Scientists

Well ID: CW21

(page 1 of 2)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: Kim Engineering
Driller	: T. NIbblett
Drilling Equipment	: Auger
Date Completed	: 4/29/2022
Weather	: 60's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	Blow Count	DESCRIPTION	REMARKS
0				(0-11') FILL Dark grey SLAG GRAVEL with SAND and SILT, loose, no plasticity, no cohesion (DRY)	
2					
4					Wet @ 4' bgs.
6	25	- 0.2	2 2 5 8		Only have ~3' of clay below DNAPL.
8					
10	25	- 3.4	5 2 1 2		
12				(11-16') FILL Dark grey SLAG GRAVEL with SAND and SILT, loose, no plasticity, no cohesion, DNAPL infused (DRY)	
14					
16	25	- 7.2	1 1 1 1	(16-17') NATIVE Dark grey SANDY CLAY with SILT, no plasticity, no cohesion (WET)	
18	75	0.5 0.5	1 2	(17-20') NATIVE Light brown CLAY, low plasticity, no cohesion (WET)	Shelby tube from 19-21' bgs
20					

Total Borehole Depth: 30' bgs
Boring terminiated after taking geotech. sample of clay.

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Well ID: CW21

(page 2 of 2)

Project Name	: B18 Soil Boring Investigation	Date Completed	: 4/29/2022
Project Number	: 20010218	Weather	: 60's, Sunny
Client	: EnviroAnalytics Group		
Site	: Sparrow's Point		
Borehole Location	: EAG Parcel B18	Northing (US ft)	:
ARM Representative	: J. Barna, GIT	Easting (US ft)	:
Checked by	: C. Norris		
Drilling Company	: Kim Engineering		
Driller	: T. NIbblett		
Drilling Equipment	: Auger		

Depth (ft.)	SS# %Recovery	PID (ppm)	Blow Count	DESCRIPTION	REMARKS
20				(20-21') NATIVE Dark grey SANDY CLAY grading to CLAYEY SAND, no plasticity, no cohesion (WET)	14" of 24" recovery for shelby tube.
22	100	1 0.3	3 4 4 6	(21-23') NATIVE Dark grey to light grey graded CLAYEY SAND, loose, no plasticity, no cohesion (WET)	
24	50	- 0	2 6 16 16	(23-25.5') NATIVE Dark grey to light grey graded CLAYEY SAND with quartz GRAVEL, loose, no plasticity, no cohesion (WET)	
26	100	0 0	4 8 21 26	(25.5-26.5') NATIVE Grey SANDY CLAY with SILT (WET)	
28	100	0 0.7	6 17 21 26	(26.5-27) NATIVE Dark grey to light grey graded CLAYEY SAND, loose, no plasticity, no cohesion (WET) (27-30') NATIVE Dark grey CLAYEY SAND, no plasticity, no cohesion, loose (WET)	
30	50	0.5	5 7	END OF BORING	
32					
34					
36					
38					
40					

Total Borehole Depth: 30' bgs
Boring terminiated after taking geotech. sample of clay.

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Well ID: CW22

(page 1 of 2)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: Kim Engineering
Driller	: T. NIbblett
Drilling Equipment	: Auger

Date Completed	: 5/2/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	Blow Count	DESCRIPTION	REMARKS
0				(0-2') FILL Black SLAG GRAVEL with SAND and SILT, loose, no plasticity, no cohesion (DRY)	
2				(2-6') FILL Brown SANDY SILT, no plasticity, no cohesion, dry (DRY)	
4					
6	50	- 0	2 1 2 4	(6-9') FILL Light to medium brown and grey CLAY with SILT, no plasticity, no cohesion (DRY)	
8					
10	50	- 0.4	34 50/2	(9-11') FILL Light to medium brown and grey CLAY with SILT, no plasticity, no cohesion (WET)	Wet @ 9' bgs.
12				(11-18.5') FILL Blue/grey SANDY SLAG GRAVEL, loose, no plasticity, no cohesion (WET)	
14					
16	50	- 0.7	1 1 2 3		
18				(18.5-25') NATIVE Light brown CLAY with SILT, low plasticity, no cohesion (WET)	
20					

Total Borehole Depth: 30' bgs
Boring terminiated after taking geotech. sample of clay.

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Well ID: CW22

(page 2 of 2)

Project Name	: B18 Soil Boring Investigation
Project Number	: 20010218
Client	: EnviroAnalytics Group
Site	: Sparrow's Point
Borehole Location	: EAG Parcel B18
ARM Representative	: J. Barna, GIT
Checked by	: C. Norris
Drilling Company	: Kim Engineering
Driller	: T. NIbblett
Drilling Equipment	: Auger
Date Completed	: 5/2/2022
Weather	: 70's, Sunny
Northing (US ft)	:
Easting (US ft)	:

Depth (ft.)	SS# %Recovery	PID (ppm)	Blow Count	DESCRIPTION	REMARKS
20	50	- 0	1 3 1 1		Shelby tube taken from 22-24' bgs.
22					
24	50	- 2.5	7 11 12 14	(25-28') NATIVE Dark grey to light grey graded SAND, loose, no plasticity, no cohesion (WET)	19" of recovery.
26	100	4.5 5.0	7 10 15 9		
28	100	0 0.2	1 2 1 1	(28-29.5') NATIVE Light brown CLAY with SILT, low plasticity, no cohesion (WET)	
30				(29.5-30') NATIVE Dark grey to light grey graded SAND, loose, no plasticity, no cohesion (WET) END OF BORING	
32					
34					
36					
38					
40					

Total Borehole Depth: 30' bgs
Boring terminiated after taking geotech. sample of clay.

APPENDIX I

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area A
Coke Point Groundwater CMS

Estimated Remedial Costs for Assessment Area A Alternatives													
	Alternative 1: No Action			Alternative 2[a]: Capping, MNA, ECs/ICs			Alternative 3[b]: Bioremediation, Capping, MNA, ECs/ICs			Alternative 4[b]: ISCO, Capping, MNA, ECs/ICs			Notes
Cost Item	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	
Active Remedy	$ -	$ -	$ -	$ -	$ -	$ -	$ 65,000	$ 188,000	$ 7,000	$ 65,000	$ 219,000	$ 7,000	Capping costs considered under redevelopment program. Performance monitoring for years 1-5 is included as part of the remedial action.
MNA (Years 1-5)	$ -	$ -	$ -	$ 16,000	$ 15,000	$ 7,000	$ -	$ -	$ -	$ -	$ -	$ -	MNA to begin in Year 1 for Alternative 2. Assumes semi-annual sampling for 15 years.
MNA (Years 3-10)	$ -	$ -	$ -	$ -	$ 15,000	$ 7,000	$ 16,000	$ 15,000	$ 7,000	$ 16,000	$ 15,000	$ 7,000	MNA to begin in Year 3 for Alternatives 3 and 4, following the implemenation of the remedial action. Assumes semi-annual sampling for years 3-10.
MNA (Years 11-15)	$ -	$ -	$ -	$ -	$ 15,000	$ 7,000	$ -	$ 15,000	$ 7,000	$ -	$ 15,000	$ 7,000	MNA for Alternatives 2, 3, and 4. Assumes semi-annual sampling for years 11-15.
Estimated Total Remedial Costs for GAA A Alternatives													
Total Net Present Value	$ -	$ -	$ -	$ 16,000	$ 137,000	$ 11,000	$ 81,000	$ 449,000	$ 11,000	$ 81,000	$ 505,000	$ 11,000	Assumes a discount rate 7%.
NPV Costs for Project Duration	$ -			$ 164,000			$ 541,000			$ 597,000			

[a] MNA will be conducted on a semi-annual basis for the full 15 year duration

[b] MNA will be conducted after completion of the remedial action in years 3-15 of the project duration.

Assessment Area A - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring well installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$16,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 1-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$3,480	$7,000	
Reporting	1	Event	$5,000	$5,000	
Subtotal - Site Monitoring				$12,000	
Subtotal - Site Monitoring				$12,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$13,000	
Project Management			5%	$1,000	
Technical Support			5%	$1,000	
Total - Site Monitoring				$15,000	
Total Annual O&M Costs				$15,000	

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (15% scope, 10% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area A - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Costs		**Present Value**
Total Captial Costs	$16,000	$16,000
Total Annual O&M Costs		
Years 1-15	*$15,000*	*$137,000*
Total Period Costs	$7,000	$11,000
Total Net Present Value		$164,000

Annual Cash Flow			
Year	**Capital Costs**	**Annual O&M Costs**	**Periodic Costs**
1	$16,000	$15,000	$0
2	$0	$15,000	$0
3	$0	$15,000	$0
4	$0	$15,000	$0
5	$0	$15,000	$7,000
6	$0	$15,000	$0
7	$0	$15,000	$0
8	$0	$15,000	$0
9	$0	$15,000	$0
10	$0	$15,000	$7,000
11	$0	$15,000	$0
12	$0	$15,000	$0
13	$0	$15,000	$0
14	$0	$15,000	$0
15	$0	$15,000	$7,000

Assessment Area A - Alternative 3 - Bioremediation and Monitored Site Attenuation - Cost Estimate

Capital Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Bioremediation System Installation					Installation costs provided by TPA drilling contractor and Weaver Consultants Group.
Injection Well Installation	15	Well	$3,600	$54,000	Includes drilling, well install, well head construction, and development (15 injection wells).
Sub Total				$54,000	
Contingency (5% scope, 5% bid)			10%	$5,000	
Subtotal - Bioremediation System Installation				$59,000	
Project Management			5%	$3,000	
Remedial Design			5%	$3,000	
Total - Bioremediation System Installation				$65,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$81,000	

Annual O&M Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Bioremediation Operation					
Semi-Annual Injection Events(Years 1-2)					Estimated costs provided by Weaver Consultants Group. Based on number of injection wells and yearly injection events.
Remedial Injections	2	YR	$56,277	$113,000	
Performance Monitoring	2	YR	$5,900	$12,000	
Reporting	1	YR	$10,000	$10,000	
			Sub Total	$135,000	
Subtotal - Bio Injections				$135,000	
Contingency (5% scope, 5% bid)			10%	$14,000	
Subtotal - Bio Injections				$149,000	
Project Management			6%	$9,000	
Remedial Design			12%	$18,000	
Technical Support			8%	$12,000	
Total - Bio Injections				$188,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 3-10)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$3,480	$7,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$12,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$3,480	$7,000	
Reporting	1	Event	$5,000	$5,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area A
Alternative 3

			Sub Total	$12,000
Subtotal - Site Monitoring			Years 3-10	Years 11-15
			$12,000	$12,000
Contingency (5% scope, 5% bid)		10%	$1,000	$1,000
Subtotal - Site Monitoring			Years 3-10	Years 11-15
			$13,000	$13,000
Project Management		5%	$1,000	$1,000
Technical Support		5%	$1,000	$1,000
Total - Site Monitoring			Years 3-10	Years 11-15
			$15,000	$15,000
		Years 1-2	Years 3-10	Years 11-15
Total Annual O&M Costs		$188,000	$15,000	$15,000

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area A - Alternative 3 - Bioremediation and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
Bioremediation Wells	$65,000	$65,000
Monitoring Wells	$16,000	$16,000
	Subtotal	$81,000
Total Annual O&M Costs		**Present Value**
Years 1-2	*$188,000*	*$340,000*
Years 3-10	*$15,000*	*$78,000*
Years 11-15	*$15,000*	*$31,000*
Total		$449,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$541,000

Annual Cash Flow						
	Capital Costs	**Annual O&M Costs**				**Periodic Costs**
Year		**Years 1-2**	**Years 3-10**	**Years 11-15**	**Years 16-20**	
1	$81,000	$188,000	$0	$0	$0	$0
2	$0	$188,000	$0	$0	$0	$0
3	$0	$0	$15,000	$0	$0	$0
4	$0	$0	$15,000	$0	$0	$0
5	$0	$0	$15,000	$0	$0	$7,000
6	$0	$0	$15,000	$0	$0	$0
7	$0	$0	$15,000	$0	$0	$0
8	$0	$0	$15,000	$0	$0	$0
9	$0	$0	$15,000	$0	$0	$0
10	$0	$0	$15,000	$0	$0	$7,000
11	$0	$0	$0	$15,000	$0	$0
12	$0	$0	$0	$15,000	$0	$0
13	$0	$0	$0	$15,000	$0	$0
14	$0	$0	$0	$15,000	$0	$0
15	$0	$0	$0	$15,000	$0	$7,000
16	0	0	0	0	$0	$0
17	0	0	0	0	$0	$0
18	0	0	0	0	$0	$0
19	0	0	0	0	$0	$0
20	0	0	0	0	$0	$7,000

Assessment Area A - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
ISCO Well Installation					Installation costs provided by TPA drilling contractor and Weaver Consultants Group.
Injection well installation	15	Well	$3,600	$54,000	Includes drilling, well install, well head construction, and development (15 injection wells)
Sub Total				$54,000	
Contingency (5% scope, 5% bid)			10%	$5,000	
Subtotal - ISCO Well Installation				$59,000	
Project Management			5%	$3,000	
Remedial Design			5%	$3,000	
Total - ISCO Well Installation				$65,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$81,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
ISCO Injections					
Semi-Annual Injection Events(Years 1-2)					Estimated costs developed based on TPA's bulk hydrogen peroxide rate. Based on number of injection wells and yearly injection events.
Remedial Injections	2	Event	$67,888	$136,000	
Performance Monitoring	2	Event	$5,900	$12,000	
Reporting	1	YR	$10,000	$10,000	
			Sub Total	$158,000	
Subtotal - ISCO Injections				$158,000	
Contingency (5% scope, 5% bid)			10%	$16,000	
Subtotal - ISCO Injections				$174,000	
Project Management			6%	$10,000	
Remedial Design			12%	$21,000	
Technical Support			8%	$14,000	
Total - ISCO Injections				$219,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 3-10)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$3,480	$7,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$12,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$3,480	$7,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area A
Alternative 4

Reporting	1	Event	$5,000	$5,000
			Sub Total	$12,000
Subtotal - Site Monitoring			Years 3-10	Years 11-15
			$12,000	$12,000
Contingency (5% scope, 5% bid)		10%	$1,000	$1,000
Subtotal - Site Monitoring			Years 3-10	Years 11-15
			$13,000	$13,000
Project Management		5%	$1,000	$1,000
Technical Support		5%	$1,000	$1,000
Total - Site Monitoring			Years 3-10	Years 11-15
			$15,000	$15,000
		Years 1-2	Years 3-10	Years 11-15
Total Annual O&M Costs		$219,000	$15,000	$15,000

Periodic Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area A - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
ISCO Wells	$65,000	$65,000
Monitoring Wells	$16,000	$16,000
	Subtotal	$81,000
Total Annual O&M Costs		**Present Value**
Years 1-2	*$219,000*	*$396,000*
Years 3-10	*$15,000*	*$78,000*
Years 11-15	*$15,000*	*$31,000*
	Subtotal	$505,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$597,000

Annual Cash Flow						
	Capital Costs	**Annual O&M Costs**				**Periodic Costs**
Year		**Years 1-5**	**Years 6-10**	**Years 11-15**	**Years 16-20**	
1	$81,000	$219,000	$0	$0	$0	$0
2	$0	$219,000	$0	$0	$0	$0
3	$0	$0	$15,000	$0	$0	$0
4	$0	$0	$15,000	$0	$0	$0
5	$0	$0	$15,000	$0	$0	$7,000
6	$0	$0	$15,000	$0	$0	$0
7	$0	$0	$15,000	$0	$0	$0
8	$0	$0	$15,000	$0	$0	$0
9	$0	$0	$15,000	$0	$0	$0
10	$0	$0	$15,000	$0	$0	$7,000
11	$0	$0	$0	$15,000	$0	$0
12	$0	$0	$0	$15,000	$0	$0
13	$0	$0	$0	$15,000	$0	$0
14	$0	$0	$0	$15,000	$0	$0
15	$0	$0	$0	$15,000	$0	$7,000
16	0	0	0	0	$0	$0
17	0	0	0	0	$0	$0
18	0	0	0	0	$0	$0
19	0	0	0	0	$0	$0
20	0	0	0	0	$0	$7,000

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area B
Coke Point Groundwater CMS

Estimated Remedial Costs for Assessment Area B Alternatives																	
	Alternative 1: No Action			Alternative 2[a]: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate Biosparge, Capping, ECs/ICs			Alternative 3[a]: NAPL Recovery Trench/Pits, Shallow/Intermediate Air Sparge, Intermediate Biosparge, Capping, ECs/ICs			Alternative 4[a]: NAPL Recovery Trench/Pits, Shallow Air Sparge, Intermediate GWPT, Intermediate Biosparge, Capping, ECs/ICs			Alternative 5[a]: NAPL Recovery Trench/Pits, Shallow Air Sparge, Two Intermediate Biosparge Systems, Capping, ECs/ICs			Notes
Cost Item	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	
Active Remedy	$ -	$ -	$ -	$ 736,000	$ 359,000	$ 7,000	$ 955,000	$ 359,000	$ 7,000	$ 1,058,000	$ 561,000	$ 7,000	$ 927,000	$ 499,000	$ 7,000	Capping costs considered under redevelopment program. Performance monitoring for years 1-5 is included as part of the remedial action.
MNA (Years 6-10)	$ -	$ -	$ -	$ -	$ 63,000	$ 7,000	$ -	$ 63,000	$ 7,000	$ -	$ 63,000	$ 7,000	$ -	$ 63,000	$ 7,000	MNA to begin in Year 6 for all Alternatives, following the implemenation of the remedial action. Assumes semi-annual sampling for years 6-10.
MNA (Years 11-15)	$ -	$ -	$ -	$ -	$ 63,000	$ 7,000	$ -	$ 63,000	$ 7,000	$ -	$ 63,000	$ 7,000	$ -	$ 63,000	$ 7,000	MNA for all Alternatives. Assumes semi-annual sampling for years 11-15.
Estimated Total Remedial Costs for GAA B Alternatives																	
Total Net Present Value	$ -	$ -	$ -	$ 736,000	$ 1,787,000	$ 11,000	$ 955,000	$ 1,787,000	$ 11,000	$ 1,058,000	$ 2,615,000	$ 11,000	$ 927,000	$ 2,361,000	$ 11,000	Assumes a discount rate 7%.
NPV Costs for Project Duration	$ -			$ 2,534,000			$ 2,753,000			$ 3,684,000			$ 3,299,000			

[a] MNA will be conducted for a 10 year duration post active remediation.

Assessment Area B - Alternative 2 - Shallow Air Sparge & Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
NAPL Recovery Trench Installation					
Trenching/Installation	1	each	$19,100	$19,000	Assumes a 250 foot trench, includes 4 days of 2 staff onsite installing plus trenching equipment/staff
Materials	1	each	$7,088	$7,000	Assumes pea gravel backfill
Sub Total				$26,000	
Contingency (5% scope, 5% bid)			10%	$3,000	
Subtotal - NAPL Recovery Trench Installation				$29,000	
Project Management			6%	$2,000	
Remedial Design			12%	$3,000	
Technical Support			8%	$2,000	
Total - NAPL Recovery Trench Installation				$36,000	
Air Sparge System Installation - Shallow					
Sparge well installation	30	Well	$3,600	$108,000	Includes drilling, well install, well head construction, and development (Assumes 500 foot curtain with 15 foot spacing). Costs based on currently operating IMs.
Air Sparge System Installation	1	LS	$211,000	$211,000	Turnkey remediation system, including sparge equipment, container construction, conveyance line installation, and startup. Costs provided by Weaver Consultants Group.
Cell 3 Sparge well optimization	5	Well	$2,600	$13,000	Installation of 5 new or redrilled sparge wells in Cell 3.
Vapor Treatment	1	Each	$92,560	$93,000	Includes thermal oxidizer (Northern Area), blowers, vapor carbon (Southern Area), and carbon vessels
Sub Total				$425,000	
Contingency (5% scope, 5% bid)			10%	$43,000	
Subtotal - Air Sparge System Installation				$468,000	
Project Management			6%	$28,000	
Remedial Design			12%	$56,000	
Technical Support			8%	$37,000	
Total - Air Sparge System Installation				$589,000	
Bio Sparge System Installation - CO209 Area					
Sparge well installation	5	Well	$3,600	$18,000	Includes drilling, well install, well head construction, and development. Costs based on currently operating IMs.
BioSparge System Installation	1	LS	$50,000	$50,000	Turnkey remediation system
Sub Total				$68,000	
Contingency (5% scope, 5% bid)			10%	$7,000	
Subtotal - BioSparge System Installation				$75,000	
Project Management			6%	$5,000	
Remedial Design			12%	$9,000	
Technical Support			8%	$6,000	
Total - BioSparge System Installation				$95,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring well installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	

Total Capital Costs				$736,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
NAPL Recovery Trench Operation					
Annual Operation and Maintenance (Years 1-5)					
Monthly Vac Truck	12	EA	$1,200	$14,000	Includes monthly removal of NAPL
NAPL Disposal	10800	gal	$5	$54,000	Assumes approximately 6 acres of land within 'NAPL' area with 0.5" remaining thickness of NAPL, at 10,800 gal/acre over 5 yr period. Costs based on current disposal rate TPA is paying.
Site Visits	12	EA	$600	$7,000	
			Sub Total	$75,000	
Subtotal - NAPL Recovery Trench Operation				$75,000	
Contingency (5% scope, 5% bid)			10%	$8,000	
Subtotal - NAPL Recovery Trench Operation				$83,000	
Project Management			6%	$5,000	
Technical Support			8%	$7,000	
Total - NAPL Recovery Trench Operation				$95,000	
Air Sparge Operation - Shallow					
Annual Operation and Maintenance (Years 1-5)					Includes operation of Northern and Southern Sparge Systems. Costs based on operation of current IM systems.
Weekly Visits	24	EA	$1,225	$29,000	
Monthly Visits	5	EA	$2,325	$12,000	
Quarterly Visits	3	EA	$5,150	$15,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	2	EA	$2,325	$5,000	
Performance Monitoring	4	Qtr	$8,200	$33,000	Includes quarterly performance monitoring for Northern and Southern Areas
Reporting	4	Qtr	$3,000	$12,000	
Subtotal - Air Sparge Staffing				$118,000	
Utilities	12	Mon	$2,500	$30,000	Includes utilities for operation of Northern and Southern Sparge Systems
Vapor Carbon	1100	Lbs	$1.6	$2,000	Cell 3 only
			Sub Total	$150,000	
Subtotal - Air Sparge Operation				$150,000	
Contingency (5% scope, 5% bid)			10%	$15,000	
Subtotal - Air Sparge Operation				$165,000	
Project Management			6%	$10,000	
Technical Support			8%	$13,000	
Total - Air Sparge Operation				$188,000	
Bio Sparge Operation - CO209 Area					
Annual Operation and Maintenance (Years 1-5)					Includes operation of biosparge system near well CO209. Costs based on operation of current IM systems.
Biweekly Visits	6	EA	$1,225	$7,000	
Monthly Visits	4	EA	$2,325	$9,000	
Quarterly Visits	2	EA	$5,150	$10,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	2	EA	$2,325	$5,000	
Performance Monitoring	2	Event	$2,733	$5,000	Includes semi-annual performance monitoring for area around CO209.
Reporting	1	YR	$7,000	$7,000	
Utilities	12	Mon	$500	$6,000	Includes utilities for operation for bio sparge near CO209.
			Sub Total	$61,000	
Subtotal - Bio Sparge Operation				$61,000	
Contingency (5% scope, 5% bid)			10%	$6,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area B
Alternative 2

Subtotal - Bio Sparge Operation				$67,000	
Project Management			6%	$4,000	
Technical Support			8%	$5,000	
Total - Bio Sparge Operation				$76,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 6-10)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
Subtotal - Site Monitoring (per year)				$52,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
Subtotal - Site Monitoring (per year)				$52,000	

Subtotal - Site Monitoring		Years 6-10	Years 11-15
		$52,000	$52,000
Contingency (5% scope, 5% bid)	10%	$5,000	$5,000

Subtotal - Site Monitoring		Years 6-10	Years 11-15
		$57,000	$57,000
Project Management	5%	$3,000	$3,000
Technical Support	5%	$3,000	$3,000

Total - Site Monitoring	Years 6-10	Years 11-15
	$63,000	$63,000

	Years 1-5	Years 6-10	Years 11-15
Total Annual O&M Costs	$359,000	$63,000	$63,000

Periodic Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Technical Support			5%	$0	
Total Period Costs				$7,000	

Assessment Area B - Alternative 2 - Shallow Air Sparge & Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
NAPL Recovery Trench	*$36,000*	*$36,000*
Air Sparge System	*$589,000*	*$589,000*
Monitoring Wells	*$16,000*	*$16,000*
CO209 Biosparge	*$95,000*	*$95,000*
	Subtotal	$736,000
Total Annual O&M Costs		
Years 1-5	*$359,000*	*$1,472,000*
Years 6-10	*$63,000*	*$184,000*
Years 11-15	*$63,000*	*$131,000*
Total		$1,787,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$2,534,000

Annual Cash Flow					
	Capital Costs	**Annual O&M Costs**			**Periodic Costs**
Year		**Years 1-5**	**Years 6-10**	**Years 11-15**	
1	$589,000	$359,000	$0	$0	$0
2	$0	$359,000	$0	$0	$0
3	$0	$359,000	$0	$0	$0
4	$0	$359,000	$0	$0	$0
5	$0	$359,000	$0	$0	$7,000
6	$0	$0	$63,000	$0	$0
7	$0	$0	$63,000	$0	$0
8	$0	$0	$63,000	$0	$0
9	$0	$0	$63,000	$0	$0
10	$0	$0	$63,000	$0	$7,000
11	$0	$0	$0	$63,000	$0
12	$0	$0	$0	$63,000	$0
13	$0	$0	$0	$63,000	$0
14	$0	$0	$0	$63,000	$0
15	$0	$0	$0	$63,000	$7,000

Assessment Area B - Alternative 3 - Shallow/Intermediate Air Sparging, CO209 BioSparging, and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
NAPL Recovery Trench Installation					
Trenching/Installation	1	each	$19,100	$19,100	Assumes a 250 foot trench, includes 4 days of 2 staff onsite installing plus trenching equipment/staff
Materials	1	each	$7,088	$7,088	Pea gravel backfill of trench
Sub Total				$26,188	
Contingency (5% scope, 5% bid)			10%	$3,000	
Subtotal - NAPL Recovery Trench Installation				$29,188	
Project Management			6%	$2,000	
Remedial Design			12%	$4,000	
Technical Support			8%	$2,000	
Total - NAPL Recovery Trench Installation				$37,188	
Air Sparge System Installation - Shallow and Intermediate					
Shallow Sparge well installation	30	Well	$3,600	$108,000	Includes drilling, well install, well head construction, and development (Assumes 500 foot curtain with 15 foot spacing)
Intermediate Sparge well installation	15	Well	$4,800	$72,000	Includes drilling, well install, well head construction, and development (assumes limited area for intermediate sparge)
Cell 3 Sparge well optimization	5	Well	$2,600	$13,000	Installation of 5 new or redrilled sparge wells in Cell 3
Air Sparge System Installation	1	LS	$271,000	$271,000	Turnkey remediation system
Vapor Treatment	1	Each	$117,560	$118,000	Includes thermal oxidizer, blowers, vapor carbon, and carbon vessels
Sub Total				$582,000	
Contingency (5% scope, 5% bid)			10%	$58,000	
Subtotal - Air Sparge System Installation				$640,000	
Project Management			6%	$38,000	
Remedial Design			12%	$77,000	
Technical Support			8%	$51,000	
Total - Air Sparge System Installation				$806,000	
Bio Sparge System Installation - CO209 Area					
Sparge well installation	5	Well	$3,600	$18,000	Includes drilling, well install, well head construction, and development. Costs based on currently operating IMs.
BioSparge System Installation	1	LS	$50,000	$50,000	Turnkey remediation system
Sub Total				$68,000	
Contingency (5% scope, 5% bid)			10%	$7,000	
Subtotal - BioSparge System Installation				$75,000	
Project Management			6%	$5,000	
Remedial Design			12%	$9,000	
Technical Support			8%	$6,000	
Total - BioSparge System Installation				$95,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	

Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$954,188	

Annual O&M Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
NAPL Recovery Trench Operation					
Annual Operation and Maintenance (Years 1-5)					
Monthly Vac Truck	12	EA	$1,200	$14,000	Includes monthly removal of NAPL
					Assumes approximately 6 acres of land within 'NAPL' area with 0.5" remaining thickness of NAPL, at 10,800 gal/acre over 5 yr period.
NAPL Disposal	10800	gal	$5	$54,000	Costs based on current disposal rate TPA is paying.
Site Visits	12	EA	$600	$7,000	
			Sub Total	$75,000	
Subtotal - NAPL Recovery Trench Operation				$75,000	
Contingency (5% scope, 5% bid)			10%	$8,000	
Subtotal - NAPL Recovery Trench Operation				$83,000	
Project Management			6%	$5,000	
Technical Support			8%	$7,000	
Total - NAPL Recovery Trench Operation				$95,000	
Air Sparge Operation - Shallow and Intermediate					
					Includes operation of Northern and Southern Sparge Systems. Costs based on operation of current IM systems. Based on current operation, staffing requirements for 2 AS systems is similar to 1 AS system.
Annual Operation and Maintenance (Years 1-5)					
Weekly Visits	24	EA	$1,225	$29,000	
Monthly Visits	5	EA	$2,325	$12,000	
Quarterly Visits	3	EA	$5,150	$15,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	2	EA	$2,325	$5,000	
					Includes quarterly performance monitoring for Northern and
Performance Monitoring	4	Qtr	$8,200	$33,000	Southern Areas
Reporting	4	Qtr	$3,000	$12,000	
					Includes utilities for operation of Northern and Southern Sparge
Utilities	12	Mon	$2,500	$30,000	Systems
Vapor Carbon	1100	Lbs	$1.6	$2,000	
			Sub Total	$150,000	
Subtotal - Air Sparge Operation				$150,000	
Contingency (5% scope, 5% bid)			10%	$15,000	
Subtotal - Air Sparge Operation				$165,000	
Project Management			6%	$10,000	
Technical Support			8%	$13,000	
Total - Air Sparge Operation				$188,000	
Bio Sparge Operation - CO209 Area					
					Includes operation of biosparge system near well CO209. Costs based on operation of current IM systems.
Annual Operation and Maintenance (Years 1-5)					
Biweekly Visits	6	EA	$1,225	$7,000	
Monthly Visits	4	EA	$2,325	$9,000	
Quarterly Visits	2	EA	$5,150	$10,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	2	EA	$2,325	$5,000	
					Includes semi-annual performance monitoring for area around
Performance Monitoring	2	Event	$2,733	$5,000	CO209.
Reporting	1	YR	$7,000	$7,000	
Utilities	12	Mon	$500	$6,000	Includes utilities for operation for bio sparge near CO209.
			Sub Total	$61,000	

Subtotal - Bio Sparge Operation				$61,000	
Contingency (5% scope, 5% bid)			10%	$6,000	
Subtotal - Bio Sparge Operation				$67,000	
Project Management			6%	$4,000	
Technical Support			8%	$5,000	
Total - Bio Sparge Operation				$76,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 6-10)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
			Sub Total	$52,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
			Sub Total	$52,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$52,000	$52,000	
Contingency (5% scope, 5% bid)		10%	$5,000	$5,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$57,000	$57,000	
Project Management		5%	$3,000	$3,000	
Technical Support		5%	$3,000	$3,000	
Total - Site Monitoring			Years 6-10	Years 11-15	
			$63,000	$63,000	
		Years 1-5	Years 6-10	Years 11-15	
Total Annual O&M Costs		$359,000	$63,000	$63,000	

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area B - Alternative 3 - Shallow/Intermediate Air Sparging, CO209 BioSparging, and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
NAPL Recovery Trench	*$37,188*	$37,188
Air Sparge System	*$806,000*	$806,000
Monitoring Wells	*$16,000*	$16,000
CO209 Biosparge	*$95,000*	$95,000
	Subtotal	$955,000
Total Annual O&M Costs		
Years 1-5	*$359,000*	*$1,472,000*
Years 6-10	*$63,000*	*$184,000*
Years 11-15	*$63,000*	*$131,000*
Total		$1,787,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$2,753,000

Annual Cash Flow						
	Capital Costs	**Annual O&M Costs**				**Periodic Costs**
Year		**Years 1-5**	**Years 6-10**	**Years 11-15**	**Years 16-20**	
1	$806,000	$359,000	$0	$0	$0	$0
2	$0	$359,000	$0	$0	$0	$0
3	$0	$359,000	$0	$0	$0	$0
4	$0	$359,000	$0	$0	$0	$0
5	$0	$359,000	$0	$0	$0	$7,000
6	$16,000	$0	$63,000	$0	$0	$0
7	$0	$0	$63,000	$0	$0	$0
8	$0	$0	$63,000	$0	$0	$0
9	$0	$0	$63,000	$0	$0	$0
10	$0	$0	$63,000	$0	$0	$7,000
11	$0	$0	$0	$63,000	$0	$0
12	$0	$0	$0	$63,000	$0	$0
13	$0	$0	$0	$63,000	$0	$0
14	$0	$0	$0	$63,000	$0	$0
15	$0	$0	$0	$63,000	$0	$7,000

Assessment Area B - Alternative 4 - Shallow Air Sparge, Groundwater Pump and Treat and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
NAPL Recovery Trench Installation					
Trenching/Installation	1	each	$19,100	$19,000	Assumes a 250 foot trench, includes 4 days of 2 staff onsite installing plus trenching equipment/staff
Materials	1	each	$7,088	$7,000	Assumes pea gravel backfill
Sub Total				$26,000	
Contingency (5% scope, 5% bid)			10%	$3,000	
Subtotal - NAPL Recovery Trench Installation				$29,000	
Project Management			6%	$2,000	
Remedial Design			12%	$3,000	
Technical Support			8%	$2,000	
Total - NAPL Recovery Trench Installation				$36,000	
Air Sparge System Installation - Shallow					
Sparge well installation	30	Well	$3,600	$108,000	Includes drilling, well install, well head construction, and development (Assumes 500 foot curtain with 15 foot spacing). Costs based on currently operating IMs.
Air Sparge System Installation	1	LS	$211,000	$211,000	Turnkey remediation system, including sparge equipment, container construction, conveyance line installation, and startup. Costs provided by Weaver Consultants Group.
Cell 3 Sparge well optimization	5	Well	$2,600	$13,000	Installation of 5 new or redrilled sparge wells in Cell 3.
Vapor Treatment	1	Each	$92,560	$93,000	Includes thermal oxidizer (Northern Area), blowers, vapor carbon (Southern Area), and carbon vessels
Sub Total				$425,000	
Contingency (5% scope, 5% bid)			10%	$43,000	
Subtotal - Air Sparge System Installation				$468,000	
Project Management			6%	$28,000	
Remedial Design			12%	$56,000	
Technical Support			8%	$37,000	
Total - Air Sparge System Installation				$589,000	
Bio Sparge System Installation - CO209 Area					
Sparge well installation	5	Well	$3,600	$18,000	Includes drilling, well install, well head construction, and development. Costs based on currently operating IMs.
BioSparge System Installation	1	LS	$50,000	$50,000	Turnkey remediation system
Sub Total				$68,000	
Contingency (5% scope, 5% bid)			10%	$7,000	
Subtotal - BioSparge System Installation				$75,000	
Project Management			6%	$5,000	
Remedial Design			12%	$9,000	
Technical Support			8%	$6,000	
Total - BioSparge System Installation				$95,000	
Groundwater Pump & Treat System Upgrade					
GWPT System Upgrade	1	LS	$201,200	$201,000	Includes upgraded controls, new thermal oxidizer, and startup
GWPT New Well Installation	3	Each	$10,500	$32,000	Includes installation of 3 new extraction wells, well head assembly, downhole pumps
Sub Total				$233,000	
Contingency (5% scope, 5% bid)			10%	$23,000	
Subtotal - GWPT Upgrade				$256,000	
Project Management			6%	$15,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area B
Alternative 4

Remedial Design			12%	$31,000	
Technical Support			8%	$20,000	
Total - GWPT System Upgrade				$322,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$1,058,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
NAPL Recovery Trench Operation					
Annual Operation and Maintenance (Years 1-5)					
Monthly Vac Truck	12	EA	$1,200	$14,000	Includes monthly removal of NAPL
NAPL Disposal	10800	gal	$5	$54,000	Assumes approximately 6 acres of land within 'NAPL' area with 0.5" remaining thickness of NAPL, at 10,800 gal/acre over 5 yr period. Costs based on current disposal rate TPA is paying.
Site Visits	12	EA	$600	$7,000	
Sub Total				$75,000	
Subtotal - NAPL Recovery Trench Operation				$75,000	
Contingency (5% scope, 5% bid)			10%	$8,000	
Subtotal - NAPL Recovery Trench Operation				$83,000	
Project Management			6%	$5,000	
Technical Support			8%	$7,000	
Total - NAPL Recovery Trench Operation				$95,000	
Air Sparge Operation - Shallow					
Annual Operation and Maintenance (Years 1-5)					Includes operation of Northern and Southern Sparge Systems. Costs based on operation of current IM systems
Weekly Visits	24	EA	$1,225	$29,000	Includes weekly O&M
Monthly Visits	5	EA	$2,325	$12,000	Includes monthly O&M
Quarterly Visits	3	EA	$5,150	$15,000	Includes quarterly O&M
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	2	EA	$2,325	$5,000	
Performance Monitoring	4	Qtr	$8,200	$33,000	Includes semi-annual performance monitoring for Northern and Southern Areas
Reporting	4	Qtr	$3,000	$12,000	
Utilities	12	Mon	$2,500	$30,000	Includes utilities for operation of Northern and Southern Sparge Systems
Vapor Carbon	1100	Lbs	$1.6	$2,000	
Sub Total				$150,000	
Subtotal - Air Sparge Operation				$150,000	
Contingency (5% scope, 5% bid)			10%	$15,000	
Subtotal - Air Sparge Operation				$165,000	
Project Management			6%	$10,000	
Technical Support			8%	$13,000	
Total - Air Sparge Operation				$188,000	
Bio Sparge Operation - CO209 Area					

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area B
Alternative 4

Annual Operation and Maintenance (Years 1-5)					Includes operation of biosparge system near well CO209. Costs based on operation of current IM systems.
Biweekly Visits	6	EA	$1,225	$7,000	
Monthly Visits	4	EA	$2,325	$9,000	
Quarterly Visits	2	EA	$5,150	$10,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	2	EA	$2,325	$5,000	
Performance Monitoring	2	Event	$2,733	$5,000	Includes semi-annual performance monitoring for area around CO209.
Reporting	1	YR	$7,000	$7,000	
Utilities	12	Mon	$500	$6,000	Includes utilities for operation for bio sparge near CO209.
			Sub Total	$61,000	
Subtotal - Bio Sparge Operation				$61,000	
Contingency (5% scope, 5% bid)			10%	$6,000	
Subtotal - Bio Sparge Operation				$67,000	
Project Management			6%	$4,000	
Technical Support			8%	$5,000	
Total - Bio Sparge Operation				$76,000	
Groundwater Pump and Treat					
Annual Operation and Maintenance (Years 1-5)					Includes
Weekly Visits	40	EA	$1,225	$49,000	Includes weekly O&M
Monthly Visits	8	EA	$2,325	$19,000	Includes monthly O&M
Quarterly Visits	3	EA	$5,150	$15,000	Includes quarerly O&M
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	4	EA	$2,325	$9,000	
Performance Monitoring	4	Qtr	$8,200	$33,000	
Reporting	4	Qtr	$3,000	$12,000	
			Sub Total	$149,000	
Subtotal - Groundwater Pump and Treat				$149,000	
Contingency (5% scope, 5% bid)			10%	$15,000	
Subtotal - Groundwater Pump and Treat				$164,000	
Project Management			8%	$13,000	
Technical Support			15%	$25,000	
Total - Groundwater Pump and Treat				$202,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 6-10)					
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
			Sub Total	$52,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
			Sub Total	$52,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$52,000	$52,000	
Contingency (5% scope, 5% bid)		10%	$5,000	$5,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$57,000	$57,000	
Project Management		5%	$3,000	$3,000	
Technical Support		5%	$3,000	$3,000	
Total - Site Monitoring			Years 6-10	Years 11-15	
			$63,000	$63,000	
		Years 1-5	Years 6-10	Years 11-15	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area B
Alternative 4

Total Annual O&M Costs	$561,000	$63,000	$63,000

Periodic Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area B - Alternative 4 - Shallow Air Sparge, Groundwater Pump and Treat and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Costs Per Year		**Present Value**
NAPL Recovery Trench	*$36,000*	$36,000
Air Sparge System	*$589,000*	$589,000
Monitoring Wells	*$16,000*	$16,000
CO209 Biosparge	*$95,000*	$95,000
	Subtotal	$1,058,000
Total Annual O&M Costs		
Years 1-5	*$561,000*	*$2,300,000*
Years 6-10	*$63,000*	*$184,000*
Years 11-15	*$63,000*	*$131,000*
Total		$2,615,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$3,684,000

Annual Cash Flow						
	Capital Costs	**Annual O&M Costs**				**Periodic Costs**
Year		**Years 1-5**	**Years 6-10**	**Years 11-15**	**Years 16-20**	
1	$0	$561,000	$0	$0	$0	$0
2	$0	$561,000	$0	$0	$0	$0
3	$0	$561,000	$0	$0	$0	$0
4	$0	$561,000	$0	$0	$0	$0
5	$0	$561,000	$0	$0	$0	$7,000
6	$0	$0	$63,000	$0	$0	$0
7	$0	$0	$63,000	$0	$0	$0
8	$0	$0	$63,000	$0	$0	$0
9	$0	$0	$63,000	$0	$0	$0
10	$0	$0	$63,000	$0	$0	$7,000
11	$0	$0	$0	$63,000	$0	$0
12	$0	$0	$0	$63,000	$0	$0
13	$0	$0	$0	$63,000	$0	$0
14	$0	$0	$0	$63,000	$0	$0
15	$0	$0	$0	$63,000	$0	$7,000

Assessment Area B - Alternative 5 - Shallow Air Sparge, Intermediate Biosparge and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
NAPL Recovery Trench Installation					
Trenching/Installation	1	each	$19,100	$19,100	Assumes a 250 foot trench, includes 4 days of 2 staff onsite installing plus trenching equipment/staff
Materials	1	each	$7,088	$7,088	Assumes pea gravel backfill
Sub Total				$26,188	
Contingency (5% scope, 5% bid)			10%	$3,000	
Subtotal - NAPL Recovery Trench Installation				$29,188	
Project Management			6%	$2,000	
Remedial Design			12%	$4,000	
Technical Support			8%	$2,000	
Total - NAPL Recovery Trench Installation				$37,188	
Air Sparge System Installation - Shallow					
Sparge well installation	30	Well	$3,600	$108,000	Includes drilling, well install, well head construction, and development (Assumes 500 foot curtain with 15 foot spacing). Costs based on currently operating IMs.
Air Sparge System Installation	1	LS	$211,000	$211,000	Turnkey remediation system, including sparge equipment, container construction, conveyance line installation, and startup. Costs provided by Weaver Consultants Group.
Cell 3 Sparge well optimization	5	Well	$2,600	$13,000	Installation of 5 new or redrilled sparge wells in Cell 3.
Vapor Treatment	1	Each	$92,560	$93,000	Includes thermal oxidizer (Northern Area), blowers, vapor carbon (Southern Area), and carbon vessels
Sub Total				$425,000	
Contingency (5% scope, 5% bid)			10%	$43,000	
Subtotal - Air Sparge System Installation				$468,000	
Project Management			6%	$28,000	
Remedial Design			12%	$56,000	
Technical Support			8%	$37,000	
Total - Air Sparge System Installation				$589,000	
Bio Sparge System Installation - CO209 Area					
Sparge well installation	5	Well	$3,600	$18,000	Includes drilling, well install, well head construction, and development. Costs based on currently operating IMs.
BioSparge System Installation	1	LS	$50,000	$50,000	Turnkey remediation system
Sub Total				$68,000	
Contingency (5% scope, 5% bid)			10%	$7,000	
Subtotal - BioSparge System Installation				$75,000	
Project Management			6%	$5,000	
Remedial Design			12%	$9,000	
Technical Support			8%	$6,000	
Total - BioSparge System Installation				$95,000	
Bio Sparge System Installation - Intermediate					
Sparge well installation	10	Well	$3,600	$36,000	Includes drilling, well install, well head construction, and development. Costs based on currently operating IMs.
BioSparge System Installation	1	LS	$100,000	$100,000	Turnkey remediation system
Sub Total				$136,000	
Contingency (5% scope, 5% bid)			10%	$14,000	
Subtotal - BioSparge System Installation				$150,000	
Project Management			6%	$9,000	

	Remedial Design		12%	$18,000	
	Technical Support		8%	$12,000	
Total - BioSparge System Installation				$189,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
	Monitoring well installation	5 Well	$2,600	$13,000	
	Sub Total			$13,000	
	Contingency (5% scope, 5% bid)		10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
	Project Management		5%	$1,000	
	Remedial Design		5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$926,188	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
NAPL Recovery Trench Operation					
Annual Operation and Maintenance (Years 1-5)					
	Monthly Vac Truck	12 EA	$1,200	$14,000	Includes monthly removal of NAPL
					Assumes approximately 6 acres of land within 'NAPL' area with 0.5" remaining thickness of NAPL, at 10,800 gal/acre over 5 yr period.
	NAPL Disposal	10800 gal	$5	$54,000	Costs based on current disposal rate TPA is paying.
	Site Visits	12 EA	$600	$7,000	
			Sub Total	$75,000	
Subtotal - NAPL Recovery Trench Operation				$75,000	
Contingency (5% scope, 5% bid)			10%	$8,000	
Subtotal - NAPL Recovery Trench Operation				$83,000	
Project Management			6%	$5,000	
Technical Support			8%	$7,000	
Total - NAPL Recovery Trench Operation				$95,000	
Air Sparge Operation - Shallow					
Annual Operation and Maintenance (Years 1-5)					Includes operation of Northern and Southern Sparge Systems. Costs based on operation of current IM systems
	Weekly Visits	24 EA	$1,225	$29,000	Includes weekly O&M
	Monthly Visits	5 EA	$2,325	$12,000	Includes monthly O&M
	Quarterly Visits	3 EA	$5,150	$15,000	Includes quarterly O&M
	Annual Visits	1 EA	$12,125	$12,000	
	Emergency Visits	2 EA	$2,325	$5,000	
	Performance Monitoring	4 Qtr	$8,200	$33,000	Includes semi-annual performance monitoring for Northern and Southern Areas
	Reporting	4 Qtr	$3,000	$12,000	
	Utilities	12 Mon	$2,500	$30,000	Includes utilities for operation of Northern and Southern Sparge Systems
	Vapor Carbon	1100 Lbs	$1.6	$2,000	
			Sub Total	$150,000	
Subtotal - Air Sparge Operation				$150,000	
Contingency (5% scope, 5% bid)			10%	$15,000	
Subtotal - Air Sparge Operation				$165,000	
Project Management			6%	$10,000	
Technical Support			8%	$13,000	
Total - Air Sparge Operation				$188,000	
Bio Sparge Operation - CO209 Area					

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area B
Alternative 5

Annual Operation and Maintenance (Years 1-5)					Includes operation of biosparge system near well CO209. Costs based on operation of current IM systems.
Biweekly Visits	6	EA	$1,225	$7,000	
Monthly Visits	6	EA	$2,325	$14,000	
Quarterly Visits	2	EA	$5,150	$10,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	2	EA	$2,325	$5,000	
Performance Monitoring	2	Event	$2,733	$5,000	Includes semi-annual performance monitoring for area around CO209.
Reporting	1	YR	$7,000	$7,000	
Utilities	12	Mon	$500	$6,000	Includes utilities for operation for bio sparge near CO209.
			Sub Total	$66,000	
Subtotal - Bio Sparge Operation				$66,000	
Contingency (5% scope, 5% bid)			10%	$7,000	
Subtotal - Bio Sparge Operation				$73,000	
Project Management			6%	$4,000	
Technical Support			8%	$6,000	
Total - Bio Sparge Operation				$83,000	
Bio Sparge Operation - Intermediate					
Annual Operation and Maintenance (Years 1-5)					
Biweekly Visits	12	EA	$1,225	$15,000	
Monthly Visits	8	EA	$2,325	$19,000	
Quarterly Visits	3	EA	$5,150	$15,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	4	EA	$2,325	$9,000	
Performance Monitoring	2	Qtr	$8,200	$16,000	
Reporting	1	Qtr	$10,000	$10,000	
Utilities	12	Mon	$800	$10,000	
			Sub Total	$106,000	
Subtotal - Bio Sparge Operation				$106,000	
Contingency (5% scope, 5% bid)			10%	$11,000	
Subtotal - Bio Sparge Operation				$117,000	
Project Management			6%	$7,000	
Technical Support			8%	$9,000	
Total - Bio Sparge Operation				$133,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 6-10)					
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
			Sub Total	$52,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					
Groundwater Sampling	2	Event	$23,320	$47,000	
Reporting	1	YR	$5,000	$5,000	
			Sub Total	$52,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$52,000	$52,000	
Contingency (5% scope, 5% bid)		10%	$5,000	$5,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$57,000	$57,000	
Project Management		5%	$3,000	$3,000	
Technical Support		5%	$3,000	$3,000	
Total - Site Monitoring			Years 6-10	Years 11-15	
			$63,000	$63,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area B
Alternative 5

	Years 1-5	Years 6-10	Years 11-15
Total Annual O&M Costs	$499,000	$63,000	$63,000

Periodic Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area B - Alternative 5 - Shallow Air Sparge, Intermediate Biosparge and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Costs Per Year		**Present Value**
NAPL Recovery Trench	*$37,188*	$37,188
Air Sparge System	*$589,000*	$589,000
Biosparge System	$189,000	$189,000
Monitoring Wells	$16,000	$16,000
CO209 Biosparge	$95,000	$95,000
	Total Captial Costs	$927,000
Total Annual O&M Costs		
Years 1-5	*$499,000*	*$2,046,000*
Years 6-10	*$63,000*	*$184,000*
Years 11-15	*$63,000*	*$131,000*
Total		$2,361,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$3,299,000

Annual Cash Flow						
	Capital Costs	**Annual O&M Costs**				**Periodic Costs**
Year		**Years 1-5**	**Years 6-10**	**Years 11-15**	**Years 16-20**	
1	$189,000	$499,000	$0	$0	$0	$0
2	$0	$499,000	$0	$0	$0	$0
3	$0	$499,000	$0	$0	$0	$0
4	$0	$499,000	$0	$0	$0	$0
5	$0	$499,000	$0	$0	$0	$7,000
6	$16,000	$0	$63,000	$0	$0	$0
7	$0	$0	$63,000	$0	$0	$0
8	$0	$0	$63,000	$0	$0	$0
9	$0	$0	$63,000	$0	$0	$0
10	$0	$0	$63,000	$0	$0	$7,000
11	$0	$0	$0	$63,000	$0	$0
12	$0	$0	$0	$63,000	$0	$0
13	$0	$0	$0	$63,000	$0	$0
14	$0	$0	$0	$63,000	$0	$0
15	$0	$0	$0	$63,000	$0	$7,000

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area C
Coke Point Groundwater CMS

Estimated Remedial Costs for Assessment Area C Alternatives										
	Alternative 1: No Action			Alternative 2: Excavation, Sheet Pile Wall Extension, Capping, MNA, ECs/ICs			Alternative 3: Excavation, Capping, MNA, ECs/ICs			Notes
Cost Item	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	
Active Remedy	$ -	$ -	$ -	$ 495,000	$ -	$ -	$ 169,000	$ -	$ -	Capping costs considered under redevelopment program. Assumes that the implementation of the Active Remedy will be completed within 2025.
MNA (Years 1-15)	$ -	$ -	$ -	$ 16,000	$ 15,000	$ 7,000	$ 16,000	$ 15,000	$ 7,000	MNA to begin in Year 1 for each Alternative. Assumes semi-annual sampling for 15 years.

Estimated Total Remedial Costs for GAA C Alternatives										
Total Net Present Value	$ -	$ -	$ -	$ 511,000	$ 137,000	$ 11,000	$ 185,000	$ 137,000	$ 11,000	Assumes a discount rate 7%.
NPV Costs for Project Duration	$ -			$ 659,000			$ 333,000			

MNA will be conducted on a semi-annual basis for the full 15 year duration

Assessment Area C - Alternative 2 - Excavation, Sheet Pile Wall Extension and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Sheet Pile Wall Extension					Includes cutting the sheet piles into 3rds, transporting to the installation site and installing the 250 LF long uncoated straight wall. Costs provided by R.E. Pierson Construction Co.
Sheet Pile Wall Extension	1	Each	$250,000	$250,000	
Sub Total				$250,000	
Contingency (5% scope, 5% bid)			10%	$25,000	
Subtotal - Sheet Pile Wall Extension				$275,000	
Project Management			6%	$17,000	
Remedial Design			12%	$33,000	
Construction Management			8%	$1,000	
Total - Sheet Pile Wall Extension				$326,000	
Excavation					Costs provided by TPA excavation contractor.
Moblilization	1	LS	$5,000	$5,000	
Test Pit Excavation	35	LS	$2,400	$84,000	
Backfill and Sampling	1	LS	$50,000	$50,000	
Sub Total				$139,000	
Contingency (5% scope, 5% bid)			10%	$14,000	
Subtotal - Hot Spot Excavation				$153,000	
Project Management			5%	$8,000	
Technical Support			5%	$8,000	
Total - Hot Spot Excavation				$169,000	
Total Capital Costs				$511,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 1-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$3,480	$7,000	
Reporting	1	Event	$5,000	$5,000	
		Subtotal - Site Monitoring		$12,000	
Subtotal - Site Monitoring				$12,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$13,000	
Project Management			5%	$1,000	
Technical Support			5%	$1,000	
Total - Site Monitoring				$15,000	
Total Annual O&M Costs				$15,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area C
Alternative 2

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area C - Alternative 2 - Excavation, Sheet Pile Wall Extension, and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
Hot Spot Excavation	$169,000	$169,000
Sheet Pile Wall Extension	$326,000	$326,000
Monitoring Wells	$16,000	$16,000
	Subtotal	$511,000
Total Annual O&M Costs		**Present Value**
Years 1-15	*$15,000*	*$137,000*
Total Period Costs	$7,000	$11,000
Total Net Present Value		$659,000

Annual Cash Flow			
Year	**Capital Costs**	**Annual O&M Costs**	**Periodic Costs**
1	$511,000	$15,000	$0
2	$0	$15,000	$0
3	$0	$15,000	$0
4	$0	$15,000	$0
5	$0	$15,000	$7,000
6	$0	$15,000	$0
7	$0	$15,000	$0
8	$0	$15,000	$0
9	$0	$15,000	$0
10	$0	$15,000	$7,000
11	$0	$15,000	$0
12	$0	$15,000	$0
13	$0	$15,000	$0
14	$0	$15,000	$0
15	$0	$15,000	$7,000

Assessment Area C - Alternative 3 - Excavation and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Hot Spot Excavation					Costs provided by TPA excavation contractor.
Moblilization	1	LS	$5,000	$5,000	
Test Pit Excavation	35	LS	$2,400	$84,000	
Backfill and Sampling	1	LS	$50,000	$50,000	
Sub Total				$139,000	
Contingency (5% scope, 5% bid)			10%	$14,000	
Subtotal - Hot Spot Excavation				$153,000	
Project Management			5%	$8,000	
Technical Support			5%	$8,000	
Total - Hot Spot Excavation				$169,000	
Total Capital Costs				$185,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 1-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$3,480	$7,000	
Reporting	1	Event	$5,000	$5,000	
			Subtotal - Site Monitoring	$12,000	
Subtotal - Site Monitoring				$12,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$13,000	
Project Management			5%	$1,000	
Technical Support			5%	$1,000	
Total - Site Monitoring				$15,000	
Total Annual O&M Costs				$15,000	

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area C - Alternative 3 - Excavation and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
Excavation	$169,000	$169,000
Monitoring Wells	$16,000	$16,000
	Subtotal	$185,000
Total Annual O&M Costs		**Present Value**
Years 1-15	*$15,000*	*$137,000*
Total Period Costs	$7,000	$11,000
Total Net Present Value		$333,000

Annual Cash Flow			
Year	**Capital Costs**	**Annual O&M Costs**	**Periodic Costs**
1	$185,000	$15,000	$0
2	$0	$15,000	$0
3	$0	$15,000	$0
4	$0	$15,000	$0
5	$0	$15,000	$7,000
6	$0	$15,000	$0
7	$0	$15,000	$0
8	$0	$15,000	$0
9	$0	$15,000	$0
10	$0	$15,000	$7,000
11	$0	$15,000	$0
12	$0	$15,000	$0
13	$0	$15,000	$0
14	$0	$15,000	$0
15	$0	$15,000	$7,000

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area D
Coke Point Groundwater CMS

Estimated Remedial Costs for Assessment Area D Alternatives													
	Alternative 1: No Action			Alternative 2[a]: Capping, MNA, ECs/ICs			Alternative 3[b]: Bioremediation, Capping, MNA, ECs/ICs			Alternative 4[b]: ISCO, Capping, MNA, ECs/ICs			Notes
Cost Item	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	
Active Remedy	$ -	$ -	$ -	$ -	$ -	$ -	$ 109,000	$ 294,000		$ 109,000	$ 454,000		Capping costs considered under redevelopment program. Performance monitoring for Year 1 inlcuded as part of the remedial action.
MNA (Years 1-5)	$ -	$ -	$ -	$ 16,000	$ 14,000	$ 7,000	$ 16,000	$ 14,000	$ 7,000	$ 16,000	$ 14,000	$ 7,000	MNA to begin in Year 1 for Alternative 2. Assumes semi-annual sampling for 15 years. To begin in Year 2 for Alternatives 3 and 4 and assumes qsemi-annual monitoring.
MNA (Years 6-10)	$ -	$ -	$ -	$ -	$ 14,000	$ 7,000	$ -	$ 14,000	$ 7,000	$ -	$ 14,000	$ 7,000	MNA for Alternatives 3 and 4 assumes semi-annual sampling for years 6-10.
MNA (Years 11-15)	$ -	$ -	$ -	$ -	$ 14,000	$ 7,000	$ -	$ 14,000	$ 7,000	$ -	$ 14,000	$ 7,000	MNA for Alternatives 3 and 4 assumes semi-annual sampling for years 11-15
Estimated Total Remedial Costs for GAA D Alternatives													
Total Net Present Value	$ -	$ -	$ -	$ 16,000	$ 128,000	$ 11,000	$ 125,000	$ 389,000	$ 11,000	$ 125,000	$ 538,000	$ 11,000	Assumes a discount rate 7%.
NPV Costs for Project Duration	$		-	$		155,000	$		525,000	$		674,000	

[a] MNA will be conducted on a semi-annual basis for the full 15 year duration

[b] MNA will be conducted after completion of the remedial action. MNA will be conducted on a semi-annual basis for years 2-15.

Assessment Area D - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Capital Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$16,000	

Annual O&M Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 1-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$2,860	$6,000	
Reporting	1	Event	$5,000	$5,000	
		Subtotal - Site Monitoring		$11,000	
Subtotal - Site Monitoring				$11,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$12,000	
Project Management			5%	$1,000	
Technical Support			5%	$1,000	
Total - Site Monitoring				$14,000	
Total Annual O&M Costs				$14,000	

Periodic Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area D - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Costs		**Present Value**
Total Captial Costs	$16,000	$16,000
Total Annual O&M Costs		
Years 1-15	*$14,000*	*$128,000*
Total Period Costs	$7,000	$11,000
Total Net Present Value		$155,000

Annual Cash Flow			
Year	**Capital Costs**	**Annual O&M Costs**	**Periodic Costs**
1	$16,000	$14,000	$0
2	$0	$14,000	$0
3	$0	$14,000	$0
4	$0	$14,000	$0
5	$0	$14,000	$7,000
6	$0	$14,000	$0
7	$0	$14,000	$0
8	$0	$14,000	$0
9	$0	$14,000	$0
10	$0	$14,000	$7,000
11	$0	$14,000	$0
12	$0	$14,000	$0
13	$0	$14,000	$0
14	$0	$14,000	$0
15	$0	$14,000	$7,000

Assessment Area D - Alternative 3 - Bioremediation and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Bioremediation System Installation					Installation costs provided by TPA drilling contractor and Weaver Consultants Group.
Injection Well Installation	25	Well	$3,600	$90,000	Includes drilling, well install, well head construction, and development (25 injection wells).
Sub Total				$90,000	
Contingency (5% scope, 5% bid)			10%	$9,000	
Subtotal - Bioremediation System Installation				$99,000	
Project Management			5%	$5,000	
Remedial Design			5%	$5,000	
Total - Bioremediation System Installation				$109,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$125,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Bioremediation Operation					
Semi-Annual Injection Events(Year 1)					Estimated costs provided by Weaver Consultants Group. Based on number of injection wells and yearly injection events.
Remedial Injections	2	YR	$89,285	$179,000	
Performance Monitoring	2	YR	$5,900	$12,000	
Reporting	1	YR	$10,000	$10,000	
			Sub Total	$201,000	
Subtotal - Bio Injections				$201,000	
Contingency (5% scope, 5% bid)			10%	$20,000	
Subtotal - Bio Injections				$221,000	
Project Management			8%	$18,000	
Remedial Design			15%	$33,000	
Technical Support			10%	$22,000	
Total - Bio Injections				$294,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area D
Alternative 3

Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 2-5)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$2,860	$6,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$11,000	
Semi-Annual Groundwater Monitoring (Years 6-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$2,860	$6,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$11,000	
Subtotal - Site Monitoring			Years 2-5	Years 6-15	
			$11,000	$11,000	
Contingency (5% scope, 5% bid)	10%		$1,000	$1,000	
Subtotal - Site Monitoring			Years 2-5	Years 6-15	
			$12,000	$12,000	
Project Management	5%		$1,000	$1,000	
Technical Support	5%		$1,000	$1,000	
Total - Site Monitoring			Years 2-5	Years 6-15	
			$14,000	$14,000	
			Year 1	Years 2-5	Years 6-15
Total Annual O&M Costs			$294,000	$14,000	$14,000

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area D - Alternative 3 - Bioremediation and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis			
Discount rate	7%		
Capital Costs			**Present Value**
Bioremediation Wells	$109,000		$109,000
Monitoring Wells	$16,000		$16,000
		Subtotal	$125,000
Total Annual O&M Costs			
Year 1	*$294,000*		*$275,000*
Years 2-5	*$14,000*		*$44,000*
Years 6-15	*$14,000*		*$70,000*
Total			$389,000
Total Period Costs	$7,000		$11,000
Total Net Present Value			$525,000

Annual Cash Flow					
	Capital Costs	**Annual O&M Costs**			**Periodic Costs**
Year		**Year 1**	**Years 2-5**	**Years 6-15**	
1	$109,000	$294,000	$0	$0	$0
2	$16,000	$0	$14,000	$0	$0
3	$0	$0	$14,000	$0	$0
4	$0	$0	$14,000	$0	$0
5	$0	$0	$14,000	$0	$7,000
6	$0	$0	$0	$14,000	$0
7	$0	$0	$0	$14,000	$0
8	$0	$0	$0	$14,000	$0
9	$0	$0	$0	$14,000	$0
10	$0	$0	$0	$14,000	$7,000
11	$0	$0	$0	$14,000	$0
12	$0	$0	$0	$14,000	$0
13	$0	$0	$0	$14,000	$0
14	$0	$0	$0	$14,000	$0
15	$0	$0	$0	$14,000	$7,000
16	0	0	0	0	$0
17	0	0	0	0	$0
18	0	0	0	0	$0
19	0	0	0	0	$0
20	0	0	0	0	$0

Assessment Area D - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
ISCO Well Installation					Installation costs provided by TPA drilling contractor and Weaver Consultants Group.
Injection well installation	25	Well	$3,600	$90,000	Includes drilling, well install, well head construction, and development (25 injection wells).
Sub Total				$90,000	
Contingency (5% scope, 5% bid)			10%	$9,000	
Subtotal - Site Monitoring				$99,000	
Project Management			5%	$5,000	
Remedial Design			5%	$5,000	
Total - ISCO Well Installation				$109,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$125,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
ISCO Injections					
Semi Annual Injection Events (Year 1)					Estimated costs developed based on TPA's bulk hydrogen peroxide rate. Based on number of injection wells and yearly injection events.
Remedial Injections	2	Event	$152,600	$305,000	
Performance Monitoring	2	Event	$5,900	$12,000	
Reporting	1	YR	$10,000	$10,000	
			Sub Total	$327,000	
Subtotal - ISCO Injections				$327,000	
Contingency (5% scope, 5% bid)			10%	$33,000	
Subtotal - ISCO Injections				$360,000	
Project Management			6%	$22,000	
Remedial Design			12%	$43,000	
Technical Support			8%	$29,000	
Total - ISCO Injections				$454,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area D
Alternative 4

Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 2-5)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$2,860	$6,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$11,000	
Semi-Annual Groundwater Monitoring (Years 6-10)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$2,860	$6,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$11,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	1	Event	$2,860	$3,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$8,000	
Subtotal - Site Monitoring			Years 2-5	Years 6-10	Years 11-15
			$11,000	$11,000	$8,000
Contingency (5% scope, 5% bid)	10%		$1,000	$1,000	$1,000
Subtotal - Site Monitoring			Years 2-5	Years 6-10	Years 11-15
			$12,000	$12,000	$9,000
Project Management	5%		$1,000	$1,000	$0
Technical Support	5%		$1,000	$1,000	$0
Total - Site Monitoring				Years 2-5	Years 6-10
				$14,000	$14,000
			Year 1	Years 2-5	Years 6-15
Total Annual O&M Costs			$454,000	$14,000	$14,000

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area D - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
ISCO Wells	$109,000	$109,000
Monitoring Wells	$16,000	$16,000
	Subtotal	$125,000
Total Annual O&M Costs		
Year 1	*$454,000*	*$424,000*
Years 2-5	*$14,000*	*$44,000*
Years 6-15	*$14,000*	*$70,000*
Total		$538,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$674,000

Annual Cash Flow					
	Capital Costs	**Annual O&M Costs**			**Periodic Costs**
Year		**Year 1**	**Years 2-5**	**Years 6-15**	
1	$109,000	$454,000	$0	$0	$0
2	$16,000	$0	$14,000	$0	$0
3	$0	$0	$14,000	$0	$0
4	$0	$0	$14,000	$0	$0
5	$0	$0	$14,000	$0	$7,000
6	$0	$0	$0	$14,000	$0
7	$0	$0	$0	$14,000	$0
8	$0	$0	$0	$14,000	$0
9	$0	$0	$0	$14,000	$0
10	$0	$0	$0	$14,000	$7,000
11	$0	$0	$0	$14,000	$0
12	$0	$0	$0	$14,000	$0
13	$0	$0	$0	$14,000	$0
14	$0	$0	$0	$14,000	$0
15	$0	$0	$0	$14,000	$7,000

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area E
Coke Point Groundwater CMS

Estimated Remedial Costs for Assessment Area E Alternatives													
	Alternative 1: No Action			Alternative 2[a]: Capping, MNA, ECs/ICs			Alternative 3[b]: Bioremediation, Capping, MNA, ECs/ICs			Alternative 4[b]: ISCO, Capping, MNA, ECs/ICs			Notes
Cost Item	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	
Active Remedy	$ -	$ -	$ -	$ -	$ -	$ -	$ 109,000	$ 327,000	$ 7,000	$ 109,000	$ 374,000		Capping costs considered under redevelopment program. Performance monitoring for Year 1 included as part of the remedial action.
MNA (Years 1-5)	$ -	$ -	$ -	$ 16,000	$ 20,000	$ 7,000	$ 16,000	$ 20,000	$ 7,000	$ 16,000	$ 20,000	$ 7,000	MNA to begin in Year 1 for Alternative 2. Assumes semi-annual sampling for 15 years. MNA to begin in year 2 for Alternatives 3 and 4 and assumes semi-annual sampling.
MNA (Years 6-10)	$ -	$ -	$ -	$ -	$ 20,000	$ 7,000	$ -	$ 20,000	$ 7,000	$ -	$ 20,000	$ 7,000	MNA for Alternatives 2, 3 and 4 assumes semi-annual sampling for years 6-10
MNA (Years 11-15)	$ -	$ -	$ -	$ -	$ 20,000	$ 7,000	$ -	$ 20,000	$ 7,000	$ -	$ 20,000	$ 7,000	MNA for Alternatives 2, 3 and 4 assumes semi-annual sampling for years 11-15
Estimated Total Remedial Costs for GAA E Alternatives													
Total Net Present Value	$ -	$ -	$ -	$ 16,000	$ 182,000	$ 11,000	$ 123,000	$ 469,000	$ 11,000	$ 123,000	$ 513,000	$ 11,000	Assumes a discount rate 7%.
NPV Costs for Project Duration	$		-	$		209,000	$		603,000	$		647,000	

[a] MNA will be conducted on a semi-annual basis for the full 15 year duration

[b] MNA will be conducted after completion of the remedial action in years 2-15 of the project duration. MNA will be conducted on a semi-annual basis.

Assessment Area E - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Capital Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Site Monitoring				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$16,000	

Annual O&M Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 1-15)					
Groundwater Sampling	2	Event	$5,340	$11,000	Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Reporting	1	Event	$5,000	$5,000	
		Subtotal - Site Monitoring		$16,000	
Subtotal - Site Monitoring				$16,000	
Contingency (5% scope, 5% bid)			10%	$2,000	
Subtotal - Site Monitoring				$18,000	
Project Management			5%	$1,000	
Technical Support			5%	$1,000	
Total Annual O&M Costs				$20,000	

Periodic Costs

Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area E - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Costs		**Present Value**
Total Captial Costs	$16,000	$16,000
Total Annual O&M Costs		
Years 1-15	*$20,000*	*$182,000*
Total Period Costs	$7,000	$11,000
Total Net Present Value		$209,000

Annual Cash Flow			
Year	**Capital Costs**	**Annual O&M Costs**	**Periodic Costs**
1	$16,000	$20,000	$0
2	$0	$20,000	$0
3	$0	$20,000	$0
4	$0	$20,000	$0
5	$0	$20,000	$7,000
6	$0	$20,000	$0
7	$0	$20,000	$0
8	$0	$20,000	$0
9	$0	$20,000	$0
10	$0	$20,000	$7,000
11	$0	$20,000	$0
12	$0	$20,000	$0
13	$0	$20,000	$0
14	$0	$20,000	$0
15	$0	$20,000	$7,000

Assessment Area E - Alternative 3 - Bioremediation and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Bioremediation System Installation					Installation costs provided by TPA drilling contractor and Weaver Consultants Group.
Injection well installation	25	Well	$3,600	$90,000	Includes drilling, well install, well head construction, and development (25 injection wells).
Sub Total				$90,000	
Contingency (5% scope, 5% bid)			10%	$9,000	
Subtotal - Bioremediation System Installation				$99,000	
Project Management			5%	$5,000	
Remedial Design			5%	$5,000	
Total - Bioremediation System Installation				$109,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$125,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Bioremediation Operation					
Semi-Annual Injection Events(Year 1)					Estimated costs provided by Weaver Consultants Group. Based on number of injection wells and yearly injection events.
Remedial Injections	2	Event	$100,353	$201,000	
Performance Monitoring	2	Event	$5,900	$12,000	
Reporting	1	YR	$10,000	$10,000	
			Sub Total	$223,000	
Subtotal - Bio Injections				$223,000	
Contingency (5% scope, 5% bid)			10%	$22,000	
Subtotal - Bio Injections				$245,000	
Project Management			8%	$20,000	
Remedial Design			15%	$37,000	
Technical Support			10%	$25,000	
Total - Bio Injections				$327,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area E
Alternative 3

Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 2-5)					
Groundwater Sampling	2	Event	$5,340	$11,000	Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Semi-Annual Groundwater Monitoring (Years 6-15)					
Groundwater Sampling	2	Event	$5,340	$11,000	Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Subtotal - Site Monitoring			Years 2-5	Years 6-15	
			$16,000	$16,000	
Contingency (5% scope, 5% bid)	10%		$2,000	$2,000	
Subtotal - Site Monitoring			Years 2-5	Years 6-15	
			$18,000	$18,000	
Project Management		5%	$1,000	$1,000	
Technical Support		5%	$1,000	$1,000	
Total - Site Monitoring			Years 2-5	Years 6-15	
			$20,000	$20,000	
		Year 1	Years 2-5	Years 6-15	
Total Annual O&M Costs		$327,000	$20,000	$20,000	

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area E - Alternative 3 - BioSparge and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis			
Discount rate	7%		
Capital Costs			**Present Value**
Bioremediation Wells	$109,000		$109,000
Monitoring Wells	$16,000		$14,000
		Subtotal	$123,000
Total Annual O&M Costs			
Year 1	*$327,000*		*$306,000*
Years 2-5	*$20,000*		*$63,000*
Years 6-15	*$20,000*		*$100,000*
Total			$469,000
Total Period Costs	$7,000		$11,000
Total Net Present Value			$603,000

Annual Cash Flow					
	Capital Costs	**Annual O&M Costs**			**Periodic Costs**
Year		**Year 1**	**Years 2-5**	**Years 6-15**	
1	$109,000	$327,000	$0	$0	$0
2	$16,000	$0	$20,000	$0	$0
3	$0	$0	$20,000	$0	$0
4	$0	$0	$20,000	$0	$0
5	$0	$0	$20,000	$0	$7,000
6	$0	$0	$0	$20,000	$0
7	$0	$0	$0	$20,000	$0
8	$0	$0	$0	$20,000	$0
9	$0	$0	$0	$20,000	$0
10	$0	$0	$0	$20,000	$7,000
11	$0	$0	$0	$20,000	$0
12	$0	$0	$0	$20,000	$0
13	$0	$0	$0	$20,000	$0
14	$0	$0	$0	$20,000	$0
15	$0	$0	$0	$20,000	$7,000

Assessment Area E - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
ISCO Well Installation					Installation costs provided by TPA drilling contractor and Weaver Consultants Group.
Injection well installation	25	Well	$3,600	$90,000	Includes drilling, well install, well head construction, and development (25 injection wells).
Sub Total				$90,000	
Contingency (5% scope, 5% bid)			10%	$9,000	
Subtotal - ISCO Well Installation				$99,000	
Project Management			5%	$5,000	
Remedial Design			5%	$5,000	
Total - ISCO Well Installation				$109,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Total Capital Costs				$125,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
ISCO Injections					
Semi-Annual Injection Events (Year 1)					Estimated costs developed based on TPA's bulk hydrogen peroxide rate. Based on number of injection wells and yearly injection events.
Remedial Injections	2	Event	$123,575	$247,000	
Performance Monitoring	2	Event	$5,900	$12,000	
Reporting	1	YR	$10,000	$10,000	
			Sub Total	$269,000	
Subtotal - ISCO Injections				$269,000	
Contingency (5% scope, 5% bid)			10%	$27,000	
Subtotal - ISCO Injections				$296,000	
Project Management			6%	$18,000	
Remedial Design			12%	$36,000	
Technical Support			8%	$24,000	
Total - ISCO Injections				$374,000	

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area E
Alternative 4

Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 2-5)					
Groundwater Sampling	2	Event	$5,340	$11,000	Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Semi-Annual Groundwater Monitoring (Years 6-10)					
Groundwater Sampling	2	Event	$5,340	$11,000	Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					
Groundwater Sampling	2	Event	$5,340	$11,000	Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Subtotal - Site Monitoring			Years 2-5	Years 6-10	Years 11-15
			$16,000	$16,000	$16,000
Contingency (5% scope, 5% bid)	10%		$2,000	$2,000	$2,000
Subtotal - Site Monitoring			Years 2-5	Years 6-10	Years 11-15
			$18,000	$18,000	$18,000
Project Management	5%		$1,000	$1,000	$1,000
Technical Support	5%		$1,000	$1,000	$1,000
Total - Site Monitoring				Years 2-5	Years 6-10
				$20,000	$20,000
			Year 1	Years 2-5	Years 6-15
Total Annual O&M Costs			$374,000	$20,000	$20,000

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area E - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
ISCO Wells	$109,000	$109,000
Monitoring Wells	$16,000	$14,000
	Subtotal	$123,000
Total Annual O&M Costs		
Year 1	*$374,000*	*$350,000*
Years 2-5	*$20,000*	*$63,000*
Years 6-10	*$20,000*	*$100,000*
Total		$513,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$647,000

Annual Cash Flow					
	Capital Costs	**Annual O&M Costs**			**Periodic Costs**
Year		**Year 1**	**Years 2-5**	**Years 6-10**	
1	$109,000	$374,000	$0	$0	$0
2	$16,000	$0	$20,000	$0	$0
3	$0	$0	$20,000	$0	$0
4	$0	$0	$20,000	$0	$0
5	$0	$0	$20,000	$0	$7,000
6	$0	$0	$0	$20,000	$0
7	$0	$0	$0	$20,000	$0
8	$0	$0	$0	$20,000	$0
9	$0	$0	$0	$20,000	$0
10	$0	$0	$0	$20,000	$7,000
11	$0	$0	$0	$20,000	$0
12	$0	$0	$0	$20,000	$0
13	$0	$0	$0	$20,000	$0
14	$0	$0	$0	$20,000	$0
15	$0	$0	$0	$20,000	$7,000

Appendix I - Estimated Remedial Costs for Groundwater Assessment Area F
Coke Point Groundwater CMS

Estimated Remedial Costs for Assessment Area F Alternatives													
	Alternative 1: No Action			Alternative 2[a]: Excavation, Capping, MNA, ECs/ICs			Alternative 3[b]: Excavation, Biosparge, Capping, MNA, and ECs/ICs			Alternative 4[b]: Excavation, ISCO, Capping, MNA, and ECs/ICs			Notes
Cost Item	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	Capital Expenses	Annual Operational Expenses	Periodic Costs	
Active Remedy	$ -	$ -	$ -	$ -	$ -	$ -	$ 303,000	$ 140,000	$ 7,000	$ 109,000	$ 277,000	$ 7,000	Capping costs considered under redevelopment program. Performance monitoring is inlcuded as part of the remedial action. Alternative 3 includes five years of remedial action. Alternative 4 includes two years of remedial action.
MNA (Years 1-5)	$ -	$ -	$ -	$ 22,000	$ 20,000	$ 7,000	$ -	$ -	$ -	$ 16,000	$ 20,000	$ 7,000	MNA to begin in Year 1 for Alternative 2 and Year 3 for Alternative 4 follwing the implementation of remedial action. Assumes semi-annual sampling.
MNA (Years 6-10)	$ -	$ -	$ -	$ -	$ 20,000	$ 7,000	$ 16,000	$ 20,000	$ 7,000	$ -	$ 20,000	$ 7,000	MNA to begin in Year 6 for Alternatives 3, following the implemenation of the remedial action. Assumes semi-annual sampling for years 6-10.
MNA (Years 11-15)	$ -	$ -	$ -	$ -	$ 20,000	$ 7,000	$ -	$ 20,000	$ 7,000	$ -	$ 20,000	$ 7,000	MNA for Alternatives 3 and 4 assumes semi-annual sampling for years 11-15.

Estimated Total Remedial Costs for GAA F Alternatives													
Total Net Present Value	$ -	$ -	$ -	$ 38,000	$ 182,000	$ 11,000	$ 336,000	$ 674,000	$ 11,000	$ 144,000	$ 647,000	$ 11,000	Assumes a discount rate 7%.
NPV Costs for Project Duration	$ -			$ 231,000			$ 1,021,000			$ 802,000			

[a] MNA will be conducted on a semi-annual basis for the full 15 year duration

[b] MNA will be conducted after completion of the remedial action in years 6-15 of the project duration. MNA will be conducted on a semi-annual basis for years 6-15.

Assessment Area F - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring well installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Excavation					Costs provided by TPA excavation contractor.
Excavation at B18-026-MWS	1	each	$12,000	$12,000	Includes mob/demob, excavation, and labor
Materials	1	each	$4,000	$4,000	Includes backfill
Sub Total				$16,000	
Contingency (5% scope, 5% bid)			10%	$2,000	
Subtotal - Excavation				$18,000	
Project Management			6%	$1,000	
Remedial Design			12%	$2,000	
Technical Support			8%	$1,000	
Total - Excavation				$22,000	
Total Capital Costs				$38,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 1-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$5,340	$11,000	
Reporting	1	Event	$5,000	$5,000	
		Subtotal - Site Monitoring		$16,000	
Subtotal - Site Monitoring				$16,000	
Contingency (5% scope, 5% bid)			10%	$2,000	
Subtotal - Site Monitoring				$18,000	
Project Management			5%	$1,000	
Technical Support			5%	$1,000	
Total - Site Monitoring				$20,000	
Total Annual O&M Costs				$20,000	

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	

Total Period Costs	$7,000

Assessment Area F - Alternative 2 - Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Costs		**Present Value**
Monitoring Wells	$16,000	$16,000
Excavation	$22,000	$22,000
Subtotal		$38,000
Total Annual O&M Costs		
Years 1-15	*$20,000*	*$182,000*
Total Period Costs	$7,000	$11,000
Total Net Present Value		$231,000

Annual Cash Flow			
Year	**Capital Costs**	**Annual O&M Costs**	**Periodic Costs**
1	$22,000	$20,000	$0
2	$0	$20,000	$0
3	$0	$20,000	$0
4	$0	$20,000	$0
5	$0	$20,000	$7,000
6	$0	$20,000	$0
7	$0	$20,000	$0
8	$0	$20,000	$0
9	$0	$20,000	$0
10	$0	$20,000	$7,000
11	$0	$20,000	$0
12	$0	$20,000	$0
13	$0	$20,000	$0
14	$0	$20,000	$0
15	$0	$20,000	$7,000

Assessment Area F - Alternative 3 - BioSparge and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
BioSparge System Installation					Installation costs provided by TPA drilling contractor. Includes drilling, well install, well head construction, and development (25 injection wells)
Sparge well installation	25	Well	$3,600	$90,000	
BioSparge System Installation	1	LS	$128,800	$129,000	
Sub Total				$219,000	
Contingency (5% scope, 5% bid)			10%	$22,000	
Subtotal - BioSparge System Installation				$241,000	
Project Management			6%	$14,000	
Remedial Design			12%	$29,000	
Technical Support			8%	$19,000	
Total - BioSparge System Installation				$303,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor. Includes drilling, well install, well head construction, and development.
Monitoring well installation	5	Well	$2,600	$13,000	
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Excavation					Costs provided by TPA excavation contractor.
Excavation at B18-026-MWS	1	each	$12,000	$12,000	Includes mob/demob, excavation, and labor
Materials	1	each	$4,000	$4,000	Includes backfill
Sub Total				$16,000	
Contingency (5% scope, 5% bid)			10%	$2,000	
Subtotal - Excavation				$18,000	
Project Management			6%	$1,000	
Remedial Design			12%	$2,000	
Technical Support			8%	$1,000	
Total - Excavation				$22,000	
Total Capital Costs				$341,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Bio Sparge Operation					
Annual Operation and Maintenance (Years 1-5)					Operation costs based on current costs incurred for operation of air sparge IMs.
Biweekly Visits	12	EA	$1,225	$15,000	
Monthly Visits	8	EA	$2,325	$19,000	
Quarterly Visits	3	EA	$5,150	$15,000	
Annual Visits	1	EA	$12,125	$12,000	
Emergency Visits	4	EA	$2,325	$9,000	
Performance Monitoring	2	Qtr	$10,800	$22,000	
Reporting	1	Qtr	$10,000	$10,000	
Utilities	12	Mon	$800	$10,000	
			Sub Total	$112,000	
Subtotal - Bio Sparge Operation				$112,000	
Contingency (5% scope, 5% bid)			10%	$11,000	

Subtotal - Bio Sparge Operation				$123,000	
Project Management			6%	$7,000	
Technical Support			8%	$10,000	
Total - Bio Sparge Operation				$140,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 6-10)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	QTR	$5,340	$11,000	
Reporting	1	QTR	$5,000	$5,000	
			Sub Total	$16,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$5,340	$11,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$16,000	$16,000	
Contingency (5% scope, 5% bid)		10%	$2,000	$2,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$18,000	$18,000	
Project Management		5%	$1,000	$1,000	
Technical Support		5%	$1,000	$1,000	
Total - Site Monitoring			Years 6-10	Years 11-15	
			$20,000	$20,000	
		Years 1-5	Years 6-10	Years 11-15	
Total Annual O&M Costs		$140,000	$20,000	$20,000	

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	
Subtotal - Periodic Costs				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Periodic Costs				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area F - Alternative 3 - BioSparge and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
Bioremediation Wells	$303,000	$303,000
Monitoring Wells	$16,000	$11,000
Excavation	$22,000	$22,000
	Subtotal	$336,000
Total Annual O&M Costs		**Present Value**
Years 1-5	*$140,000*	*$574,000*
Years 6-10	*$20,000*	*$58,000*
Years 11-15	*$20,000*	*$42,000*
Total		$674,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$1,021,000

Annual Cash Flow					
	Capital Costs	**Annual O&M Costs**			**Periodic Costs**
Year		**Years 1-5**	**Years 6-10**	**Years 11-15**	
1	$303,000	$140,000	$0	$0	$0
2	$0	$140,000	$0	$0	$0
3	$0	$140,000	$0	$0	$0
4	$0	$140,000	$0	$0	$0
5	$0	$140,000	$0	$0	$7,000
6	$16,000	$0	$20,000	$0	$0
7	$0	$0	$20,000	$0	$0
8	$0	$0	$20,000	$0	$0
9	$0	$0	$20,000	$0	$0
10	$0	$0	$20,000	$0	$7,000
11	$0	$0	$0	$20,000	$0
12	$0	$0	$0	$20,000	$0
13	$0	$0	$0	$20,000	$0
14	$0	$0	$0	$20,000	$0
15	$0	$0	$0	$20,000	$7,000

Assessment Area F - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Capital Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	*Notes*
ISCO Well Installation					Installation costs provided by TPA drilling contractor and Weaver Consultants Group.
Injection well installation	25	Well	$3,600	$90,000	Includes drilling, well install, well head construction, and development (25 injection wells).
Sub Total				$90,000	
Contingency (5% scope, 5% bid)			10%	$9,000	
Subtotal - ISCO Well Installation				$99,000	
Project Management			5%	$5,000	
Remedial Design			5%	$5,000	
Total - ISCO Well Installation				$109,000	
Monitoring Well Installation					Installation of new monitoring wells to replace old or damaged wells, as needed. Costing from TPA drilling contractor.
Monitoring well installation	5	Well	$2,600	$13,000	Includes drilling, well install, well head construction, and development.
Sub Total				$13,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Subtotal - Monitoring Well Installation				$14,000	
Project Management			5%	$1,000	
Remedial Design			5%	$1,000	
Total - Monitoring Well Installation				$16,000	
Excavation					Costs provided by TPA excavation contractor.
Excavation at B18-026-MWS	1	each	$12,000	$12,000	Includes mob/demob, excavation, and labor
Materials	1	each	$4,000	$4,000	Includes backfill
Sub Total				$16,000	
Contingency (5% scope, 5% bid)			10%	$2,000	
Subtotal - Excavation				$18,000	
Project Management			6%	$1,000	
Remedial Design			12%	$2,000	
Technical Support			8%	$1,000	
Total - Excavation				$22,000	
Total Capital Costs				$147,000	

Annual O&M Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
ISCO Injections					
Semi-Annual Injection Events(Years 1-2)					Estimated costs developed based on TPA's bulk hydrogen peroxide rate. Based on number of injection wells and yearly injection events.
Remedial Injections	2	Event	$89,150	$178,000	
Performance Monitoring	2	Event	$5,900	$12,000	
Reporting	1	YR	$10,000	$10,000	
			Sub Total	$200,000	
Subtotal - ISCO Injections				$200,000	
Contingency (5% scope, 5% bid)			10%	$20,000	
Subtotal - ISCO Injections				$220,000	
Project Management			6%	$13,000	
Remedial Design			12%	$26,000	
Technical Support			8%	$18,000	

Total - ISCO Injections				$277,000	
Site Monitoring					
Semi-Annual Groundwater Monitoring (Years 3-10)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$5,340	$11,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Semi-Annual Groundwater Monitoring (Years 11-15)					Number of wells to be sampled based on the *Coke Point Sampling Plan* . Unit cost based on labor and equipment.
Groundwater Sampling	2	Event	$5,340	$11,000	
Reporting	1	Event	$5,000	$5,000	
			Sub Total	$16,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$16,000	$16,000	
Contingency (5% scope, 5% bid)		10%	$2,000	$2,000	
Subtotal - Site Monitoring			Years 6-10	Years 11-15	
			$18,000	$18,000	
Project Management		5%	$1,000	$1,000	
Technical Support		5%	$1,000	$1,000	
Total - Site Monitoring			Years 6-10	Years 11-15	
			$20,000	$20,000	
		Years 1-2	Years 3-10	Years 11-15	
Total Annual O&M Costs		$277,000	$20,000	$20,000	

Periodic Costs					
Description	*Quantity*	*Unit*	*Unit Cost*	*Total Cost*	
Five Year Review Report	1	ea	$6,000	$6,000	Update report to be submitted to the Agencies every five years
Subtotal - Site Monitoring				$6,000	
Contingency (5% scope, 5% bid)			10%	$1,000	
Sub Total				$7,000	
Project Management			5%	$0	
Remedial Design			5%	$0	
Total Period Costs				$7,000	

Assessment Area F - Alternative 4 - ISCO and Monitored Site Attenuation - Cost Estimate

Net Present Value Analysis		
Discount rate	7%	
Capital Costs		**Present Value**
ISCO Wells	$109,000	$109,000
Monitoring Wells	$16,000	$13,000
Excavation	$22,000	$22,000
	Subtotal	$144,000
Total Annual O&M Costs		**Present Value**
Years 1-5	*$277,000*	*$501,000*
Years 6-10	*$20,000*	*$104,000*
Years 11-15	*$20,000*	*$42,000*
	Subtotal	$647,000
Total Period Costs	$7,000	$11,000
Total Net Present Value		$802,000

Annual Cash Flow					
	Capital Costs	**Annual O&M Costs**			**Periodic Costs**
Year		**Years 1-5**	**Years 6-10**	**Years 11-15**	
1	$109,000	$277,000	$0	$0	$0
2	$0	$277,000	$0	$0	$0
3	$16,000	$0	$20,000	$0	$0
4	$0	$0	$20,000	$0	$0
5	$0	$0	$20,000	$0	$7,000
6	$0	$0	$20,000	$0	$0
7	$0	$0	$20,000	$0	$0
8	$0	$0	$20,000	$0	$0
9	$0	$0	$20,000	$0	$0
10	$0	$0	$20,000	$0	$7,000
11	$0	$0	$0	$20,000	$0
12	$0	$0	$0	$20,000	$0
13	$0	$0	$0	$20,000	$0
14	$0	$0	$0	$20,000	$0
15	$0	$0	$0	$20,000	$7,000