December 13, 2024

Baltimore City, Dept. of
Recreation and Parks and MedStar Hospital
C/o GreenVest, LLC
Attn: Andrew Forbes, PE
4201 Northview Dr, Ste 202
Bowie, Maryland 20716

Via email: andrew@greenvestus.com

Re: Agency Interest Number: 180069
Tracking Number: 202361698
Tidal Authorization Number: 24-WQC-0020

Dear Baltimore City, Dept. of Recreation and Parks and Medstar Hospital:

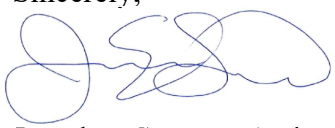
Your project did not qualify for approval under the Maryland State Programmatic General Permit (MDSPGP); therefore a separate review and issuance of the federal permit will be required by the U.S. Army Corps of Engineers. The federal permit is not attached.

Additionally, your project required a Wetlands License to be approved and issued by the Maryland Board of Public Works (BPW). The Wetlands License will be sent to you by BPW's Wetlands Administrator.

A project that does not qualify for approval under the MDSPGP requires an individual Water Quality Certification (WQC) to be issued by the Maryland Department of the Environment, which is attached. Please take a moment to read and review your WQC to ensure that you understand the limits of the authorized work and all of the general and special conditions.

You should not begin any work until you have obtained all necessary State, local, and federal authorizations. Please contact Matthew Wallach at matthew.wallach@maryland.gov or 410-207-0893 with any questions.

Sincerely,



Jonathan Stewart, Acting Chief
Tidal Wetlands Division

STATE OF MARYLAND
DEPARTMENT OF THE ENVIRONMENT
WATER AND SCIENCE ADMINISTRATION
WATER QUALITY CERTIFICATION

24-WQC-0020

EFFECTIVE DATE:	**November 15, 2024**	
CERTIFICATION HOLDERS:	**Baltimore City Dept. of Recreation and Parks**	**MedStar Hospital**
ADDRESS:	**3001 East Drive** **Baltimore, MD 20716**	**3001 S. Hanover St** **Baltimore, MD 21221**
PROJECT LOCATION:	**Medstar Harbor Hospital** **3001-3131 S. Hanover Street, Baltimore City, MD 21217**	

UNDER AUTHORITY OF SECTION 401 OF THE FEDERAL WATER POLLUTION CONTROL ACT AND ITS AMENDMENTS AND IN ACCORDANCE WITH § 9-313 THROUGH § 9-323, INCLUSIVE, OF THE ENVIRONMENT ARTICLE, ANNOTATED CODE OF MARYLAND, THE MARYLAND DEPARTMENT OF THE ENVIRONMENT, WATER AND SCIENCE ADMINISTRATION HAS DETERMINED THAT THE REGULATED ACTIVITIES DESCRIBED IN THE REQUEST FOR CERTIFICATION FOR THE PROPOSED MARSH CREATION AND AS DESCRIBED IN THE ATTACHED PLAN SHEETS DATED MAY 21, 2024 AND ANY SUBSEQUENT MODIFICATIONS APPROVED BY THE DEPARTMENT WILL NOT VIOLATE MARYLAND'S WATER QUALITY STANDARDS, IF CONDUCTED IN ACCORDANCE WITH THE CONDITIONS OF THIS CERTIFICATION.

THIS CERTIFICATION DOES NOT RELIEVE THE APPLICANT OF RESPONSIBILITY FOR OBTAINING ANY OTHER APPROVALS, LICENSES, OR PERMITS IN ACCORDANCE WITH FEDERAL, STATE, OR LOCAL REQUIREMENTS AND DOES NOT AUTHORIZE COMMENCEMENT OF THE PROPOSED PROJECT. A COPY OF THIS REQUIRED CERTIFICATION HAS BEEN SENT TO THE CORPS OF ENGINEERS. THE CERTIFICATION HOLDER SHALL COMPLY WITH THE CONDITIONS LISTED BELOW.

The Maryland Department of Environment satisfied the statutory and regulatory public notice requirements by placing the WQC on Public Notice from June 1, 2024 to July 1, 2024 on Maryland Department of the Environment's Public Notice webpage and advertising in the Baltimore Sun on June 4, 2024.

PROJECT DESCRIPTION

Construct an 11.59-acre marsh at MedStar Harbor Hospital within 420 feet channelward of the mean high water line. The proposed marsh consists of the following:

- Construct approximately 2,000 linear feet of segmented stone and gravel sill.
- Fill and grade with 63,500 cubic yards of clean sand fill including a carbon layer to contain existing legacy contaminants.
- Establish 4.14 acres of low marsh vegetation and 4.49 acres of high marsh vegetation.

GENERAL CONDITIONS

1. All water quality-related performance standards and conditions required by the Department in any state issued authorization for activities in tidal wetlands, nontidal wetlands, their 100-year floodplains, nontidal wetlands buffers, or nontidal wetland expanded buffers to ensure that any discharges will not result in a failure to comply with water quality standards in COMAR 26.08.02 or any other water quality requirements of state law or regulation shall be met.

2. This Certification does not obviate the need to obtain required authorizations or approvals from other State, federal or local agencies as required by law.

3. All additional authorizations or approvals, including self-certifying General Permits issued by the Department, shall be obtained and all conditions shall be completed in compliance with such authorizations.

4. The proposed project shall be constructed in accordance with the approved final plan by the Department, or, if Department approval is not required, the plan approved by the U.S. Army Corps of Engineers, and its approved revisions.

5. All fill and construction materials not used in the project shall be removed and disposed of in a manner which will prevent their entry into waters of this State.

6. This Certification does not authorize any injury to private property, any invasion of rights, or any infringement of federal, state, or local laws or regulations.

7. Authorized representatives of the Department shall be provided access to the site of authorized activities during normal business hours to conduct inspections and evaluations of the operations and records necessary to assure compliance with this Certification.

8. No stockpiles of any material shall be placed in Waters of the U.S. or state or private tidal wetlands.

9. Temporary construction trailers or structures, staging areas and stockpiles shall not be located within tidal wetlands, nontidal wetlands, nontidal wetlands buffers, or the 100-year floodplain unless specifically included on the Approved Plan.

10. This Certification is valid for the project identified herein and the associated U.S. Army Corps of Engineers NAB-2023-61698, until such time as that federal approval expires or is not administratively extended.

SPECIAL CONDITIONS

1. All Critical Area requirements shall be followed and all necessary authorizations from the Critical Area Commission ("Commission") shall be obtained. This Certification does not constitute authorization for disturbance in the 100-foot Critical Area Buffer. "Disturbance" in the Buffer means clearing, grading, construction activities, or removal of any size of tree or vegetation. Any anticipated Buffer disturbance requires prior written approval, before commencement of land disturbing activity, from local jurisdiction in the form of a Buffer Management Plan.

2. All work performed under this Water Quality Certification shall be conducted by a marine contractor licensed by the Marine Contractors Licensing Board (MCLB) in accordance with Title 17 of the Environment Article of Annotated Code of Maryland. Licensing by MCLB shall occur prior to the beginning of construction activities. A list of licensed marine contractors may be obtained by-contacting the MCLB at 410-537- 3249, by e-mail at MDE.MCLB@maryland.gov or by accessing the Maryland Department of the Environment, Environmental Boards webpage.

3. The issuance of this Certification is not a validation or authorization by the Department for any of the existing structures depicted on the plan sheets on the subject property that is not part of the authorized work description, nor does it relieve the Certification Holder of the obligation to resolve any existing noncompliant structures and activities within tidal wetlands.

4. The Certification Holder shall construct the marsh establishment area in accordance with the following conditions:

    1. The Certification Holder shall use clean substrate fill material, no more than 10% of which shall pass through a standard number 100 sieve.
    2. The marsh establishment area shall be planted within one year following completion of the filling operation.
    3. The marsh establishment project shall be maintained as a wetland, with non-nuisance species' aerial coverage of at least 85% for three consecutive years. If 85% coverage is not attained, the reasons for failure shall be determined, corrective measures shall be taken, and the area shall be replanted.
    4. If the fill is graded hydraulically, the Certification Holder shall use a turbidity curtain around the perimeter of the instream work.
    5. If the existing bank is to be cleared or graded:
        a. The Certification Holder shall perform all work under and in accordance with an approved Soil Erosion and Sediment Control Plan from the applicable sediment and erosion control agency; and
        b. The Certification Holder shall perform all work under and in accordance with the Critical Area requirements of the local jurisdiction in the form of an approved Buffer Management Plan.

5. The Certification Holder shall follow the requirements of the marsh maintenance plan as required by Wetlands License 23-WL-1096 and any subsequent modifications.

6. The Certification Holder shall not perform any in water work from February 15 through June 15 of any year within the area on sheet 4 of the attached plan set to protect spawning yellow perch.

7. The Certification Holder shall deploy and maintain a turbidity curtain tightly around and channelward of the project area prior to any excavation and backfilling along the shoreline through completion of any excavation and backfilling along the shoreline.

8. The Certification Holder shall include the placement of an activated carbon amendment, per the guidance identified in the attached Memorandum from Dr. Upal Ghush, dated December 22, 2023.

9. The Certification Holder shall monitor the entire middle branch as outlined in the attached habitat monitoring plan dated June 5, 2023.

10. The Certification Holder shall not stockpile any material in State or private tidal wetlands.

CITATIONS AND STATEMENTS OF NECESSITY

1. Statement of Necessity for General Conditions 1, 2, 3, 4, and Special Conditions 1, 3: These conditions are necessary to ensure that water quality standards are met, and designated uses are maintained.

   Citations: Federal and state laws which authorize this condition include but are not limited to: 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.08.02.10G(3); COMAR 26.23.02.06; COMAR 26.17.01;COMAR 26.23; COMAR 26.24

2. Statement of Necessity for General Conditions 5, 8, 9: Fill or construction material within or adjacent to regulated resources may cause discharges resulting in turbidity in excess of water quality standards and interfere with designated uses of growth and propagation of fish, other aquatic life, wildlife; and other designated uses; and fail to meet general water quality criteria that waters not be polluted by substances in amounts sufficient to be unsightly or create a nuisance.

   Citation: 26.08.02.03B(l)-B(2); COMAR 26.23; COMAR 26.24; COMAR 26.17.04

3. Statement of Necessity for General Condition 6: This condition is necessary to clarify the scope of this certification to ensure compliance with water quality regulations, without limiting restrictions through other requirements.

   Citation: Federal and state laws which authorize this condition include but are not limited to: 33 U.S.C. § 134l(a), (b), & (d); 33 U.S.C. § 125l(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08, COMAR 26.08.02.l0E; COMAR 26.23.02.06; COMAR 26.17.04; COMAR26.23; COMAR 26.24

4. Statement of Necessity for General Condition 7: Conditions of certification involve precise actions to comply with water quality standards. Site inspection may be necessary to ensure that limits, methods, and other requirements are met to ensure that water quality standards are met and designated uses are maintained. These conditions are necessary to ensure that the activity was conducted, and project completed according to terms of the authorization/certification, while allowing for review of in-field modifications which may have resulted in discharges to ensure that water quality standards were met. Designated uses include support of estuarine and marine aquatic life and shellfish harvesting and for growth and propagation of fish, other aquatic life, and wildlife.

   Citation: Federal and state laws that authorize this condition include but are not limited to: 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env.Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.08.02.03B(l)(b); COMAR 26.08.02.03B(2); COMAR 26.23.02.06; COMAR 26.23; COMAR 26.24; COMAR 26.17.04

5. Statement of Necessity for General Condition 10: This condition is necessary to qualify the period of applicability of the terms and conditions of this Certification to be protective of Maryland water quality standards.

   Citations: Federal and state laws which authorize this condition include but are not limited to: 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; 40 C.F.R. 121, 15 C.F.R. 930, Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.17.04; COMAR 26.23; COMAR 26.24

6. Statement of Necessity for Special Condition 2: Expertise for conducting certain activities is required to ensure that there is no violation of water quality standards nor interference with designated uses. This condition is necessary to ensure that discharges will be conducted in a manner which does not violate water quality criteria nor interfere with designated uses.

   Citation: COMAR 26.08.02.02B(2)- B(4); COMAR 26.08 02.03B(2)(d)-(e); COMAR 26.08.02.03B(l)(b); 26.08.02.03B(2); COMAR 23.02.04.04

7. Statement of Necessity for Special Conditions 4, 5: Stabilization of the site with vegetation is required to ensure that waters continue to meet designated uses. Loss of substrate fill material may result in discharges which reduce water quality and interfere with designated uses, including the support of estuarine and marine aquatic life, and the protection of shellfish harvesting, shallow water submerged aquatic vegetation, and migratory fish spawning and nurseries in tidal wetlands. Loss limits will maintain the designated use.

   Citation: 1) COMAR 26.08.02.02.B.(3) 2) COMAR 26.08.02.03-3.C.(2)d.(5); 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.24

8. Statement of Necessity for Special Condition 6: A time of year restriction is necessary to allow for yellow perch to migrate between February 15 and June 15 to find suitable spawning habitat. Access to the upper reaches of rivers and tributaries to habitat suitable for spawning is essential to support yellow perch populations. Disturbance during the closure period would interfere directly or indirectly with designated uses.

   Citation: COMAR 26.08.02.02.B.(3); COMAR 26.08.02.03-3.C.(2)d.(5); 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.24

9. Statement of Necessity for Special Condition 7: The discharge and deposition of material within or adjacent to regulated resources may result in discharges that result in impacts to water quality and designated uses.

   Citations: 1) 26.08.02.02.B.(3) 2) 26.08.02.03-3.C.(2)d.(5)

10. Statement of Necessity for Special Condition 8: Discharges may be found to violate or potentially violate water quality standards during and after the discharge. Compensatory actions which fail to meet performance criteria will result in a failure of the water to meet designated uses. Remedial measures are necessary to ensure that water quality standards are met.

    Citations: 26.08.02.02B(1) 26.08.02.03B(1)(b) 26.08.02.03B(2)(e) 26.08.02 26.08.01.02A 26.08.02.09A

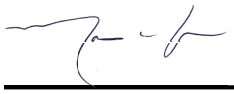
11. Statement of Necessity for Special Condition 9: Activities which discharge in regulated waters must be conducted according to certain procedures to maintain water quality. Monitoring the quality, characteristics, effects, and compensatory offsets may be necessary to ensure that water quality standards are met.

    Citations: COMAR 26.08.02.10B(1)(f) COMAR 26.08.02.10B(1)(g) COMAR 26.24 COMAR 26.23 COMAR 26.17.04

12. Statement of Necessity for Specials Condition 10: This condition is necessary to ensure discharges related to the stockpiling of material does not result in additional discharges which may result in violations of water quality due to turbidity and other alterations which interfere with designated uses as well as designated use class for support of estuarine and marine aquatic life, and support of designated uses for growth and propagation of fish, shallow water submerged vegetation, other aquatic life and wildlife. Loss limits will maintain the designation use.

    Citation: Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 5, Subtitles 5 and 9; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.24; COMAR 26.08; COMAR 26.08.02.10G(3); COMAR 26.08.02.06; COMAR 26.17.04; COMAR 26.23; COMAR 26.23.02.06; 33 U.S.C. § 1341(a), (b), & (d); 33 U.S.C. § 1251(b); 33 U.S.C. § 1370; Md. Ann. Code, Env. Article, Title 1, Subtitles 3 and 4; Md. Ann. Code, Env. Article, Title 9, Subtitle 3; Md. Ann. Code, Env. Article, Title 16; COMAR 26.08; COMAR 26.24

CERTIFICATION APPROVED



D. Lee Currey, Director
Water and Science Administration

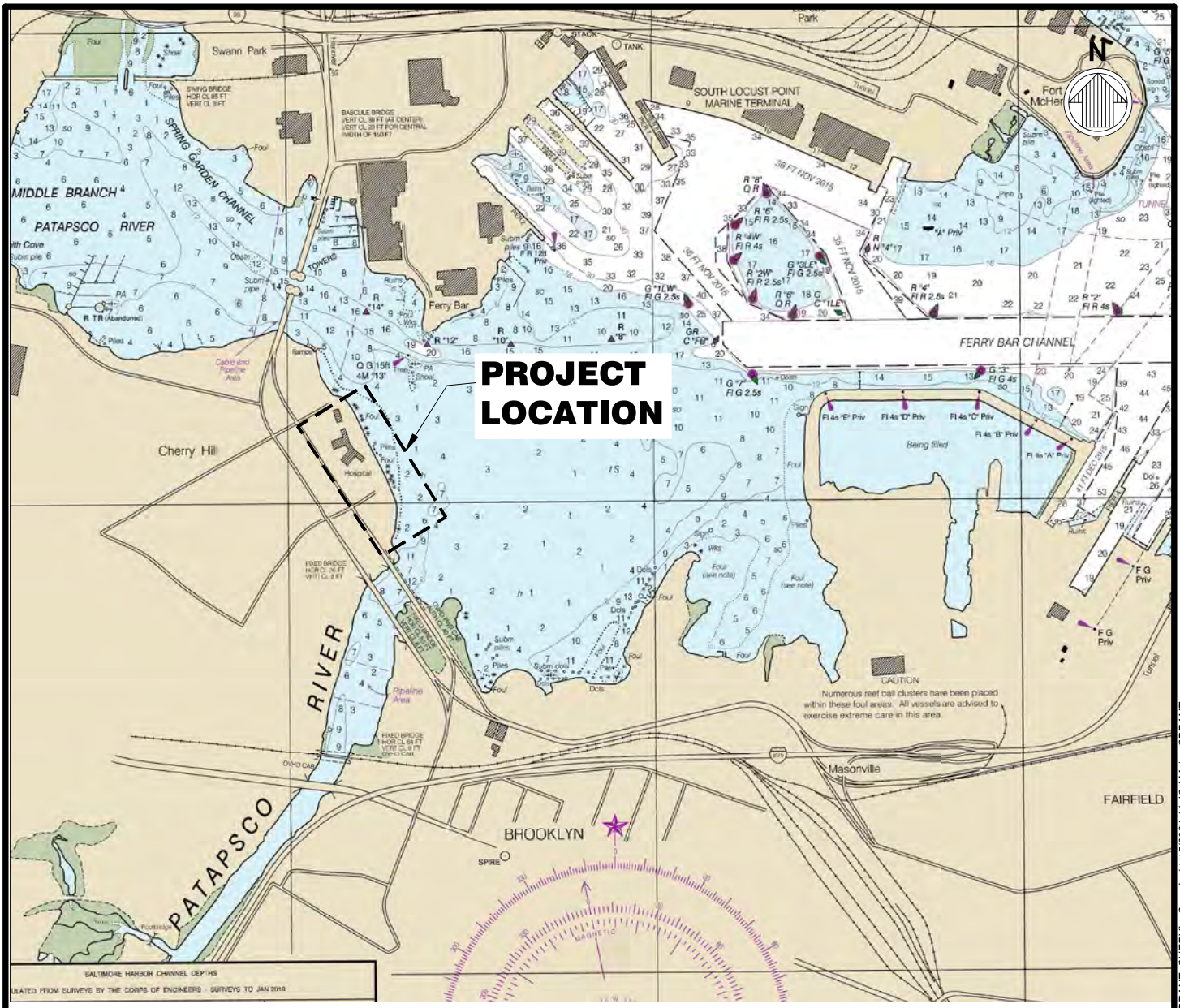
Dec 13, 2024
Date

Tracking Number: 202361698
Agency Interest Number: 180069

Effective Date: December 13, 2024

Enclosure: Plan Sheets dated May 21, 2024

cc: WSA Inspection & Compliance Program
Army Corps of Engineers



VICINITY MAP

SUMMARY:

1. REMOVE LITTER FROM 2,000 LF OF SHORELINE.
2. CONSTRUCT 2,000 LF OF NEW GRAVEL SHORELINE.
3. CONSTRUCT 8.63 AC OF TIDAL WETLANDS BY PLACING 63,500 CY OF CLEAN FILL .

NOTES:

BACKGROUND TAKEN FROM NOAA CHART 12281, 57TH ED., NOV. 27, 2018

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
24-WQC-0020
202361698
11/12/2024
1 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

1000' 0' 1000' 2000'
SCALE: 1"=2000'

DATE: NOVEMEBER 12, 2024

SHEET 1 OF 15

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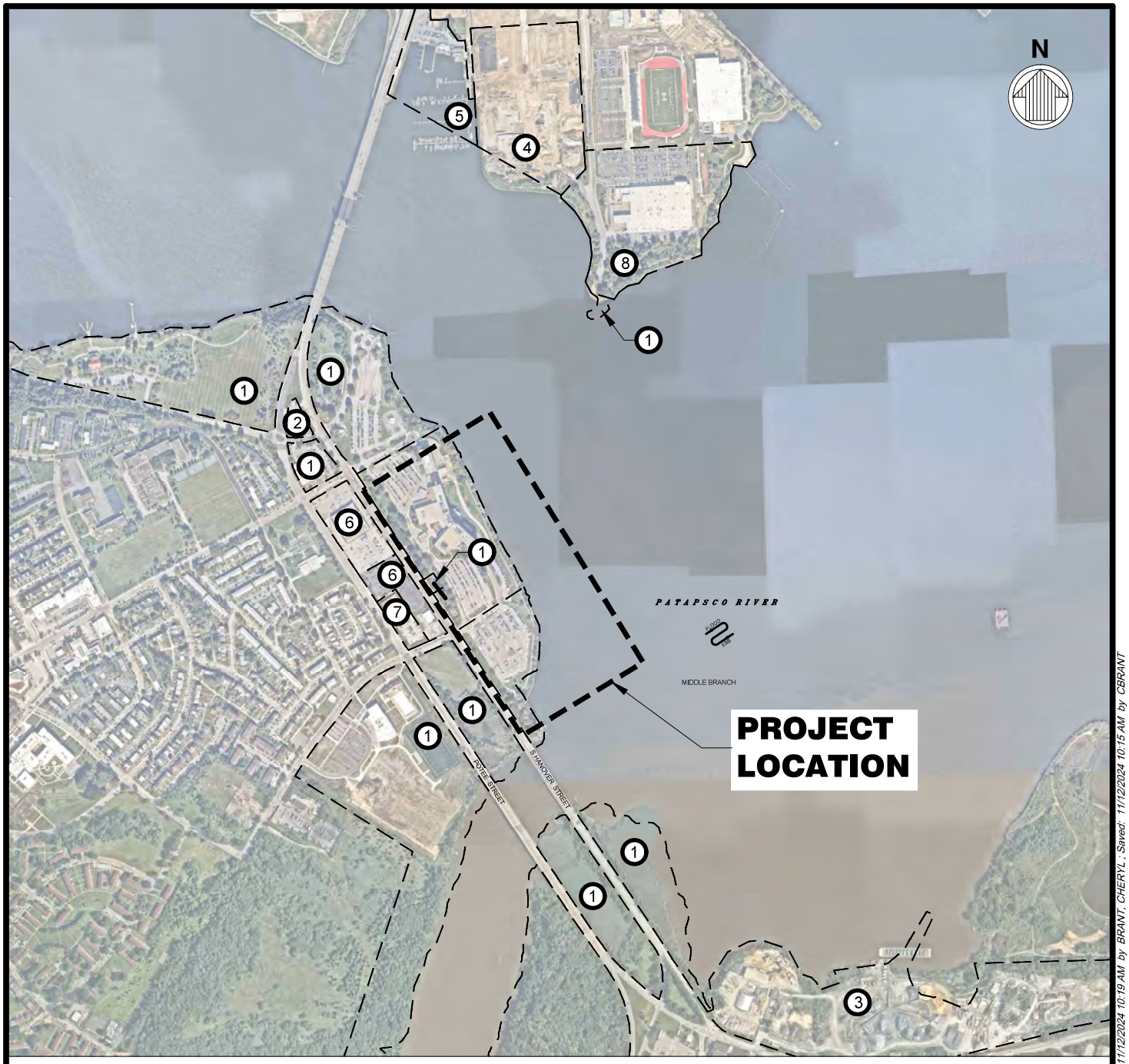

LOCATION PLAN

ADJACENT PROPERTIES

1. MAYOR AND CITY COUNCIL
   100 N. HOLLIDAY ST, SUITE 400
   BALTIMORE, MD, 21202
2. HANOVER BRIDGE, LLC
   100 E. PENNSYLVANIA AVE, SUITE 200
   BALTIMORE, MD, 21286
3. VULCAN MATERIALS
   P. O. BOX 385014, BIRMINGHAM, AL, 35238
4. INSULATOR DRIVE, LLC, (C/O MAG PARTNERS)
   1500 WHETSTONE WAY, SUITE 101
   BALTIMORE, MD, 21230
5. 2600 INSULATOR DRIVE, LLC, (C/O MAG PARTNERS)
   101 W. DICKMAN ST, SUITE 200
   BALTIMORE, MD, 21230
6. HARBOR HOSPITAL, INC
   3001 S. HANOVER ST, BALTIMORE, MD, 21225
7. HARBOR HOSPITAL CENTER, INC.
   C/O HANOVER DEV. ASS. LLC.
   P. O. BOX 196, STEVENSON, MD, 21153
8. UA PORT COVINGTON HOLDINGS, LLC
   1000 KEY HIGHWAY EAST, BALTIMORE, MD, 21230

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
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AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
24-WQC-0020
202361698
11/12/2024
2 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

500' 0' 500' 1000'
SCALE: 1"=1000'

DATE: NOVEMEBER 12, 2024

SHEET 2 OF 15

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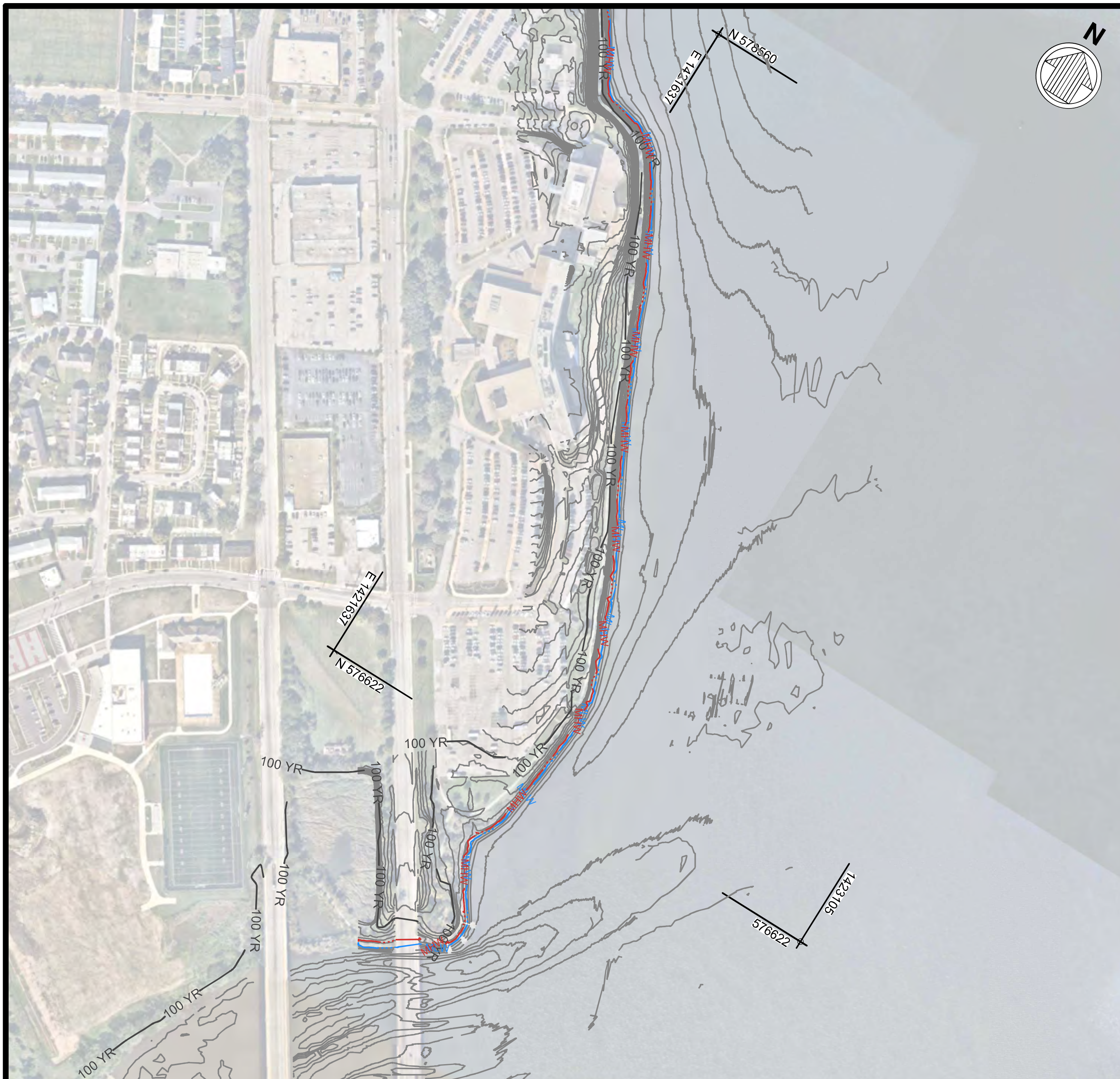

EXISTING CONDITIONS

NOTES:

1. TOPOGRAPHIC AND HYDROGRAPHIC SURVEY PERFORMED BY MERCADO CONSULTANTS, INC IN MAY 2023.

LEGEND

MHW	MEAN HIGH WATER
MLW	MEAN LOW WATER
100 YR	100 YEAR FLOOD PLAIN

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
24-WQC-0020
202361698
11/12/2024
3 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

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SCALE: 1"=400'

DATE: NOVEMEBER 12, 2024

SHEET 3 OF 15

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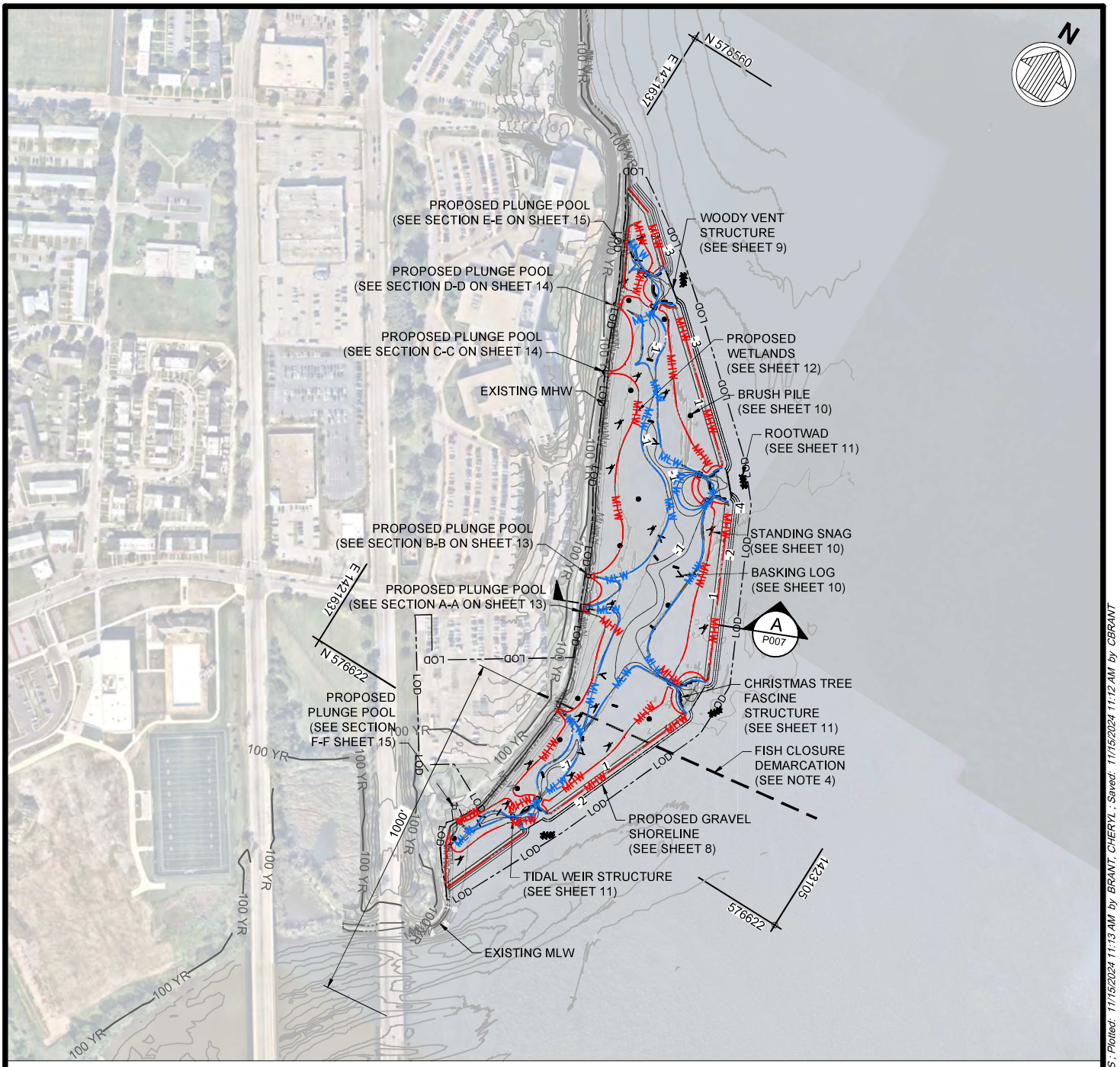

PROPOSED CONDITIONS

NOTES:

1. REMOVE LITTER AND OTHER DEBRIS FROM 2,000 LF OF SHORELINE
2. PLACE 63,500 CY OF FILL MATERIAL TO CONSTRUCT TIDAL WETLANDS AND GRAVEL SHORELINE.
3. INSTALL WETLAND PLANTS AND SHRUBS (SEE SHEET 12).
4. CONSTRUCTION WILL NOT OCCUR SOUTH OF THE FISH CLOSURE DEMARCATION LINE BETWEEN FEBRUARY 15 - JUNE 15 OF ANY GIVEN YEAR. FISH CLOSURE DEMARCATION LINE SET 1,000 FT FROM CENTER OF HANOVER/POTTEE STREET BRIDGE.

LEGEND

- MHW — PROPOSED MEAN HIGH WATER
- MLW — PROPOSED MEAN LOW WATER
- 100 YR — 100 YEAR FLOODPLAIN
- LOD — LOD — LIMIT OF DISTURBANCE

APPLICATION BY:

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GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
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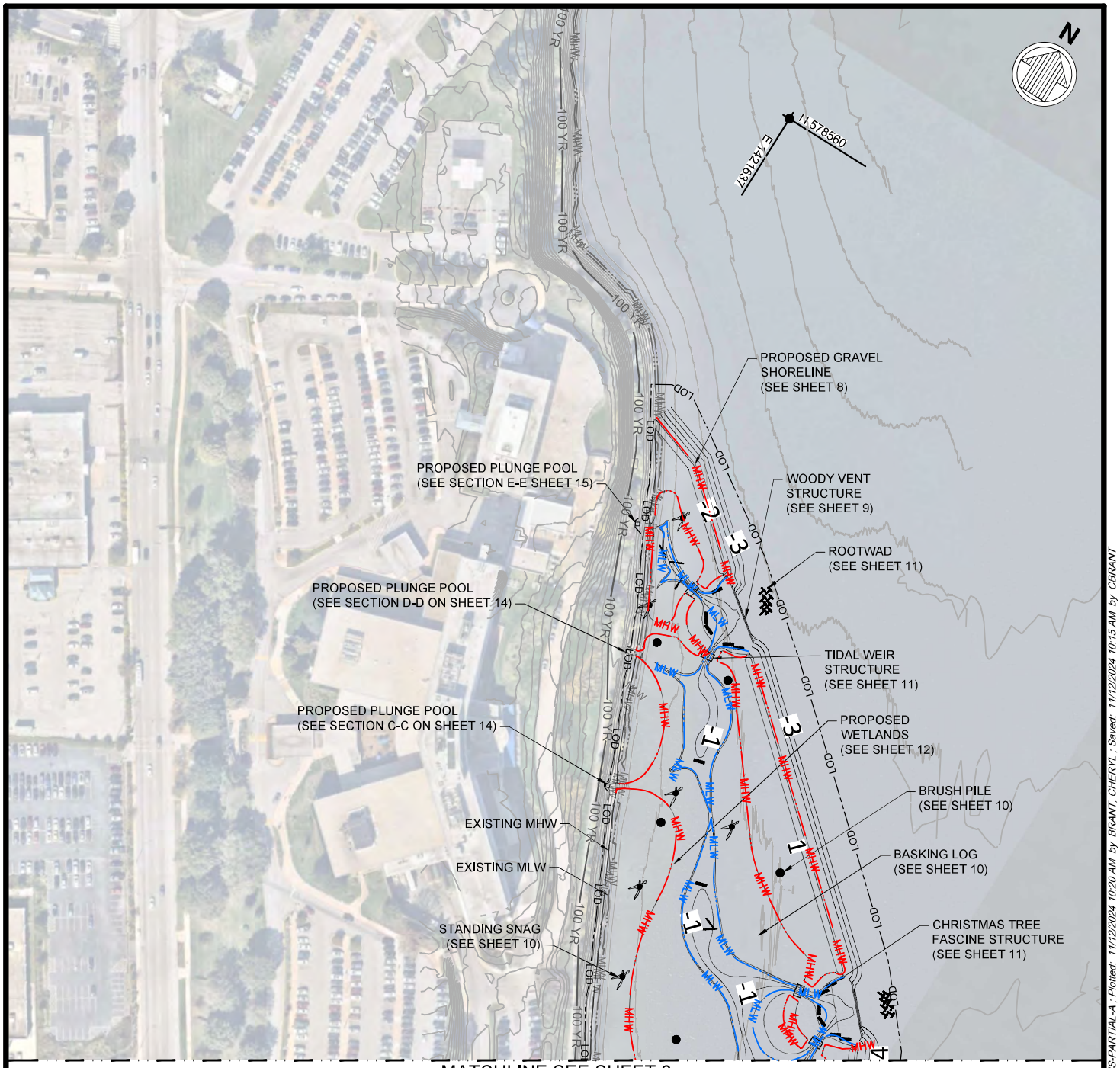
202361698
11/12/2024
4 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

200' 0' 200' 400'
SCALE: 1"=400'

DATE: NOVEMEBER 12, 2024

SHEET 4 OF 15



MATCHLINE SEE SHEET 6

PROPOSED CONDITIONS-PARTIAL-A

LEGEND

- MHW — PROPOSED MEAN HIGH WATER
- MLW — PROPOSED MEAN LOW WATER
- 100 YR — 100 YEAR FLOODPLAIN
- LOD — LOD — LIMIT OF DISTURBANCE

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
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AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
24-WQC-0020
202361698
11/12/2024
5 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

100' 0' 100' 200'
SCALE: 1"=200'

DATE: NOVEMEBER 12, 2024

SHEET 5 OF 15

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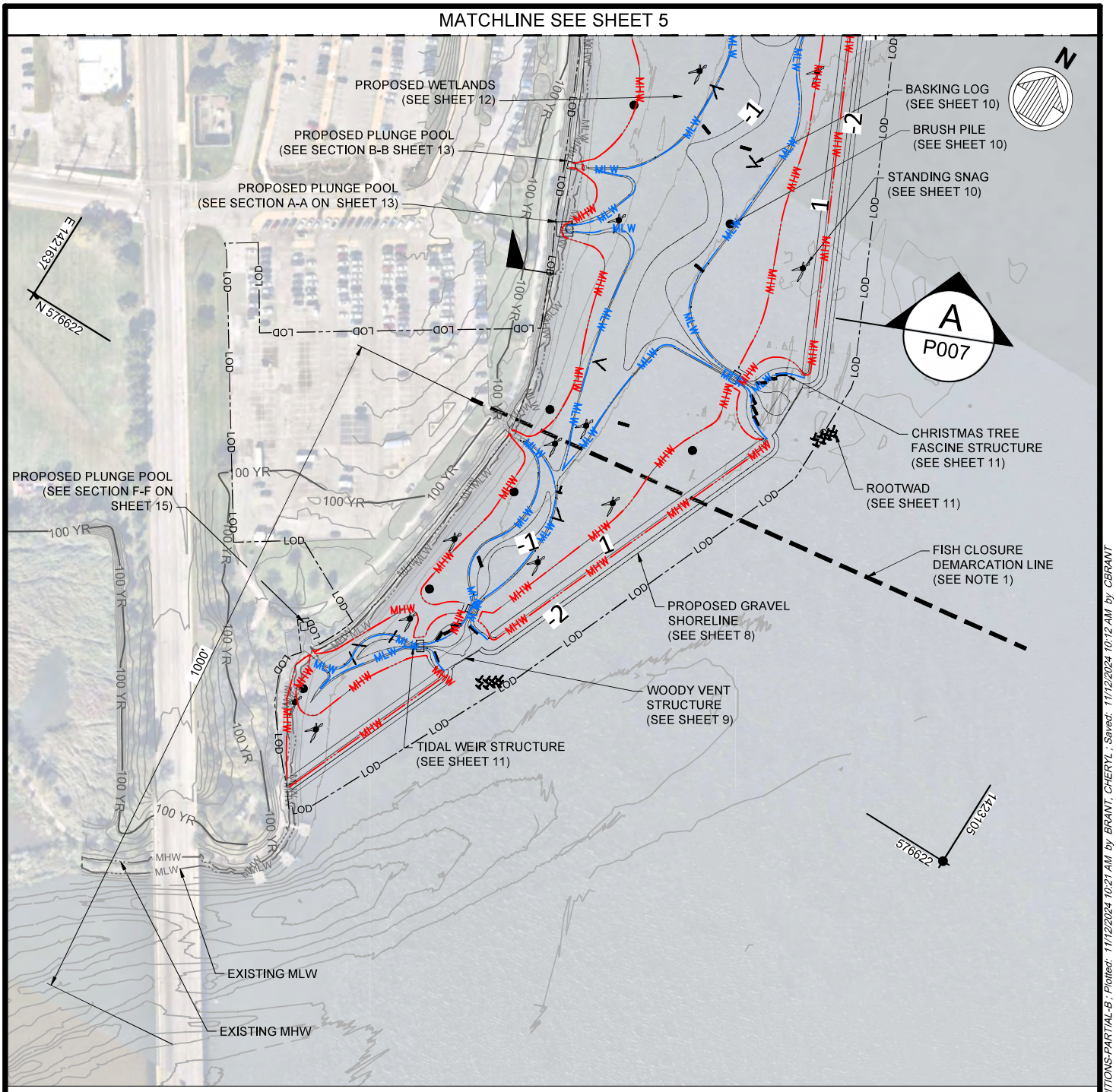

PROPOSED CONDITIONS-PARTIAL-B

NOTES:

1. CONSTRUCTION WILL NOT OCCUR SOUTH OF THE FISH CLOSURE DEMARCATION LINE BETWEEN FEBRUARY 15 - JUNE 15 OF ANY GIVEN YEAR. FISH CLOSURE DEMARCATION LINE SET 1,000 FT FROM CENTER OF HANOVER/POTTEE STREET BRIDGE.

LEGEND

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24-WQC-0020
202361698
11/12/2024
6 of 15

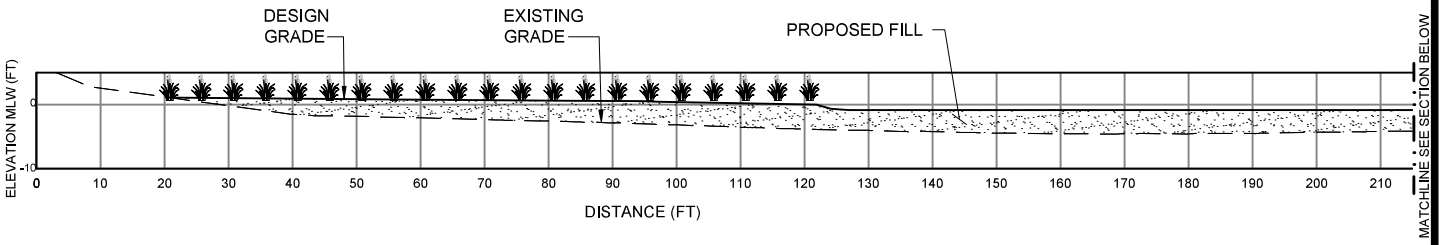
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

100' 0' 100' 200'
SCALE: 1"=200'

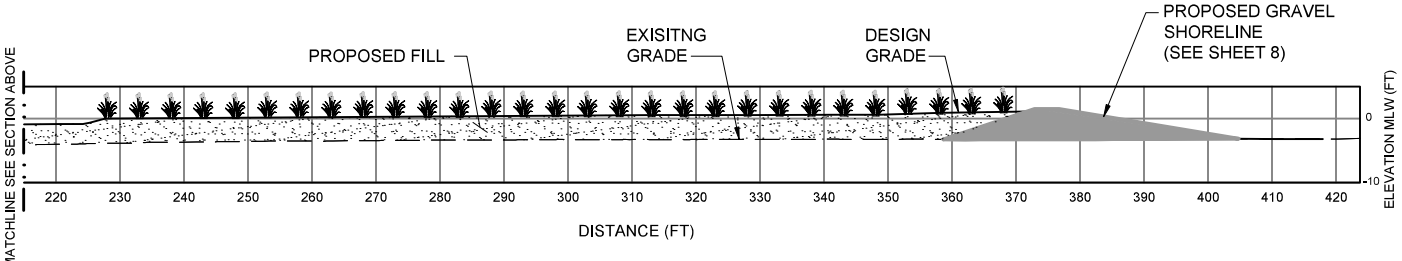
DATE: NOVEMEBER 12, 2024

SHEET 6 OF 15

File: Q:\BA\22602\20 CADD_Active_Permit\22602C-P006-PROPOSED CONDITIONS-PARTIAL-B ; Plotted: 11/12/2024 10:21 AM by BRANT, CHERYL ; Saved: 11/12/2024 10:12 AM by CBRANT



TYPICAL PARTIAL SECTION A



TYPICAL PARTIAL SECTION A

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
24-WQC-0020
202361698
11/12/2024
7 of 15

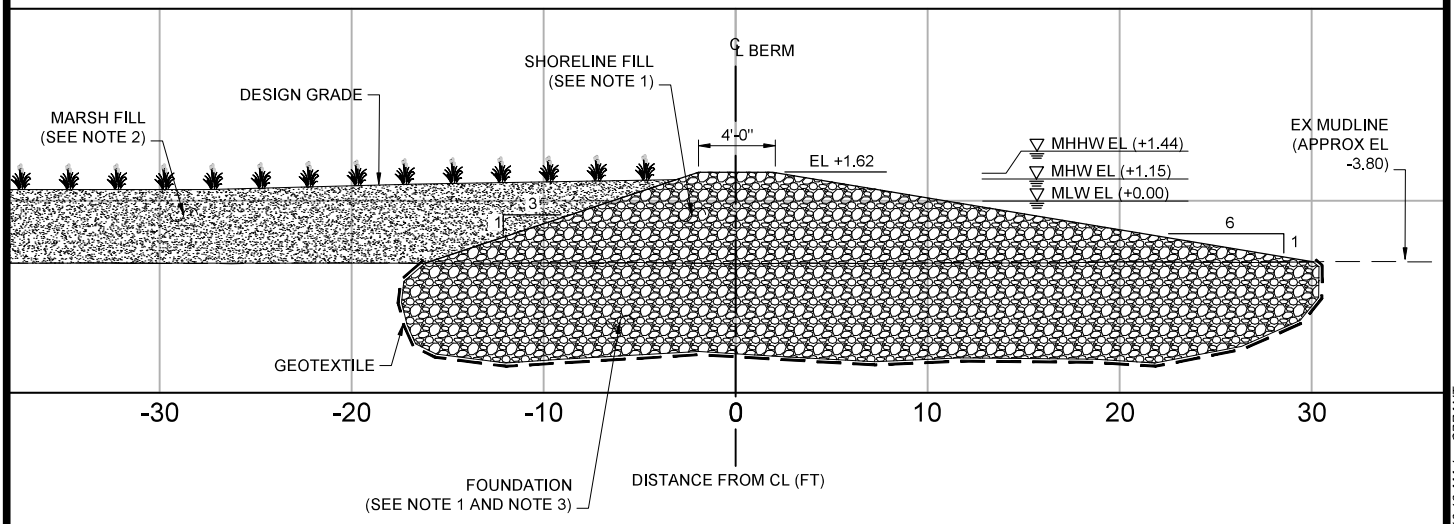
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

15' 0' 15' 30'
SCALE: 1"=30'

DATE: NOVEMEBER 12, 2024

SHEET 7 OF 15

File: Q:\BA\22260212\0 CADD_Active_Permit\22260212-P007-TYPICAL SECTION ; Plotted: 11/12/2024 10:21 AM by BRANT, CHERYL ; Saved: 11/12/2024 10:14 AM by CBRANT



DETAIL - GRAVEL SHORELINE

NOTES:

1. SHORELINE FILL SHALL BE BANK RUN.
2. MARSH FILL SHALL BE CLEAN SAND.
3. ELEVATION OF APPROXIMATE BOTTOM OF FOUNDATION BASED ON SETTLEMENT CALCULATION.

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

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MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
24-WQC-0020
202361698
11/12/2024
8 of 15

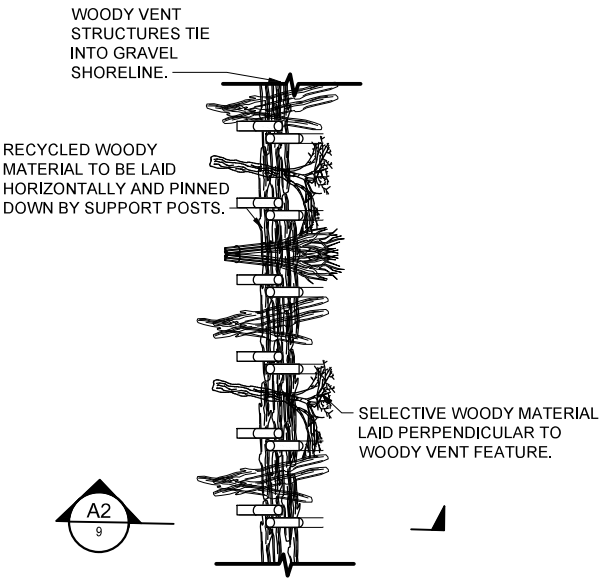
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

5' 0' 5' 10'
SCALE: 1"=10'

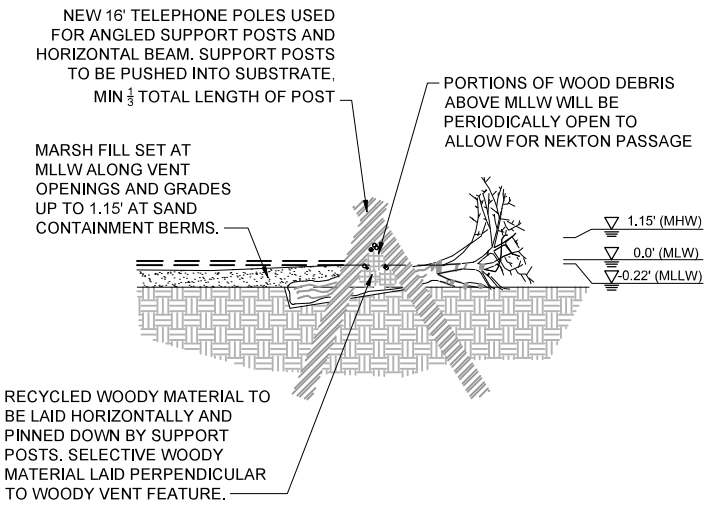
DATE: NOVEMEBER 12, 2024

SHEET 8 OF 15

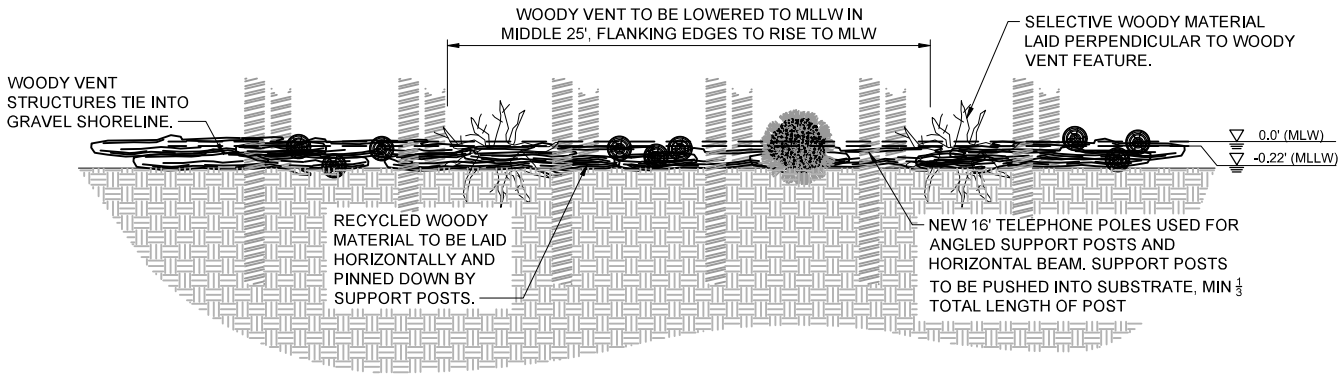
File: Q:\BA\22602\20 CADD_Active_Permit\22602C-P008-TYPICAL DETAIL ; Plotted: 11/12/2024 10:22 AM by BRANT, CHERYL ; Saved: 11/12/2024 10:12 AM by CBRANT



A1 9 PLAN - WOODY VENT STRUCTURE
SCALE: NTS



A2 9 SECTION - WOODY VENT STRUCTURE
SCALE: NTS



B1 9 ELEVATION - WOODY VENT STRUCTURE
SCALE: NTS

PROPOSED FEATURE DETAILS - 1

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
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BOWIE, MD 20716

AGENT/ENGINEER:

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TIDAL WETLANDS RESTORATION

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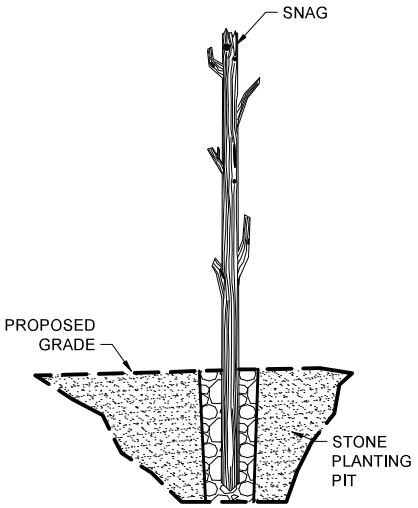
202361698
11/12/2024
9 of 15

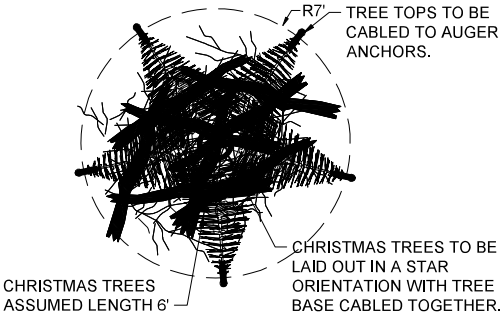
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

DATE: NOVEMEBER 12, 2024

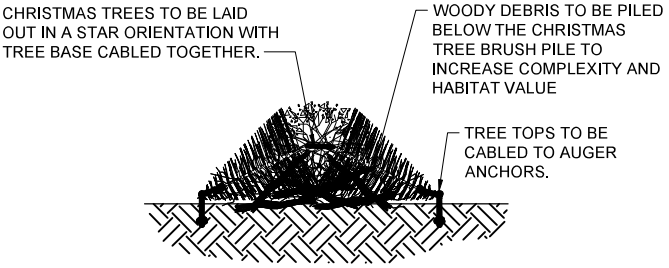
SHEET 9 OF 15



A1 10 SECTION - STANDING SNAG
SCALE: NTS



BUSH PILE PLAN

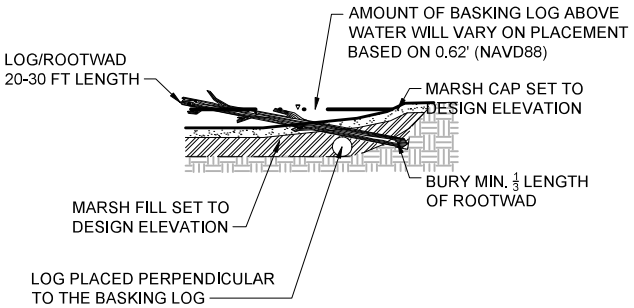


BUSH PILE SECTION

B1 10 PLAN AND SECTION - BUSH PILE
SCALE: NTS

NOTE FOR SNAG INSTALLATION:

1. INSTALL SNAGS MIN. 1/3 OF LOG LENGTH BELOW GROUND.
2. ABOVE GROUND SNAG LENGTH TO BE 10-20'
3. ALL EXPOSED END OF LOGS TO BE BROKEN. SAWED ENDS WILL BE UNACCEPTABLE.
4. STANDING SNAG SHALL BE LOCATED A MINIMUM DISTANCE OF 1.5 TIMES THE ABOVE GROUND HEIGHT OF THE SNAG AWAY FROM ANY TRAILS OR LANDINGS.
5. ROCK SHALL BE USED IN THE "PLANTING PIT" TO STABILIZE THE UNDERGROUND PORTION OF THE SNAG.
6. PROVIDE 2 FT. MIN. WIDTH OF ROCK ON ALL SIDES OF STANDING SNAG IN PLANTING PIT.



C1 10 SECTION - BASKING LOG WITH ANCHOR PARTIALLY BURIED
SCALE: NTS

PROPOSED FEATURE DETAILS - 2

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

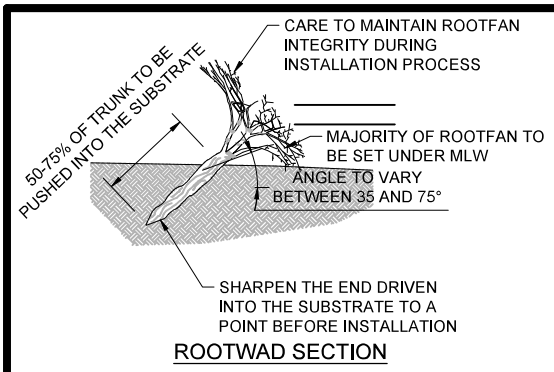
MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
24-WQC-0020
202361698
11/12/2024
10 of 15

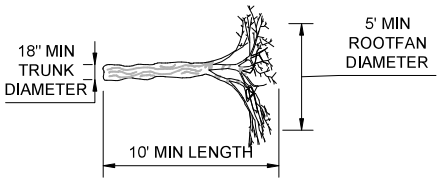
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

DATE: NOVEMEBER 12, 2024

SHEET 10 OF 15

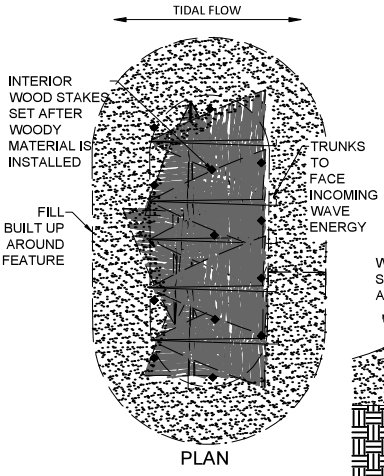


ROOTWAD SECTION

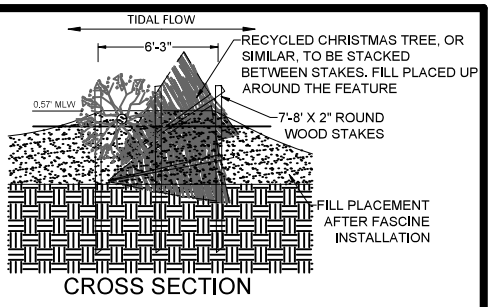


ROOTWAD PLAN

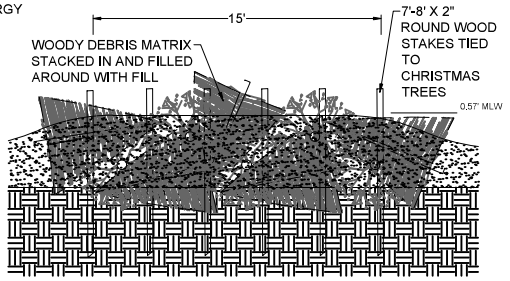
A1 / 11 — DETAIL - ROOTWAD
SCALE: NTS



PLAN

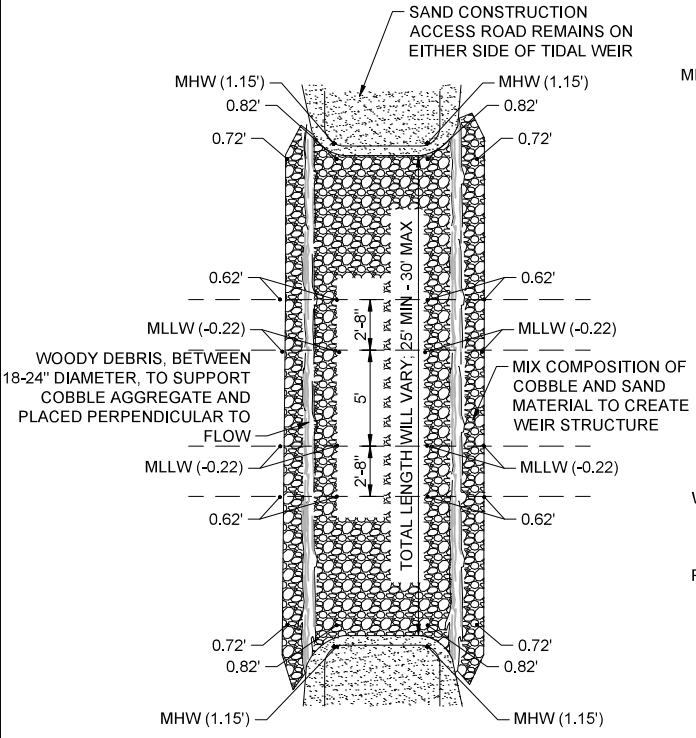


CROSS SECTION

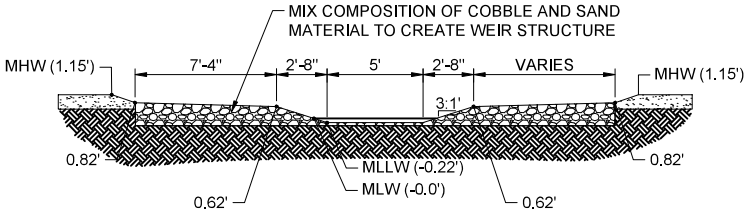


PROFILE

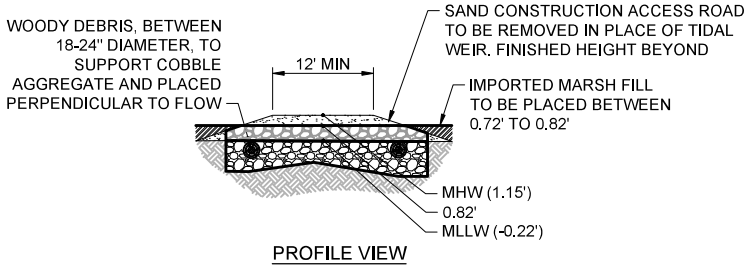
B1 / 11 — DETAIL - CHRISTMAS TREE FASCINE STRUCTURE
SCALE: NTS



PLAN VIEW



SECTION VIEW



PROFILE VIEW

C1 / 11 — DETAIL - TIDAL WEIR
SCALE: NTS

PROPOSED FEATURE DETAILS - 3

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
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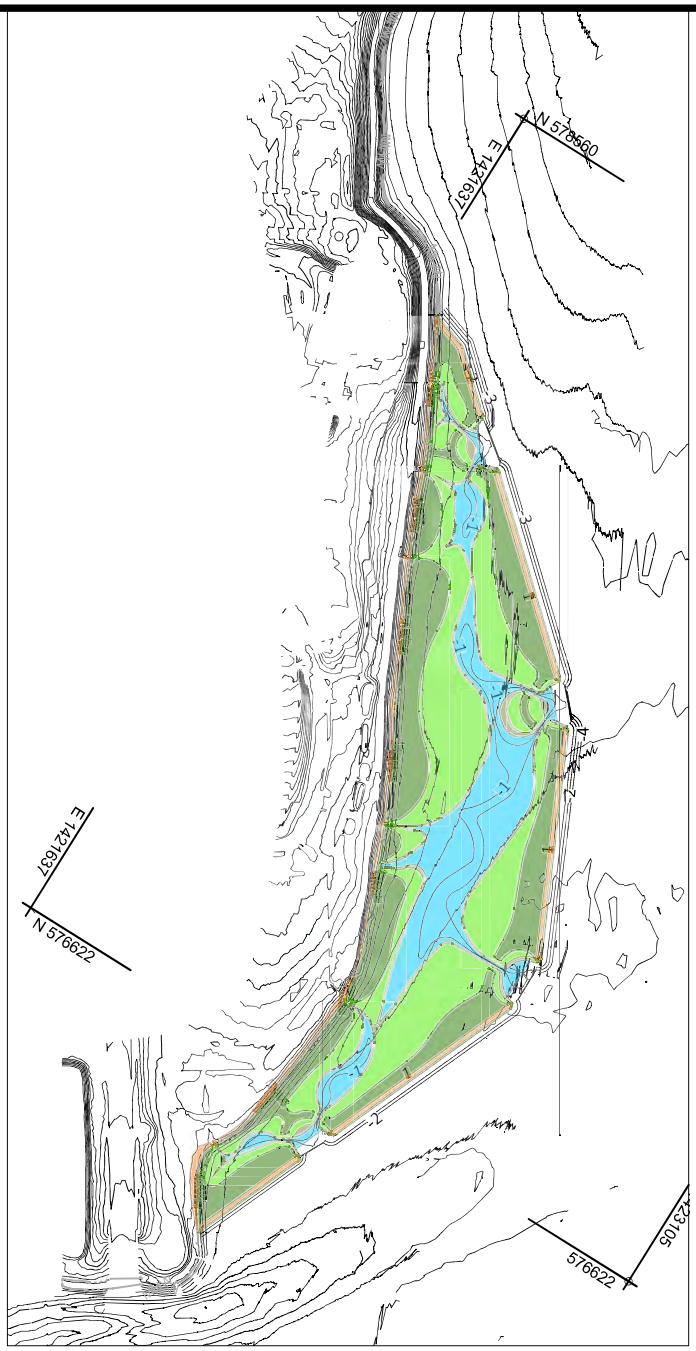
202361698
11/12/2024
11 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

DATE: NOVEMEBER 12, 2024

SHEET 11 OF 15



N

LOW MARSH

- BOLBOSCHOENUS ROBUSTUS (STURDY BULRUSH)
- SCIRPUS VALIDUS (SOFT-STEMMED BULRUSH)
- SPOROBOLUS ALTERNIFLORUS (SMOOTH CORDGRASS)

HIGH MARSH

- BACCHARIS HALIMIFOLIA (GROUNDSEL TREE)
- HIBISCUS MOSCHEUTOS (MARSH HIBISCUS)
- IVA FRUTESCENS (MARSH ELDER)
- AMARANTHUS CANNABINUS (TIDALMARSH AMARANTH)
- BOLBOSCHOENUS ROBUSTUS (STURDY BULRUSH)
- DISTICHLIS SPICATA (SALTGRASS)
- KOSTELETZKYA PENTACARPOS (VIRGINIA SALTMARSH MALLOW)
- SCHOENOPLECTUS PUNGENS (THREE-SQUARE BULRUSH)
- SOLIDAGO SEMPERVIRENS (SEASIDE GOLDENROD)
- SYMPHYOTRICUM UNDULATUM (PERENNIAL SALTMARSH ASTER)
- SPOROBOULS CYNOSUROIDES (BIG CORDGRASS)
- SCHOENOPLECTUS AMERICANUS (OLNEY'S THREE-SQUARE BULRUSH)
- SPOROBOLUS PUMILUS (SALTMEADOW CORDGRASS)

SUPRATIDAL

- BACCHARIS HALIMIFOLIA (GROUNDSEL TREE)
- HIBISCUS MOSCHEUTOS (MARSH HIBISCUS)
- PRUNUS MARITIMA (BEACH PLUM)
- MORELLA PENNSYLVANICA (NORTHERN BAYBERRY)
- MORELLA CERIFERA (WAX MYRTLE)
- IVA FRUTESCENS (MARSH ELDER)
- PANICUM VIRGATUM (SWITCHGRASS)
- SPARTINA PATENS (SALTMARSH HAY)
- AMARANTHUS CANNABINUS (TIDALMARSH AMARANTH)
- SOLIDAGO SEMPERVIRENS (SEASIDE GOLDENROD)
- SYMPHYOTRICUM UNDULATUM (PERENNIAL SALTMARSH ASTER)

LEGEND

- HIGH MARSH
- LOW MARSH
- SUPRATIDAL
- OPEN WATER

WETLANDS AND WATERS PERMANENT IMPACTS			
ACTIVITY	WoUS IMPACT (LF)	WoUS IMPACT (ACRES/SF)	AUTHORITY
LIVING SHORELINE FILL	2,000	11.59/504,860	SECTION 10/404
STONE SILL	2,000	1.24/54,015	SECTION 10/404
LOW MARSH	-	4.14/180,338	SECTION 10/404
HIGH MARSH/SUPRATIDAL	-	4.49/195,584	SECTION 10/404

TYPICAL MARSH PLANTINGS

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

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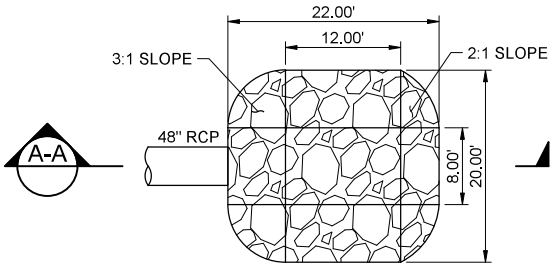
24-WQC-0020
202361698
11/12/2024
12 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

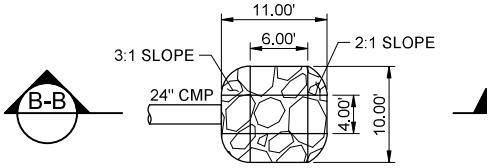
200' 0' 200' 400'
SCALE: 1"=400'

DATE: NOVEMEBER 12, 2024

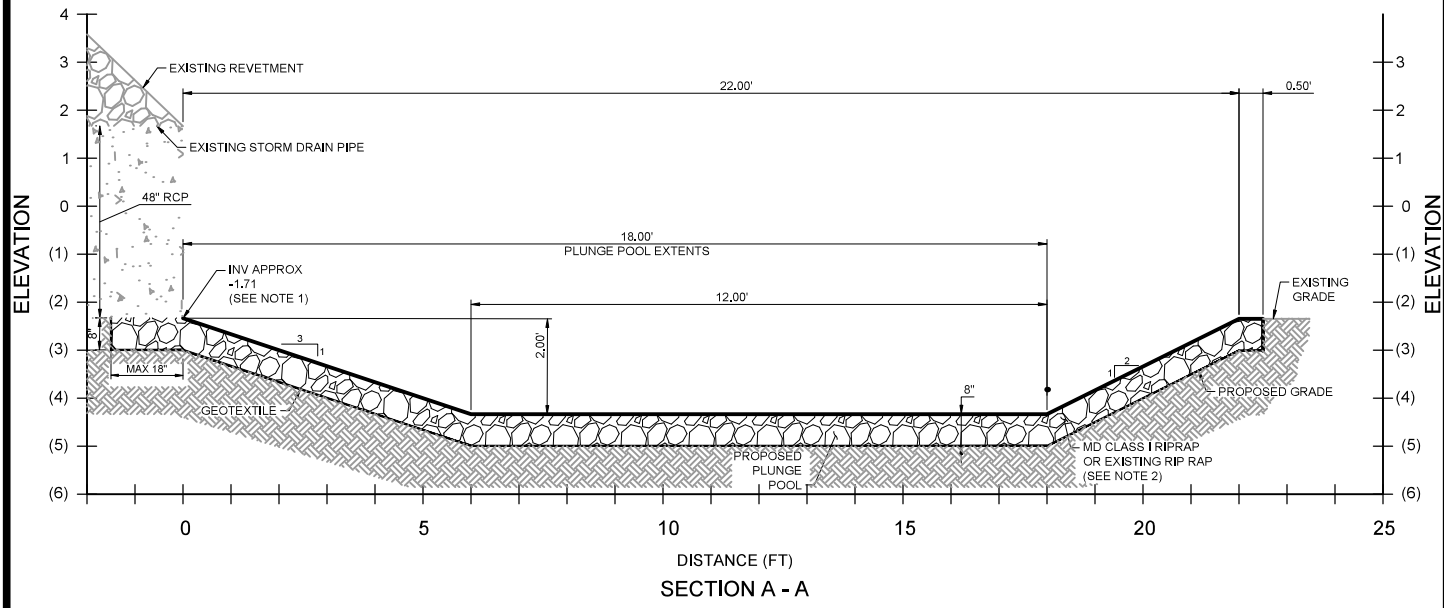
SHEET 12 OF 15



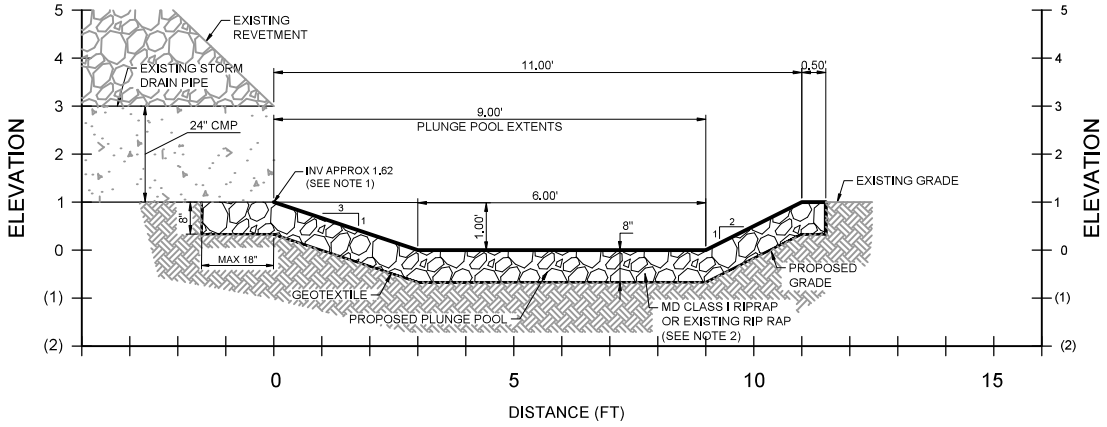
PLAN VIEW



PLAN VIEW



SECTION A - A



SECTION B - B

NOTES:

PLUNGE POOL DETAILS AND SECTIONS 1 OF 3

1. PIPE INVERT IS APPROXIMATED AND SHOULD BE CONFIRMED BY CONTRACTOR PRIOR TO BEGINNING OF WORK. ANY DIFFERENCE IN CONDITIONS SHOULD BE REPORTED TO THE ENGINEER IN THE EVENT CHANGES TO TIE-INS ARE NEEDED.
2. EXISTING RIPRAP ALONG THE REVETMENT TOE MAY BE USED IN THE PLUNGE POOL IF QUAINTLY IS SUFFICIENT. ADDITIONAL CLASS I RIP RAP MAY BE REQUIRED TO MEET DESIGN DIMENSIONS.

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

23-WL-1096
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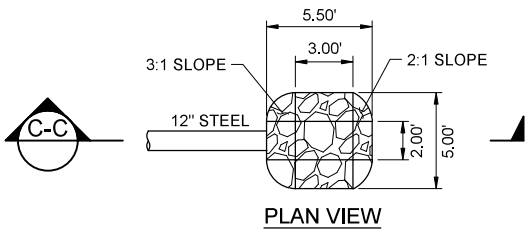
202361698
11/12/2024
13 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

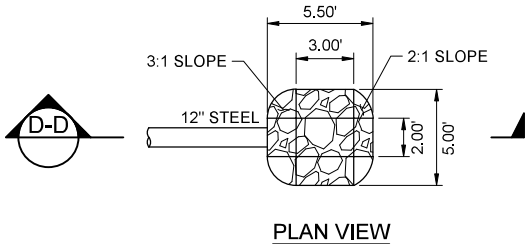
1' 0' 1' 2'
SCALE: 1"=1'

DATE: NOVEMEBER 12, 2024

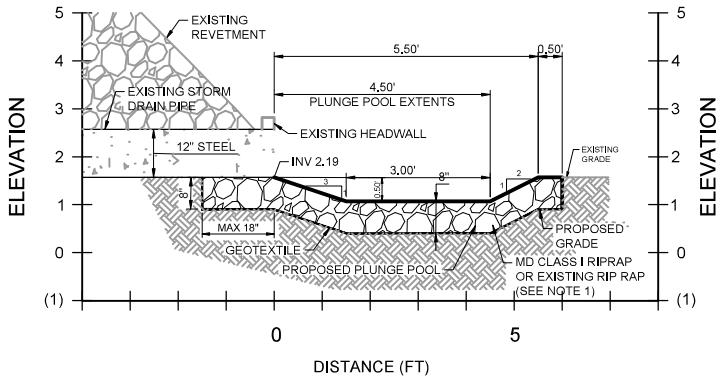
SHEET 13 OF 15



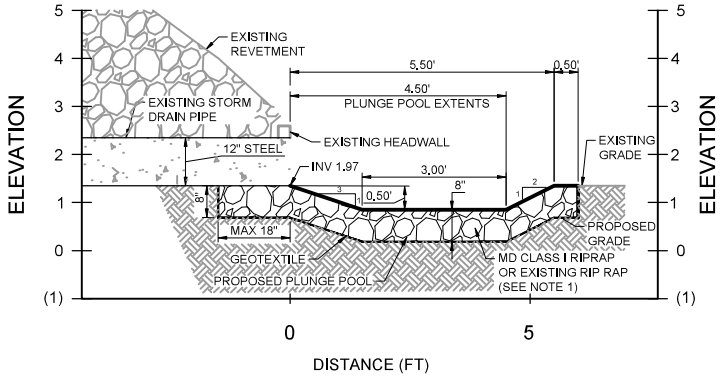
PLAN VIEW



PLAN VIEW



SECTION C - C



SECTION D - D

PLUNGE POOL DETAILS AND SECTIONS 2 OF 3

NOTES:

1. EXISTING RIP RAP ALONG THE REVETMENT TOE MAY BE USED IN THE PLUNGE POOL IF QUANTITY IS SUFFICIENT. ADDITIONAL CLASS I RIP RAP MAY BE REQUIRED TO MEET DESIGN DIMENSIONS.

APPLICATION BY:

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GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
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23-WL-1096
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14 of 15

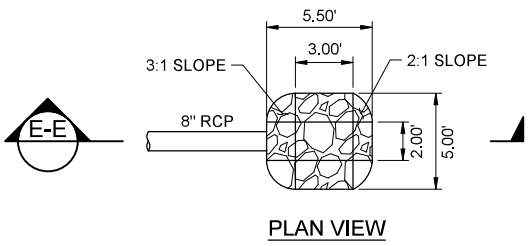
PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

1' 0' 1' 2'
SCALE: 1"=1'

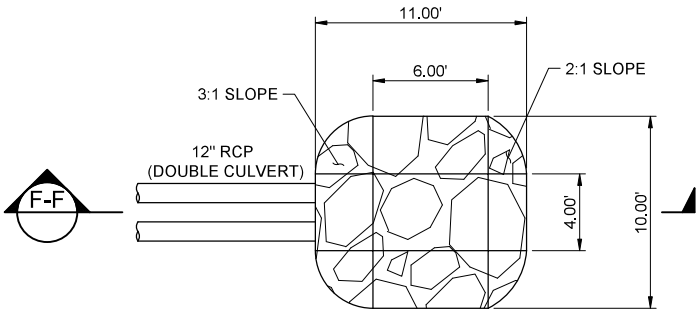
DATE: NOVEMEBER 12, 2024

SHEET 14 OF 15

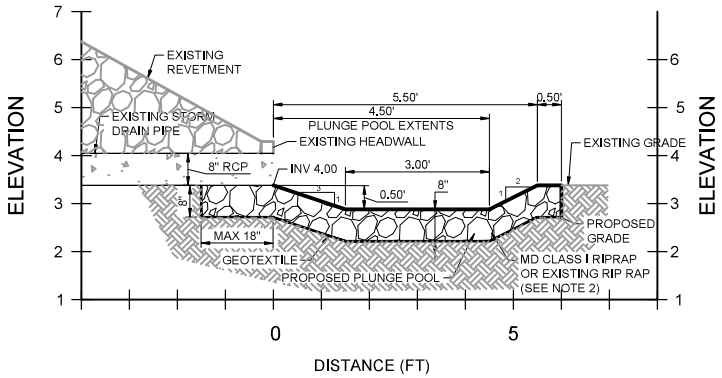
File: Q:\BA\22602\20 CADD_Active_Permit\22602C-P014-PLUNGE POOL SECTIONS-2 ; Plotted: 11/12/2024 10:25 AM by BRANT, CHERYL ; Saved: 11/12/2024 10:15 AM by CBRANT



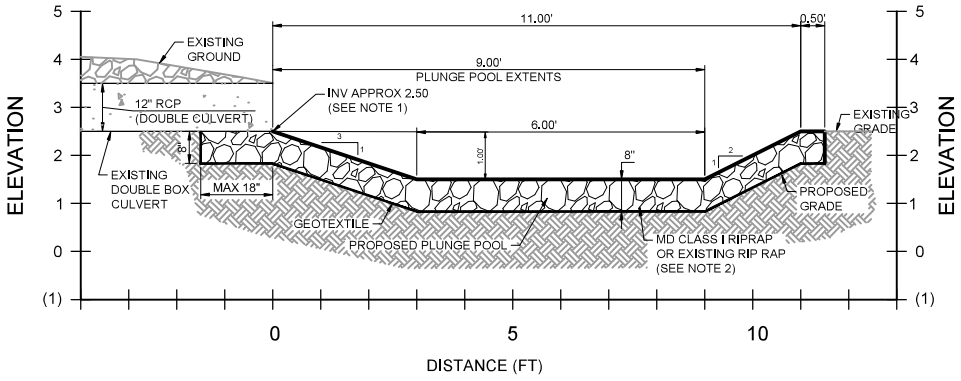
PLAN VIEW



PLAN VIEW



SECTION E - E



SECTION F - F

PLUNGE POOL DETAILS AND SECTIONS 3 OF 3

NOTES:

1. PIPE INVERT IS APPROXIMATED AND SHOULD BE CONFIRMED BY CONTRACTOR PRIOR TO BEGINNING OF WORK. ANY DIFFERENCE IN CONDITIONS SHOULD BE REPORTED TO THE ENGINEER IN THE EVENT CHANGES TO TIE-INS ARE NEEDED.
2. EXISTING RIP RAP ALONG REVETMENT TOE MAY BE USED IN THE PLUNGE POOL IF QUANTITY IS SUFFICIENT. AFFITIONAL CLASS I RIP RAP MAY BE REQUIRED TO MEET DESIGN DIMENSIONS.

APPLICATION BY:

BRIAN CRAMER
GREENVEST, LLC
4201 NORTHVIEW DRIVE, SUITE 202
BOWIE, MD 20716

AGENT/ENGINEER:

moffatt & nichol

MEDSTAR HARBOR HOSPITAL
TIDAL WETLANDS RESTORATION

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11/12/2024
15 of 15

PROJECT LOCATION:
MIDDLE BRANCH
BALTIMORE CITY, MARYLAND

1' 0' 1' 2'
SCALE: 1"=1'

DATE: NOVEMEBER 12, 2024

SHEET 15 OF 15

MIDDLE BRANCH
PATAPSCO DELTA EAST (SITE 5A)
Appendix H – Habitat Monitoring Plan

Memorandum

To: Matt Wallach, MDE, and Maria Teresi, USACE

From: Kyle Spendiff, GreenVest, LLC

Date: 09/01/2023

Re: Middle Branch Resiliency Initiative (MBRI) – Habitat Monitoring Plan

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Introduction

The Middle Branch Resiliency Initiative (MBRI) currently proposes to construct nature-based solutions (NBS) along the coastline at five (5) locations within the Middle Branch of the Patapsco River: Site 5A, BGE Spring Gardens, Medstar Harbor Hospital (MHH,), Patapsco Delta (PDP) and Smith Cove Environmental Justice Project (SCEJP). MBRI will include a variety of NBS to address three key program goals: 1) improve coastal resiliency, 2) improve water quality, and 3) improve aquatic habitat structure and diversity. To effectively monitor the project's impact on the Middle Branch of the Patapsco, six (6) monitoring locations have been identified (Figure 1). The following memorandum details the proposed monitoring plan to be completed beginning in 2023 and lasting throughout the lifespan of the MBRI project. Monitoring will cease when the regulatory agencies determine the project is complete. The proposed monitoring plan will collect valuable site data to understand the changes to habitat, fish, benthic, sediment, and project stability metrics, at the six monitored locations.

Existing Data Review

An extensive review of publicly available information on fish communities within the Middle Branch area of Baltimore Harbor resulted in generalized lists of species that are either documented to occur or are thought to be in the area. Although no systematic surveys documenting the presence or abundance of specific species within the shallow water zone (<3 feet) of the Middle Branch were found, the structural habitat requirements of these species are well documented and were used to inform the technical approach of the project.

In addition, the MBRI team has coordinated with the Masonville Cove Habitat Restoration Project (MCHRP) to better align the MBRI habitat monitoring plan with work currently underway in the area. The MBRI team has obtained data collected as part of the Masonville project and has used that data as a guide for developing the MBRI habitat monitoring plan.

MBRI Habitat Goals and Objectives

The use of marsh edges by forage fish and macroinvertebrates is well documented, as are the high rates of productivity with coastal marshes. Through the creation of highly productive habitats that are currently lacking within the proposed project limits as well as the Middle Branch at large, the MBRI will provide levels of habitat function and value that currently do not exist. Furthermore, it is presumed that this project will yield localized benefits for forage and juvenile fish and macroinvertebrate species; organisms that form an important link in the Chesapeake Bay's food web and support many recreational and sport fisheries. This key linkage will provide habitat gaps at a critical transition between fluvial and estuarine areas that have

been subject to barrier removal and restoration actions, making this project temporally and contextually appropriate as a means to uplift aquatic dependent wildlife habitat.

While it is assumed that fish and macroinvertebrate species diversity will eventually improve post-construction, population dynamics are dependent upon many factors outside the control of the MBRI. Therefore, project goals, objectives, and monitoring will focus on the re-establishment of structural habitat characteristics that can be controlled and measured in the post construction condition. Functional characteristics (fish and macroinvertebrate species presence and abundance) will also be monitored to determine if/how species are adapting to the habitat provided to supplement the documentation of achieving structural objectives.

- Habitat Goal:
    - Improve structural habitat characteristics known to benefit macroinvertebrates and juvenile and forage fish, habitat that is currently absent in the MBRI area.
- Objective:
    - Assess existing structural habitat characteristics within near shore (<3 feet) areas.
    - Create structural habitat components known to benefit macroinvertebrate and juvenile and forage fish species along the water/land interface.
    - Monitor post-construction structural habitat components to document structural and continue observing functional improvements.

Monitoring Plan

A robust monitoring plan has been developed to collect current baseline data of existing conditions, collect data at each project location and approved locations throughout the Middle Branch at various intervals post-construction. The monitoring plan will focus on collecting data for the following items of interest:

1. Habitat assessment
2. Fish monitoring
3. Benthic Macroinvertebrate monitoring
4. Sediment sampling
5. Porewater sampling
6. Project stability

Habitat Assessment

Habitat assessment data will be collected for each sample location utilizing the survey protocols from the Evaluation of Planned Wetlands (EPW) method (Bartoldus, 1994). EPW evaluates six (6) different wetlands functions:

1. Shoreline Bank Erosion Control- Capacity to provide erosion control and to dissipate erosive forces at the shoreline bank.
2. Sediment Stabilization- Capacity to stabilize and retain previously deposited sediments.
3. Water Quality- Capacity to retain and process dissolved or particulate materials to the benefit of “downstream” surface water quality.
4. Wildlife- Degree to which a wetland functions as habitat for wildlife as described by habitat complexity.
5. Fish- Degree to which a wetland habitat meets the food/ cover, reproductive, and water quality requirements of fish.

6. Uniqueness/ Heritage- Presence of characteristics that distinguish a wetland as unique, rare, or valuable.

The structural characteristics in the pre- and post-construction condition will be compared to determine the project's effect on local habitat quality.

Fish Monitoring

To support the project goals to improve habitat for smaller forage and juvenile fish species more likely to use shallow, near shore habitats, fish samples will be collected at project locations within and in the vicinity of the MBRI prior to construction activities to establish baseline data and to monitor post-construction conditions at the MBRI projects. Fish will be collected utilizing methods that are comparable with the fish sampling efforts at the nearby MCHRP, to the extent practicable. Proposed sampling methods will include Fyke Nets, Seine Nets and Minnow Traps to collect fishes and macroinvertebrates (blue crab, mud crab, etc.) from near shore habitats.

- **Fyke Net Sampling**- The primary fish sampling method to capture juvenile and forage fishes utilizing the created tidal marsh will deploy a 3'H x 4'W x 12'L knotless ¼" mesh fyke net with 3' H x 30'L x ¼" mesh wings. To capture fish and macroinvertebrates as they egress or are flushed out of the created tidal marsh with the receding tide, the fyke net will be set in a pre-determined location at the center of the vent openings with the wings extending to the edges of the vent opening to prevent fish and macroinvertebrates from evading capture. The nets will be set at or near high tide and sampled at the end of the tide cycle/ low tide providing a sampling duration of approximately six (6) hours. Sampling on the outgoing tide will help prevent net fouling, displacement, and damage caused by multi-directional tidal flow. A representative sample of up to fifty (50) individuals per species will be measured (mm) and recorded. Finfish length measurements will be recorded using the appropriate method (total length, fork length, etc.) depending on the species, while carapace measurements will be recorded for sampled blue crabs. Other macroinvertebrates such as mud crabs and grass shrimp will be counted only. Any specimen captured that cannot be identified in the field will be photographed and/or preserved in a 95% alcohol solution for later identification.
- **Beach Seine Sampling**- To sample shallow water habitat along the living shoreline areas beach seining will be conducted at each site utilizing a 4'H x 25'L x ¼" mesh beach seine. The beach seine net will be deployed perpendicular to the shoreline in a wide arc, while maintaining contact with the bottom. Three (3) replicate hauls will be conducted at different locations at each site and catch will be sorted and processed after each haul. Captured fish will be identified to species, measured and quantified, then returned to the water. Blue crabs, mud crabs and other macroinvertebrates will also be identified and counted. A representative sample of up to fifty (50) individuals per species will be measured in millimeters (mm). Finfish length measurements will be recorded using the appropriate method (total length, fork length, etc.) depending on the species, while carapace measurements will be recorded for sampled blue crabs. Any specimen captured that cannot be identified in the field will be photographed and/or preserved in a 95% alcohol solution for later identification.
- **Minnow Trap Sampling**- To sample fish utilizing the created marsh areas that are not suitable for seeing or fyke netting "Gee-type" galvanized 17 ½" L x 9"H x 1/4" mesh minnow traps will be

deployed within channels, or pools within the created marsh. The traps will be set during or near low-tide and sampled approximately 12 hours after setting to ensure fish utilizing the marsh surface at high tide are sampled. A representative sample of up to fifty (50) individuals per species will be measured (mm) and recorded. Captured fish will be identified by species, quantified, and returned to the water. Finfish length measurements will be recorded using the appropriate method (total length, fork length, etc.) depending on the species, while carapace measurements will be recorded for sampled blue crabs. Any specimen captured that cannot be identified in the field will be photographed and/or preserved in a 95% alcohol solution for later identification.

Post-construction sampling will be continued in years one (1), three (3), and five (5), at the sampling locations within the newly created habitats of the MBRI. Post-construction data will be compared to pre-construction data at the site as well as data collected from the other MBRI sites to determine if changes in structural habitat alone are able to bring about changes in the local fish community within the MBRI. The data can also be compared with sampling efforts at MCHRP. Fish species of interest can be found in Table 1.

Table1. MBRI Fish Species of Interest

Fish Target Species	Sampling Notes
Alewife *(Alosa pseudoharengus)*	Anadromous, summer juvenile sampling.
American Eel *(Anguilla rostrata)*	Summer shallows
American Shad *(Alosa sapidissima)*	Anadromous, summer juvenile sampling
Atlantic Croaker *(Micropogonias undulatus)*	Summer shallows
Atlantic Menhaden *(Brevoortia tyrannus)*	Summer shallows
Atlantic Silverside (*Menidia menidia*)	Summer shallows
Banded Killifish *(Fundulus diaphanus***)**	Resident
Bay Anchovy *(Anchoa mitchillii)*	Summer shallows
Blueback Herring *(Alosa aestivalis)*	Anadromous, summer juvenile sampling
Bluefish *(Pomatomus saltatrix)*	Juveniles May-Oct.
Gizzard Shad *(Dorosoma cepadianum)*	Resident
Hickory Shad *(Alosa mediocris)*	Anadromous, summer juvenile sampling.
Inland Silverside *(Menidia beryllina)*	Summer shallows
Largemouth Bass *(Micropterus salmoides)*	Resident. Near shore with cover
Mummichog *(Fundulus heteroclitus)*	Resident
Sheepshead Minnow *(Cyprinodon variegatus)*	Resident
Spot *(Leiostomus xanthurus)*	Summer shallows
Spottail Shiner *(Notropis hudsonius)*	Resident
Striped Bass *(Morone saxatilis)*	Resident, Anadromous
Striped Killifish *(Fundulus majalis)*	Resident, Summer shallows
Summer Flounder *(Paralichthys dentatus)*	Juveniles, Summer shallows
White Perch *(Morone americana)*	Resident, Semi-anadromous
Windowpane Flounder *(Scopthalmus aquosus)*	Adults and juveniles
Winter Flounder *(Pleuronectes americanus)*	Juveniles, Summer shallows
Yellow Perch *(Perca flavescens)*	Resident, Semi-anadromous

Benthic Macroinvertebrate Baseline Survey

A pre-construction baseline benthic community survey will be conducted to characterize the existing community composition within the proposed project areas. Additional benthic post-construction sampling

will be conducted within the created wetlands at year one (1) year three (3) and again at year five (5)- the end of the five (5) year monitoring period which should allow time for the benthic community to re-establish post-disturbance and to make comparisons between the benthic communities found within the shallow open water and tidal low marsh.

Benthic macroinvertebrate sampling will occur prior to construction activities to determine baseline conditions in the Summer of 2023. Three (3) replicate benthic grab samples will be obtained from each site, with one additional sample taken to evaluate sediment grain size and TOC. Macroinvertebrates will be sampled using a petite ponar grab sampler or equivalent equipment. Each replicate benthic sample will be sieved in the field through a 500-micron screen to remove fine sediment particles. Individual replicates are transferred to labeled bottles and preserved in the field using 95% ethanol solution and transmitted to a laboratory for processing following industry standards. Benthic macroinvertebrates will be enumerated and identified to the lowest genomic level. The samples are then analyzed for species composition and abundance. Macroinvertebrate species of interest can be found in Table 3.

Table 2. MBRI Macroinvertebrate Species of Interest

Macroinvertebrate Target Species	Sampling Notes
Atlantic Mud Crab *(Panopeus herbstii)*	Resident
Blue Crab *(Callinectes sapidus)*	Summer shallows
Eastern Elliptio *(Elliptio complanata)*	Resident
Grass Shrimp *(Palaemonetes pugio)*	Resident

Sediment Sampling

To address concerns related to the potential remobilization of contaminants in the Middle Branch of the Patapsco River resulting from the completed projects, pre- and post-construction sediment screening for metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), herbicides, and pesticides will be conducted at each site. Baseline data on contamination levels will be evaluated and compared to subsequent post-construction sampling to determine measurable increases/ decreases in contaminants within the surface sediments. If a notable increase in contamination is detected, a remediation plan will be developed and implemented with the approval of the regulatory agencies.

Surficial sediment samples will be taken at pre-determined sampling locations to a depth of 0-6 inches below the surface using a petite ponar grab or equivalent sampling equipment. Samples will be properly preserved in the field and sent to an accredited laboratory for analysis. A report summarizing the sampling results will be prepared and submitted to the agencies at the end of each monitoring year. Information obtained from the sediment monitoring will be used, when appropriate, to inform adaptive management activities. Basic water quality testing for temperature, dissolved oxygen, salinity, conductivity, and turbidity will be conducted at each sample location.

Pore Water Sampling

Pre- and post-construction pore water sampling will be conducted semi-annually at the six locations depicted in Figure 1 using the standard operating procedures outlined in the February 2013 Environmental Protection Agency, Science and Ecosystem Support Division (SESD), Pore Water Sampling (513) AF. R2 guidance document. Samples will be collected using a PushPoint sampler or similar device fitted with a watertight flange to prevent surface water intrusion. Samples will be analyzed for contaminants which may include metals, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), semi-volatile

organic compounds (SVOCs), herbicides, and pesticides, and all results will be included in the monitoring reports.

Project Stability Monitoring

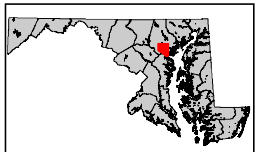
To ensure the installed breakwater structures and marsh fill contained within them are stable, regular inspections will be conducted during construction and during the post-construction monitoring period. During construction intensive monitoring of the breakwater structures will occur to ensure long term stability. When structure stability has been observed and verified, monitoring of the marsh fill materials will continue during construction to identify potential sediment releases, structural deficiencies, unexpected erosion, etc. After construction, visual inspections of the breakwater structures, marsh soils, and marsh vegetation will occur routinely during the 5-year monitoring period. Inspections of the breakwater will focus on the stability of structure elevations and components (riprap, sand, fill, stone, etc.) while marsh stability inspections will identify areas of erosion and wasting, vegetation loss, and sediment deposition. Inspections will be conducted on a quarterly basis and the findings reported to MDE and USACE upon request. If remedial action/ adaptive management is needed, corrective actions will be determined and completed using the specific project adaptive management plan.

Sampling Locations and Monitoring Schedule

Figure 1 depicts the MBRI project wide monitoring locations. Monitoring will be performed bi-annually at all sites throughout the Middle Branch (2023, 2025, 2027, 2029, 2031, 2033, etc.) and will continue until it is determined by the regulatory agencies that the Middle Branch Resiliency Project is complete. An individual marsh maintenance plan will be developed for each site where marsh development is proposed and will be monitored and maintained for a minimum period of five (5) years, with a potential to extend the monitoring period up to three (3) additional years depending on site conditions and monitoring results.

Grab Sample Orthometric View

Total grab sample volume: 0.00463 CY



Middle Branch Resiliency Initiative

Habitat and Sediment Monitoring Locations

Baltimore Harbor
Baltimore City, MD

Legend

Sample Site

NOTE:
Sediment samples will be taken with a Petite Ponar Grab (6"x6"). Each grab is 0.00463 CY.

3 grabs per site (6) = 18 grabs = total of 0.08334 CY per sampling year

N

0 675 1,350 Feet

GreenVest

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Document Path: X:\Planning_Design\PROJECTS\MBRI\GIS\Benthic_Sampling_Map.mxd

Date Figure Created: 8/10/2023

MEMORANDUM

TO: GreenVest LLC.

FROM: Dr. Upal Ghosh, Sediment Solutions LLC.

DATE: Dec 22, 2023

SUBJECT: A Review of Middle Branch Harbor Hospital Chemical Characterization Data and Feasibility of Amendment of Activated Carbon to Address Pollutant Exposure Concerns

Introduction

GreenVest in collaboration with other partners is engaged in developing plans for and implementing a shoreline and ecological restoration project as a part of the Middle Branch Resiliency Initiative. Concerns have been raised about the potential for impacts from pollutants in existing sediments. The overall objective of this memorandum is to assess available site contamination data and provide recommendations for a sustainable design that is less likely to be compromised in the future from migration of pollutants from existing sediments. Documents reviewed to develop this report include:

1) Summary of the Environmental Evaluation at the Middle Branch Resiliency Initiative Medstar Harbor Hospital (MHH) Site for the MRBI BRIC Redevelopment Project, by CSI Environmental, July 18, 2023.
2) Middle Branch Resiliency Initiative Medstar Harbor Hospital Construction Documents.
3) Reimagine Middle Branch, Parks, Projects, and Programs to connect communities in South Baltimore. Executive Summary, Feb 2023.

Data Review

The primary source of data for this review was the report on site chemical characterization by CSI Environmental LLC. The MHH site is located at the mouth of the Patapsco River in Baltimore Harbor where suspended sediments from the river have formed deposits of organic matter laden soft fine sediments. Past industrial activities around the site likely resulted in contamination of the historically deposited sediments. The sediments have the characteristics of typical fine-grained material found at estuarine sites with a range of organic and metal pollutants present at low concentrations across the site.

Two types of sediment samples were collected: deep sediment cores going down up to 50 ft below mud line, and six surface sediment samples collected from the top 1 ft of sediment surface. Sediment samples from four soil cores and all surface sediment samples were analyzed for VOCs, SVOCs, PCBs, herbicides, pesticides, and metals.

The report from CSI Environmental provides a synthesis of the chemical analysis results and compares the values with available screening criteria. Due to unavailability of sediment specific screening criteria, the primary human health screening criteria used were the MDE residential and non-residential cleanup goals for soil. For ecological screening, the USEPA Region III or NOAA criteria were utilized in the CSI report.

The VOC concentrations were generally low in both the surface sediments and deeper soil samples with only bromomethane concentrations in two of the deeper samples and one surface sediment sample showing levels higher than the residential soil standard but below non-residential soil standards. Thus, risk of human or ecological exposure from VOCs is minimal especially after the proposed placement of clean material over the restoration project area.

Among the SVOCs measured, several PAHs exceeded residential soil screening criteria for human health and EPA Region III criteria for ecological screening. The SVOC analysis included 16 USEPA priority pollutant parent PAHs and one alkylated PAH (2-Methylnaphthalene). While the highest concentration of total of 17 PAHs (26 mg/kg) was measured in deeper sediments (BHH-4 3.4-10 ft), several of the surface sediment samples were also elevated in total PAHs (3 – 15 mg/kg). PAHs, like other hydrophobic compounds in sediments, bind to the sediment organic carbon, thus expressing the concentration in organic carbon normalized units can be helpful in interpreting environmental fate and effects. Table 1 shows the PAH concentrations in surface sediments and two deeper sediments for which both PAH and organic carbon concentration data were available. The highest organic carbon normalized PAH concentrations are observed in the deeper sediments from BHH-4 and BHH-8 (799 and 1094 ug/g-OC). Among the surface sediment samples, BHH-10 sample was the most elevated in PAH concentration (791 ug/g-OC) close to the two deeper sediments. The remaining surface sediment sample concentrations were lower and ranged between 138 – 301 ug/g-OC (see Table 1).

Table 1. Organic carbon normalized PAH concentrations in sediments

		Organic Carbon normalized PAH concentrations							
	Surface sediments						Deeper sediments		
PAHs (ug/g-OC)	**BHH-2-SED**	**BHH-3-SED**	**BHH-7-SED**	**BHH-9-SED**	**BHH-10-SED**	**BHH-13-SED**	BHH-4 3.5-1	BHH-8 13-17	FCV
Naphthalene	3.23	2.39	6.99	3.73	5.14	7.50	15.85	10.85	385
2-Methylnaphthalene	6.47	3.39	13.94	7.44	8.35	15.00	11.73	19.73	444
Acenaphthylene	5.83	4.24	6.99	3.73	4.18	7.50	23.59	13.49	452
Acenaphthene	3.23	1.70	6.99	3.73	4.79	7.50	23.00	9.85	491
Fluorene	3.23	1.70	6.99	3.73	5.23	7.50	10.50	14.05	538
Phenanthrene	17.70	10.67	13.83	6.90	61.76	12.86	62.23	51.35	596
Anthracene	6.57	5.31	6.99	3.73	11.59	7.50	44.58	27.70	594
Fluoranthene	33.38	31.30	41.03	17.78	132.35	32.86	107.74	128.11	707
Pyrene	33.58	31.88	32.80	14.09	101.76	27.30	154.80	186.49	697
Benzo(a)anthracene	21.03	16.74	16.80	8.18	53.00	12.96	66.87	98.92	841
Chrysene	22.30	18.92	28.23	12.17	84.12	19.85	61.30	141.89	844
Benzo(b)fluoranthene	16.37	20.38	26.06	12.12	80.59	20.00	36.84	95.95	979
Benzo(k)fluoranthene	16.96	17.90	22.51	9.90	70.59	19.49	39.94	85.95	981
Benzo(a)pyrene	23.14	22.71	25.26	11.53	71.76	18.47	63.47	88.78	965
Indeno(1,2,3-cd)pyrene	14.71	13.29	19.09	7.78	43.71	15.10	32.51	53.92	1115
Dibenzo(a,h)anthracene	3.23	3.04	6.99	3.73	11.00	7.50	6.93	9.85	1123
Benzo(g,h,i)perylene	14.66	13.41	19.31	8.18	41.29	15.77	36.84	57.43	1095
Total PAHs	**246**	**219**	**301**	**138**	**791**	**255**	**799**	**1,094**	
TOC (mg/kg)	20,400	68,700	8,750	20,300	17,000	19,600	32,300	7,400	

The toxicity to benthic invertebrates from PAHs in sediments can be assessed based on the narcosis model as described in USEPA (2003). In this approach, the measured concentration of PAHs in sediment normalized to sediment organic carbon is compared to the Final Chronic Values (FCV) for PAHs to aquatic organisms assuming equilibrium partitioning of PAHs between sediment and porewater. The toxic contribution from each PAH is summed to develop total Equilibrium Partitioning Sediment Benchmark Toxic Units (ESBTU) reflective of the overall chronic toxicity. In this analysis, the narcosis model was utilized to estimate toxicity from sediment PAH concentrations by first calculating the organic carbon normalized PAH concentrations in sediment as shown in Table 1 and then calculating ESBTU for the PAHs in Table 2. For the determination of overall toxicity of PAHs, the sum of toxic units is designed to reflect 34 PAH compounds listed in the USEPA (2003) method. Where full data for 34 PAHs are not available, the method document provides an approach to estimate the total PAH toxicity using a subset of PAHs such as the 13 PAHs highlighted in light green in Table 2. ESBTU value for 13 PAHs is multiplied with a factor of 11.5 to estimate the total PAH toxic units for 95% confidence in the determination of toxicity. As shown in Table 2, the two deeper sediments BHH-4 and BHH-8 show elevated toxicity from PAHs that are more than 10-fold higher than the benchmark of 1 (values below 1 indicate sediments are unlikely to be toxic to benthic invertebrates). Among the surface sediments, BHH-10 is the most elevated with estimated ESBTU value of 10, while the remaining 5 surface sediments show elevated but lower toxicity in the range of 1.8-3.3 total toxic units. Thus, the overall assessment is that the PAHs in surface sediments can pose toxicity to benthic invertebrates, with the highest impact in the southern region of the site near BHH-10.

Table 2. Equilibrium Sediment Benchmark Toxic Units (ESBTU) calculation for PAHs in surface and deeper sediments as per USEPA (2003).

				Toxic Units				
	Surface sediments						Deeper sediments	
	BHH-2-SED	BHH-3-SED	BHH-7-SED	BHH-9-SED	BHH-10-SED	BHH-13-SE	BHH-4 3.5-10	BHH-8 13-17
Naphthalene	0.0084	0.0062	0.0182	0.0097	0.0133	0.0195	0.0412	0.0282
2-Methylnaphthalene	0.0146	0.0076	0.0314	0.0168	0.0188	0.0338	0.0264	0.0444
Acenaphthylene	0.0129	0.0094	0.0155	0.0083	0.0092	0.0166	0.0522	0.0298
Acenaphthene	0.0066	0.0035	0.0142	0.0076	0.0098	0.0153	0.0468	0.0201
Fluorene	0.0060	0.0032	0.0130	0.0069	0.0097	0.0139	0.0195	0.0261
Phenanthrene	0.0297	0.0179	0.0232	0.0116	0.1036	0.0216	0.1044	0.0862
Anthracene	0.0111	0.0089	0.0118	0.0063	0.0195	0.0126	0.0751	0.0466
Fluoranthene	0.0472	0.0443	0.0580	0.0252	0.1872	0.0465	0.1524	0.1812
Pyrene	0.0482	0.0457	0.0471	0.0202	0.1460	0.0392	0.2221	0.2676
Benzo(a)anthracene	0.0250	0.0199	0.0200	0.0097	0.0630	0.0154	0.0795	0.1176
Chrysene	0.0264	0.0224	0.0334	0.0144	0.0997	0.0235	0.0726	0.1681
Benzo(b)fluoranthene	0.0167	0.0208	0.0266	0.0124	0.0823	0.0204	0.0376	0.0980
Benzo(k)fluoranthene	0.0173	0.0183	0.0230	0.0101	0.0720	0.0199	0.0407	0.0876
Benzo(a)pyrene	0.0240	0.0235	0.0262	0.0119	0.0744	0.0191	0.0658	0.0920
Indeno(1,2,3-cd)pyrene	0.0132	0.0119	0.0171	0.0070	0.0392	0.0135	0.0292	0.0484
Dibenzo(a,h)anthracene	0.0029	0.0027	0.0062	0.0033	0.0098	0.0067	0.0062	0.0088
Benzo(g,h,i)perylene	0.0134	0.0122	0.0176	0.0075	0.0377	0.0144	0.0336	0.0524
ESBTU-17	0.32	0.28	0.40	0.19	1.00	0.35	1.11	1.40
ESBTU-13	0.28	0.24	0.33	0.15	0.89	0.28	1.01	1.25
ESBTU-13*11.5 (95% CI)	**3.21**	**2.81**	**3.80**	**1.77**	**10.23**	**3.26**	**11.61**	**14.36**

The concentrations of pesticides and herbicides were low and all below screening criteria for human health and ecosystem protection.

PCB concentrations ranged from 52 to 71 µg/kg in deeper sediments and from 44 to 100 µg/kg in surface sediments. There was no consistent trend with sediment depth. The highest concentration of 100 µg/kg was observed at the southernmost surface sediment location (BHH-13). However, the RDL values for the 9 PCB Aroclors were high and ranged from 44-55 µg/kg for each. If ND values are assigned with ½ RDL value, the total PCB Aroclors could potentially be higher.

For the set of 6 metals that often drive risk at sediment sites, the concentrations were low and potential for exposure and risk was mitigated by the high level of sulfide and organic matter in sediments. Metals complexed with sulfide and organic matter are not available for toxic impacts. Table 3 below shows the estimation of risk based on USEPA (2005) from the six metals that precipitate as sulfides in sediments (Cd, Cu, Pb, Ni, Ag, and Zn). The metals in excess of total sulfide are complexed with natural organic matter in sediments in all of these samples resulting in a low value of the key indicator parameter of available excess metals divided by the fraction of organic carbon in sediments [(SEM – AVS)/foc]. All values are below the critical value for toxicity of 130 µmole/g-OC (highest is 55 µmole/g-OC at BHH-7). Thus, these metals are unlikely to cause negative impacts on the benthic ecosystem, especially after a cover of clean fill is placed which would drive these underlying sediments more anaerobic and less prone to metals leaching.

Table 3. Risk assessment for key metals in sediments across all samples for which metal and AVS data were available. The key parameter [(SEM – AVS)/foc] is compared with the value of 130 umole/gOC below which toxicity to aquatic organisms is unlikely (*Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks (ESBs) for the Protection of Benthic Organisms: Metal Mixtures (Cadmium, Copper, Lead, Nickel, Silver, and Zinc): EPA-600-R-02-011*).

			Assessment of metals toxicity						
	Shallow sediments							**Deeper sediments**	
Sample ID	**BHH-2-SED**	**BHH-3-SED**	**BHH-7-SED**	**BHH-9-SED**	**BHH-10-SE**	**BHH-13-SED**		BHH-4 3.5-10	BHH-8 13-17
Sulfide, AV (uMole/g)	0.361	4.7	0.022	0.116	0.082	0.47		56	11.8
Cadmium, (uMole/g)	0.00054	0.0033	0.00054	0.00067	0.00061	0.00064		0.0016	0.0013
Copper, (uMole/g)	0.0833	0.0059	0.0899	0.162	0.115	0.083		0.01	0.008
Lead, (uMole/g)	0.0506	0.156	0.0367	0.0608	0.0765	0.0486		0.0661	0.053
Nickel, (uMole/g)	0.0264	0.0642	0.0163	0.0437	0.0336	0.0517		0.0693	0.0568
Silver, (uMole/g)	0.001	0.0017	0.001	0.0012	0.0011	0.0012		0.003	0.0024
Zinc, (uMole/g)	0.735	2.27	0.364	0.679	0.773	0.569		1.79	0.841
SUM SEM	0.895	2.496	0.507	0.946	0.998	0.752		1.925	0.951
Solids, T%	69.3	42.4	71.3	55.8	66	57.8		46.9	62.8
REDOX P (mV)	70	78	113	134	139	108		79	131
CARBON TOC	20400	68700	8750	20300	17000	19600		32300	7400
SEM/AVS	2.48	0.53	23.04	8.15	12.17	1.60		0.03	0.08
SEM-AVS	0.53	-2.20	0.48	0.83	0.92	0.28		-54.07	-10.85
(SEM-AVS)/foc	26	-32	55	41	54	14		-1674	-1466

The remaining metal species including mercury that are present in the existing sediments are at relatively low concentrations and unlikely to migrate or cause impacts especially after the placement of new clean fill materials. Care will need to be taken during the construction phase of the project to minimize any major disturbance and upwelling of buried sediments that can result in exposure to air and oxidation of sulfide resulting in the leaching of some of the bound metals.

Project Assessment

A review of the available design document for the site indicates proposed creation of offshore berm structures to shelter a set of wetland habitat features that include shallow open water areas, mudflats, low and high marsh, and supra tidal marsh. The detailed design and project planning aspects (90% design document) were not available at the time of this review. While the pollutant levels in sediment are low as described above, there is some concern about the potential for some pollutants to mobilize into the created marsh habitat either during construction disturbance or in the long-term through groundwater upwelling. The remaining report addresses these concerns and explores potential approaches to consider that can minimize the transport of pollutants to the surface of the new marsh. For this site, the greatest concern would be ecological harm from exposure to elevated levels of PAHs in surface sediments in the southern area. Surface sediment from site BHH-10 showed equilibrium sediment benchmark toxic unit of 10. The potential for exposure of benthic invertebrate community in the marsh to the elevated PAHs in sediments needs to be mitigated. The highest PCB concentration of 100 μg/kg was also observed in the southern area of the site (BHH-13). The concentrations of other organic chemicals and metals are low and likely to be not of concern especially after the creation of the marsh structures.

PCBs are of concern due to the existing PCB TMDLs in the Bay that are attempting to reduce PCB loadings in the surface water and resulting human health impacts from accumulation in fish. The Reimagining Middle Branch initiative will bring the community closer to the water through water related activities that can include fishing. Thus, efforts that can reduce potential release of bioaccumulative pollutants from the underlying sediments will further the long-term objective of creating a safe and healthy environment where ecosystem and human activities can flourish together.

The focus of this analysis is on hydrophobic organic pollutants such as PAHs that are the ones most likely to be of concern from the standpoint of ecological exposure in the open water, mudflat, and low marsh environments, and some PCB bioaccumulation in the aquatic food web.

The wetlands will likely be constructed with clean fill after the berm structures are complete. The potential for ecological exposure of contaminants present in the existing surface sediments and deeper sediments can be from the following potential pathways:

1) Surface sediments can be mobilized during debris removal and other construction related activities. Adopting best management practices during construction can minimize chances of sediment release.

2) Surface sediments at this site was observed by field crew to be very fine grained and soft. Some mobilization of soft contaminated surface sediments is possible during the placement of

materials used to construct the base of the berm structure and the contained wetlands and open water areas.

3) Tidal pumping and subsurface groundwater discharge can result in the long-term migration of some dissolved porewater constituents through the fill material. The areas potentially prone to such discharges are the berms constructed of stone and coarse gravel (high hydraulic conductivity), and the Low Marsh wetlands, mudflats, and shallow open water areas (e.g. Low Marsh more prone to tidal pumping action compared to the High Marsh – Guimond and Tamborski, 2021).

Pathways 1 and 2 can be controlled partially by adequate planning of the construction activities. Pathway 3 of long-term groundwater flow related exposure can be controlled by strategic placement of activated carbon amendments to create a barrier layer between the existing sediment surface and the new marsh material. The placement of activated carbon on the contaminated soft sediment locations can also mitigate impacts from the soft sediments if they are partly mobilized during placement of cover material.

Activated Carbon Amendment Feasibility

Aquatic sediments form the ultimate repositories of past and ongoing discharges of hydrophobic organic compounds (HOCs) such as PCBs, as well as some heavy metals. Sediment HOCs can be taken up by pelagic or benthic organisms through ingestion and dermal absorption, and subsequently passed on to higher organisms and humans as illustrated in **Figure 1**. For both of these pathways, the uptake exposure depends on the bioavailability of contaminants in sediment (Luthy et al. 1997; NRC 2003). Work in the last two decades has demonstrated that "Natural" contaminant sequestration in native sediments can be greatly enhanced by the addition of activated carbon (AC) as illustrated in **Figure 1** (Ghosh et al. 2011). Laboratory tests with a range of field sediments showed that AC amendment in the range of 2-5% by weight reduces equilibrium porewater concentration of PCBs, PAHs, DDT, dioxins, and furans in the range of 70-99%, thus reducing the driving force for the diffusive flux of HOCs into the water column and transfer into organisms. Most of the studies using benthic organisms show a reduction of biouptake of HOCs in the range of 70-90% compared to untreated control sediment (Ghosh et al 2011). Recent studies have also demonstrated that AC amendment can reduce porewater concentrations and biouptake of mercury and methylmercury in sediments (Gilmour et al. 2013; 2018). These studies have been generally successful in demonstrating that contaminant bioavailability in sediments can be altered by engineered amendments. Several pilot-scale and full-scale implementations of AC in sediments have demonstrated the effectiveness in reducing the bioavailability of PCBs in sediments. Demonstration in a tidal marsh environment (Sanders et al., 2019) showed that fine AC applied as SediMite pellets successfully reduced porewater PCB concentrations by 97% and reduced PCB bioaccumulation in invertebrates by 98%. In a recent full-scale project, SediMite was applied in a 5-acre lake using a tele-belt (Patmont et al. 2020). Post-treatment sampling indicated an average AC concentration of 4.3% by dry weight in surface sediments. Sediment porewater and surface water measurement using passive samplers showed reductions of 60-80% of freely dissolved PCBs and both have been reduced to below the Delaware Human Health Water Quality Criteria. Fish tissue analysis of resident fish samples

collected before and 3 to 5 years after treatment showed reductions of approximately 70% on a lipid normalized basis and agree with modeled predictions (Patmont et al. 2020).

Based on the observations made in the above field applications of activated carbon, it is feasible to incorporate amendment of activated carbon into the current plans of Harbor Hospital site to minimize exposure to the sediment contamination. The amendment of activated carbon to the underlying sediments is likely to be effective in reducing porewater concentrations of PAHs, PCBs and other hydrophobic pollutants minimizing the risk of contamination of the new marsh habitat.

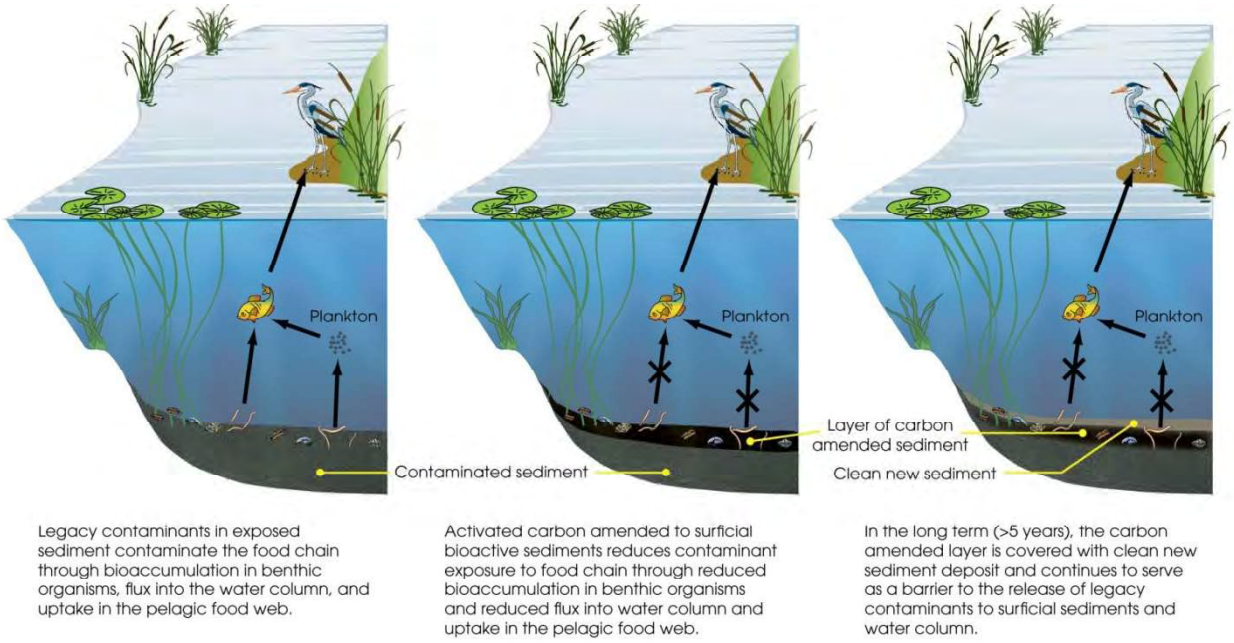

Figure 1*. Conceptual model of how sorbent amendment of sediment reduces contaminant exposure pathways of benthic organism accumulation and flux from the sediment bed. (Ghosh et al. feature article, ES&T 2011).*

Activated Carbon Amendment Recommendation

A recommended design for Activated Carbon amendments for the Harbor Hospital site is based on the following assumptions:

1) The primary exposure pathway of concern is the long-term vertical migration of PAHs, PCBs, and other organic pollutants from deeper sediments via groundwater upwelling.
2) PCB concentrations in sediment are low as determined in the site characterization.
3) Geotechnical considerations in the current construction design will be adequate to maintain stability of the clean fill and underlying sediments.
4) All fill materials are clean and do not contain any COCs of concern.
5) New sediments that will be deposited on the constructed marsh surface over time will be cleaner than existing sediments and will not pose exposure concerns.

While the total area undergoing restoration is large, not all of that area is likely to be impacted from potential upwelling of contaminants associated with underlying sediments. The area to be filled to create marsh habitat that lies below the Mean High Water (MHW) line is likely to be potentially prone to groundwater discharge. The area in the vicinity of BHH-10 has the highest observed concentrations of PAHs and PCBs in surface sediments and is likely to experience potential impacts. While filling up of this area will elevate the marsh surface, the fill material is sand, gravel, and stones, which have a high hydraulic conductivity. Thus, any upwelling in this area has the potential to impact the surface of the new marsh, especially in the low marsh and shallow water areas that are critical ecological habitats for many benthic invertebrates. In contrast, the area above the MHW line is unlikely to experience much intrusion of groundwater and is also going to be largely converted into a high marsh habitat.

The marsh areas on the waterside of the MHW line will be filled with marsh fill (mixture of sand, wood chips, gravel, and silt) followed by the placement of a marsh cap made up of sand. To address the possibility of pollutant migration through the constructed marshes, it is recommended to place a thin layer of activated carbon over the existing sediments to act as a barrier layer between sediments and the overlying cap. as shown in Figure 2 (cross section view) and Figure 3 (plan view).

The project area of low marsh and shallow open water in the vicinity of BHH-10 requiring treatment is approximately 2.0 acres.

For in-situ sediment remediation applications, typical target dose is between 2-5% activated carbon in the treated bioactive layer of sediments. For fine-grained, organic rich sediment, a 5% dose of AC in the top 4" of bioactive sediment translates to a dosing rate of approximately 10 MT AC per acre. For this site, the target application is not a contaminated surface sediment habitat, but application in the form of a treatment layer under a cap. Thus, the cap is expected to provide additional protection from the underlying sediments and a lower range dose of activated carbon (5 MT AC per acre) can be used. Assuming the use of SediMite, a pelletized activated carbon product containing 50% activated carbon by weight, 10 metric tons of pellets can be applied every acre to provide comprehensive coverage of a thin layer of activated carbon against the in-situ sediments. The application of AC as described above will create a treatment zone under the new marsh as illustrated in Figure 2 and 3 and protect the sediment habitat from potential intrusion of pollutants from groundwater discharge.

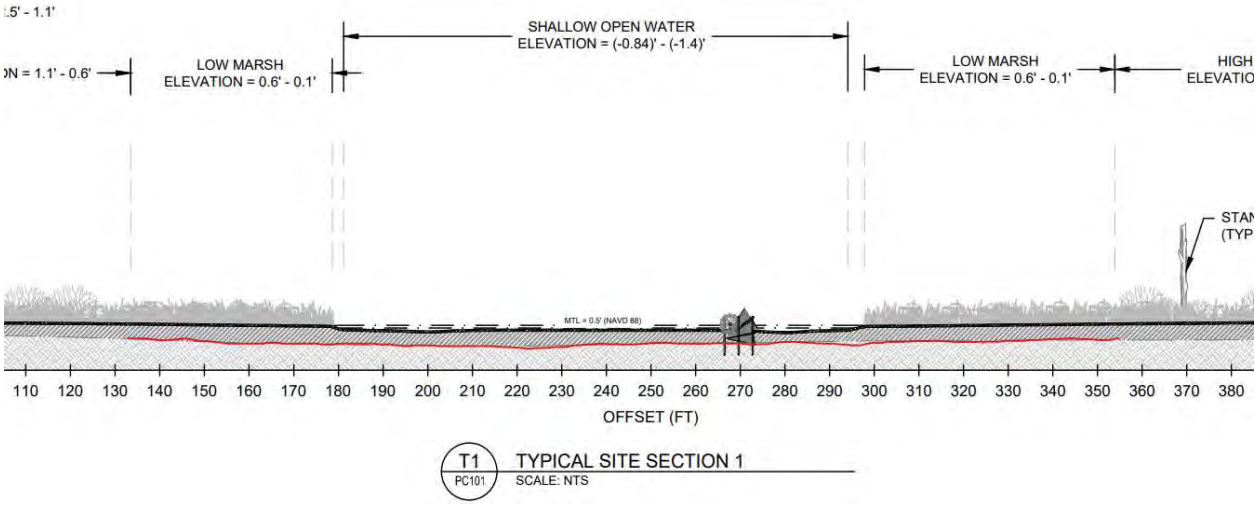

Figure 2. Schematic cross section of application of thin layer of activated carbon (red line) in the areas waterside of MHW line.

Figure 3. Schematic plan view of application of thin layer of activated carbon limits in the vicinity of BHH-10 (red line) in the areas waterside of MHW line.

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Attachment A

Adjacent Property Owners				
Map ID	Owner	Type	PIN	Mailing Address
1	Mayor and City Council	Adjacent and/or Riparian property within 0.5 mi	7612K003; 7612K001; 1053003; 7612M001; 7612L001A; 7610015; 7610011	100 N. Holliday St, Suite 400, Baltimore, MD 21202
2	Hanover Bridge, LLC	Adjacent	7610013	100 E Pennsylvania Ave, Suite 200, Baltimore, MD, 21286
3	Vulcan Materials	Riparian property within 0.5 mi	7042001	P.O. Box 385014, Birmingham, AL 35238
4	Insulator Drive, LLC (C/O MAG Partners)	Riparian property within 0.5 mi	1079001	1500 Whetstone Way, Suite 101, Baltimore, MD 21230
5	2600 Insulator Drive, LLC (C/O MAG Partners)	Riparian property within 0.5 mi	1078002	101 W Dickman St, Suite 200, Baltimore, MD 21230
6	Harbor Hospital, Inc.	Adjacent	7612J002; 7612J001	3001 S. Hanover St, Baltimore, MD 21225
7	Harbor Hospital Center, Inc. (C/O Hanover Dev. Ass. LLC)	Adjacent	7612J003	P.O. Box 196, Stevenson, MD 21153
8	UA Port Covington Holdings, LLC.	Riparian property within 0.5 mi	1053010J	1000 Key Highway East, 21230
9	Cherry Hill Development Corp	Interested Party**	N/A	806 Cherry Hill Road, Baltimore, MD, 21226
10	Greater Baybrook Alliance	Interested Party**	N/A	3430 2nd Street, Baltimore, MD, 21225
11	Action Baybrook, Inc.	Interested Party**	N/A	511 E Patapsco Ave, Baltimore, MD, 21225

* Please refer to permit drawings Sheet 2 for map of adjacent properties

** Locations of interested parties are not shown on permit drawings Sheet 2 but should be included for public notice