

# Maryland National Separate Storm Sewer System (MS4) Monitoring Database

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*Database Design Documentation and Data Dictionary*

*Version 4.1*

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Interstate Commission on the Potomac River Basin

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## Background

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Since the early 1990's, the Maryland Department of the Environment (MDE) has required Phase I Municipal Separate Stormwater Sewer System (MS4) jurisdictions (includes Anne Arundel, Baltimore, Carroll, Charles, Frederick, Harford, Howard, Montgomery, and Prince George's counties, Baltimore City, and the State Highway Administration) to conduct discharge characterization monitoring in small headwater watersheds with different land uses. Chemical, biological, and physical monitoring and assessments were required at outfall and in-stream stations. The jurisdictions are also requested to monitor above and below restoration projects.

Potentially, these assessments would enable the State to detect changes in stream health, water chemistry, and pollutant loads in the watersheds and to assess the efficacy of stream restoration projects and/or best management practices (BMPs). The data could also be used to explore any temporal changes in the biological, chemical, or physical characteristics of monitored streams.

In the past, the monitoring data were stored in a variety of formats, including Access databases, Excel spreadsheets, PDF files, Word documents, EDAS databases, and Geodatabases. To facilitate data analyses, MDE has tasked the Interstate Commission on the Potomac River Basin (ICPRB) to migrate the data into an MS Access database.

## Relational Database Structure

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The MS4 database was designed with the principle of normalization. This entails creating tables and establishing relationships between the tables in such a manner that data redundancy and inconsistent dependencies are avoided. Separate tables are created for sets of related data, which are linked to each other by common key fields. Most of the tables relate to each other via one-to-many relationships. In other words, the one record in the "parent" table is related to many records in the "child" table. Using the key fields to create relationships between the tables allows for the enforcement of referential integrity, which forbids entering duplicate records in the parent table or adding records to a child table for which there is no record in the parent table. Tables are divided into primary data tables and associated domain tables, whose names are prefixed with a "d". The domain tables function as lookup tables and define in detail the codes contained in the primary tables.

## Database Overview

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The MDE MS4 Monitoring Access database is designed to house all relevant data collected by Phase I MS4 jurisdictions, including monitoring site and outfall information as well as chemical, biological, habitat, and physical monitoring data. This user manual describes how the data are organized into primary and associated domain tables within the database.

The following table provides an overview of all tables within the database. The following sections give more detailed descriptions of the table entries, and a database relationship diagram is provided at the end of the manual.

Table Name	Function
<b>Primary Tables</b>	
ACTIVITY	Records the location, date and time, and type of sampling activities.
ACTIVITY_COMMENT	Tracks activity comments provided by collecting agencies or data manipulations performed by ICPRB.
ACTIVITY__EMC	Stores information about EMC data that may be censored.

Table Name	Function
ASSESSMENT_CHEMICAL	Includes information about chemical monitoring and event mean concentrations of stormwater discharges from MS4 outfall and instream monitoring locations.
ASSESSMENT_INSITU	Stores in-situ chemical data that was taken in conjunction with biohabitat assessments).
ASSESSMENT_PHYSICAL	Will store information related to geomorphologic stream assessments.
INDEX_BIOHABITAT	Contains biological and habitat indices and metrics calculated by the MS4 permittees to assess stream health.
MASTER_TAXA_LIST	Provides taxonomic information for all collected macroinvertebrates.
METRIC_BENTHIC	Stores benthic metrics calculated by the MS4 permittees to assess stream health.
METRIC_HABITAT	Stores habitat metrics calculated MS4 permittees to assess overall stream health.
MONITORING_SITES	Provides sampling location names and associated geographic attributes.
OUTFALLS	Provides information about outfalls associated with MS4 permit monitoring.
PROJECT	Provides ad description of the project purpose and/or a summary.
TAXA_COUNT	Contains raw benthic counts submitted by the MS4 permittees.
<b>Domain tables</b>	
dAgency	Lists sampling agencies.
dActivity_Type	Provides information about the type of sample collected.
dFFGroup	Describes the functional feeding group designation of a benthic organism.
dHabit	Provides a description of the habit/behavior assignment of benthic organisms based on their locomotion or behavior in relation to their habitat.
dIndex_Biohab	Defines biohabitat indices
dLandUse	Provides Maryland Department of Planning (MDP) land use descriptions.
dLifeStage	Lists life stages of benthic organisms.
dMetrics_Benthic	Provides descriptions of benthic metrics calculated by the MS4 jurisdictions.
dMonitoringRequirement	Defines the specific monitoring requirement for an activity.
dOutfallMaterial	Provides information about the outfall material at monitoring locations.
dOutfallType	Provides information about the outfall type at monitoring locations.
dParameter_Chemical	Provides descriptions of chemical assessment parameters.
dParameter_Habitat	Clarifies the habitat assessment parameters.
dParameter_Physical	Describes the characteristics of the physical assessment.
dSiteCriteria	Defines the site selection criteria
dStatisticalBase	Describes methods used to calculate the values for the chemical assessment.
dStrata	Defines the physiographic stratum in which a site is located.
dQuality	Provides qualitative description of the benthic or habitat sample

## Table Design

Following is an explanation of the table columns used in this document to describe the fields in the database tables.

**Field Name:** This column provides the field name(s) of a database table and its designation as a primary key (PK), a foreign key (FK), a unique field (U), a required entry (i.e. not null) (NN), and/or an optional field (O).

Primary and foreign keys describe the relationship(s) between individual tables and therefore, cannot be null. The origin table's primary key must be unique record that relates to the foreign key in the destination table. The relationship between the primary and foreign keys can either be one-to-one or one-to-many. A one-to-one relationship means that there is only one match between the origin and destination table, while a one-to-many relationship permits a match to one or more records in the destination table.

Fields that serves as neither primary nor foreign keys but have been designated as not null or unique are considered essential to some applications of the database.

**Type/Size:** This column specifies whether the field type is text, number (num), date, or time, and the maximum length of the entry.

**Description:** This column provides an explanation of the field name as well as example(s) of valid entries

## Primary Data Tables

This section describes the primary data tables housed in the MS4 Access database

### ACTIVITY

Every event for which data is reported must have a record in the ACTIVITY table, which Records the location, date and time, and type of sampling activities.

Field Name	Type/Size	Description
PROJECT_ID (FK, NN)	Text 35	A unique identifier for the project. Format: AGENCY_ID + MONITORING_REQUIREMENT + location abbreviation. Example: AACO_WRM_PP. Relates to primary table <b>PROJECT</b> .
MDE_MONITORING_LOCATION_ID (FK, NN)	Text 35	A unique monitoring station identifier either reported by the MS4 permittee or generated for this database. Example: AA94MSI000008. Relates to primary table <b>MONITORING_SITES</b> .
ACTIVITY_ID (PK, U, NN)	Text 35	Unique identifier for each sampling activity. Example: Agency:Location:In/Out_Activity Type_MMDDYYYY:HHMM AACO:PP:I_CHEM_01012003:0800
EVENT_DATE (NN)	Date 10	Date when the sample was collected. Format: YYYY-MM-DD
EVENT_TIME (O)	Time 8	Time when the sample was collected. Format: HH:MM:SS
ACTIVITY_TYPE (NN)	Text 5	Indicates the type of sample collected during an activity. Examples: BIOH, BIOL, CHEM, HABI, INST, PHY. Relates to domain table <b>dActivity_Type</b> .

### ACTIVITY\_COMMENTS

This table tracks activity comments provided by the collecting agencies or data manipulations performed by ICPRB.

Field Name	Type/Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.
COMMENTS_ICPRB (O)	Text 255	Comments related to data manipulations performed by ICPRB.

### ACTIVITY EMC

This table stores information about EMC data that may be censored. This table still needs a final QAQC.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
FLOW_TYPE (FK, NN)	Text 5	Indicates if sample was taken during storm or base flow events.
PARAMETER (FK, NN)	Text 120	Characteristic name associated with chemical monitoring. Relates to domain table Error! Not a valid result for table..
CENSORED (NN)	Text 3	ICPRB estimation of the likelihood that the EMC value may be censored (yes or no).
COMMENTS_ICPRB (O)	Text 255	ICPRB comments related to the EMC value.

### ASSESSMENT\_CHEMICAL

The table includes information about chemical monitoring and event mean concentrations (EMCs) of stormwater discharges from MS4 outfall and in-stream monitoring locations.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
FLOW_TYPE (FK, NN)	Text 5	Indicates if sample was taken during storm or base flow events.
CHEMICAL_PARAMETER (FK, NN)	Text 20	Characteristic name associated with chemical monitoring. Relates to domain table Error! Not a valid result for table..
RESULT_VALUE (NN)	Num	Measured value of the parameter
RESULT_UNIT (FK, NN)	Text 12	Unit of the Result_Value. Examples: mg/l, ug/l, gal
RESULT_VALUE_TYPE (NN)	Text 15	Qualifies the Result_Value. Examples: Calculated, Actual
RESULT_STATISTICAL_BASE (FK, NN)	Text 5	Method used to calculate derived results. Examples: FWA, EMC0, EMCdt, OBS. Relates to domain table <b>dStatistical_Base</b> .
RESULT_DETECTION_LIMIT (NN)	Num	Detection limit reported and/or used for EMCdt calculation
RESULT_DETECTION_LIMIT_UNIT (NN)	Text 12	Unit of the detection limit

### ASSESSMENT\_INSITU

The table includes information about in-situ water quality data collected concurrently with biohabitat sampling.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
SAMPLE_NUMBER (NN)	Text 3	Allows for marking duplicate or QC samples. Examples: 0, 1 where 0 is the original sample and 1 identifies a duplicate sample.

Field Name	Type/ Size	Description
PARAMETER (FK, NN)	Text 20	Characteristic name associated with chemical monitoring. Relates to domain table Error! Not a valid result for table..
VALUE (NN)	Num	Measured value of the parameter
UNIT (FK, NN)	Text 12	Unit of the Result_Value. Examples: mg/l, ug/l, gal
METHOD (O)	Text 50	Identifies the sampling method used by the collecting agency.
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.
COMMENTS_ICPRB (O)	Text 255	ICPRB comments related to in-situ water quality samples.

### ASSESSMENT\_PHYSICAL

This table is intended to store information related to geomorphologic stream assessments conducted between MS4 outfall and in-stream sites. The table will not be populated with data for the current database version (v4.1).

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
REACH_ID (O)	Text 35	Reach identifier provided by the collecting agency.
XSECTION_ID (O)	Text 35	Cross section identifier provided by the collecting agency.
CHARACTERISTIC NAME (FK, NN)	Text 120	Geomorphological characteristic. Relates to domain table <b>dParameter_Physical</b> .
RESULT VALUE (NN)	Num	Measured value of characteristic
RESULT_UNIT (FK, NN)	Text 12	Unit for characteristic result
RESULT_VALUE_TYPE (NN)	Text 12	Example: Actual, Calculated
REACH_LENGTH_MEASURE (O)	Num	Length measurement of the reach
REACH_LENGTH_UNIT (O)	Text 12	Unit of the reach length value
REACH_WIDTH_MEASURE (O)	Num	Width measurement of the reach
REACH_WIDTH_UNIT (O)	Text 12	Unit of the reach width value
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.



### INDEX\_BENTHIC

This table contains information of the Benthic Index of Biotic Integrity (BIBI) calculated by the MS4 permittees.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
SAMPLE_NUMBER (NN)	Text 3	Allows for marking duplicate or QC samples. Examples: 0, 1 where 0 is the original sample and 1 identifies a duplicate sample.
INDEX (NN)	Num 8	Benthic Index of Biotic Integrity (BIBI): BIBI
INDEX_VALUE (NN)	Num 8	Calculated value of the BIBI.
INDEX_NARRATIVE (O)	Text 50	Narrative description of the index. Examples for BIBI: good, fair, poor. Examples for PHI: Degraded, partial degraded
METHOD (O)	Text 50	Identifies the sampling method used by the collecting agency.
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.
COMMENTS_ICPRB (O)	Text 255	ICPRB comments related to the BIBI score.

### INDEX\_HABITAT

This table contains biological and habitat indices calculated by the MS4 permittees to assess overall stream health.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
SAMPLE_NUMBER (NN)	Text 3	Allows for marking duplicate or QC samples. Examples: 0, 1 where 0 is the original sample and 1 identifies a duplicate sample.
INDEX (NN)	Num 8	Specifies the habitat index: Physical Habitat Index (PHI) or Rapid Bioassessment Protocol Index (RBP). Relates to domain table dIndex_Habitat
INDEX_VALUE (O)	Num 8	Calculated value of the habitat indices.
INDEX_NARRATIVE (O)	Text 50	Narrative description of the index. Examples for BIBI: good, fair, poor. Examples for PHI: Degraded, partial degraded
METHOD (O)	Text 50	Identifies the sampling method used by the collecting agency.
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.
COMMENTS_ICPRB (O)	Text 255	ICPRB comments related to the habitat scores.

### MASTER\_TAXA\_LIST

The data in the master taxa lists is the most up-to-date (as of September 11, 2018) available from the Maryland Biological Stream Survey (MBSS) program of the Maryland Department of Natural Resource (DNR).

Note: Most permittees included taxa in their raw benthic counts that are not found in the master taxa list. For these cases, the taxonomic classification was added but no other information including habit, functional feeding group, and tolerance values. DNR should be consulted for updates.

Field Name	Type/ Size	Description
TAXON (PK, NN, U)	Text 35	Unique taxonomic identification name. In most cases benthic macroinvertebrates are identified to genus. When this was not possible, and a higher taxonomic level was provided. Relates to <b>TAXA_COUNT</b> .
TAXON_LEVEL (NN)	Text 5	Phylogenetic classification level, including phylum (PHY), class (CLA), order (ORD), family (FAM), tribe (TRI), genus (GEN).
PHYLUM (O)	Text 35	Latin name of phylum
CLASS (O)	Text 35	Latin name of class
ORDER (O)	Text 35	Latin name of order
TRIBE (O)	Text 35	Latin name of tribe
FAMILY (O)	Text 35	Latin name of family
GENUS (O)	Text 35	Latin name of genus
OTHER_TAXA (O)	Text 35	Alternative Latin name.
HABIT (O)	Text 10	Describes the habit/behavior of the organism. Examples: Burrower, climber, clinger, collector, sprawler, swimmer. Relates to domain table <b>dHabit</b> .
FFG (O)	Text 5	Indicates the functional feeding group an organism belongs to. Examples: Collector, filterer, predator, scrapper, shredder. Relates to domain table Error! Not a valid result for table..
FAM_TV (O)	Num	Stressor tolerance value at the family taxonomic level
FinalTolVal07 (O)	Num	Tolerance value for the taxon
COMMENTS_DNR (O)	Text 255	General comments provided by DNR.
COMMENTS_ICPRB	Text 255	ICPRB comments related taxa.

### METRIC\_BENTHIC

This table stores various benthic metrics calculated by the MS4 permittees used to assess the overall stream health.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
SAMPLE_NUMBER (NN)	Text 3	Allows for marking duplicate or QC samples. Examples: 0, 1 where 0 is the original sample and 1 identifies a duplicate sample.

Field Name	Type/ Size	Description
BENTHIC_METRIC (NN)	Text 35	A descriptor of the calculated metric. Example: Taxa richness, percent climber taxa. Relates to domain table <b>dMetrics_Benthic</b> , which also describes permissible entries.
METRIC_VALUE (O)	Num	Provides the calculated value of the benthic metric.
METRIC_SCORE (O)	Num	Provides the scaled score of the benthic metric.
METHOD (O)	Text 50	Identifies the sampling method used by the collecting agency. Example: MBSS
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.
COMMENTS_ICPRB (O)	Text 255	Comments entered by ICPRB about the data.

### METRIC\_HABITAT

This table stores habitat metrics calculated by the collecting agencies to assess overall stream health.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
SAMPLE_NUMBER (NN)	Text 3	Allows for marking duplicate or QC samples. Examples: 0, 1 where 0 is the original sample and 1 identifies a duplicate sample.
HABITAT_METRIC (FK, NN)	Text 120	Characteristic name associated with habitat monitoring. Relates to domain table <b>dParameter_Habitat</b> .
METRIC_VALUE (NN)	Text 10	Provides the calculated value of the habitat metric.
METHOD (O)	Text 50	Identifies the sampling method used by the collecting agency. Example: MBSS PHI, RBP
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.
COMMENTS_ICPRB (O)	Text 255	Comments entered by ICPRB about the data.

### MONITORING\_SITES

This table provides sampling location names and associated geographic attributes.

Field Name	Type/ Size	Description
MDE_MONITORING_LOCATION_ID (PK, U, NN)	Text 35	A unique monitoring station identifier either reported by the MS4 permittee or generated for this database. Example: AA94MSI000008. Relates to primary table <b>ACTIVITY</b> .
MONITORING_LOCATION_NAME (NN)	Text 255	A geographically descriptive name
MONITORING_LOCATION_TYPE (NN)	Text 10	Type of monitoring location. Examples: INSTREAM, OUTFALL
SITE_SELECTION_CRITERIA (FK, NN)	Text 5	Specifies the site selection criteria. Examples: Targeted, Random. Relates to domain table <b>dSiteCriteria</b>

Field Name	Type/ Size	Description
STRATA (FK, O)	Text 35	Physiographic region (i.e., COASTAL, EPIEDMONT, HIGHLAND). Relates to domain table <b>dStrata</b> .
ALTERNATE_MONITORING_ LOCATION_ID (O)	Text 35	Local monitoring station identifier or local outfall identifier
OUTFALL_ID (FK, O)	Text 35	Outfall identifier. Relates to primary table <b>OUTFALLS</b> .
SW_PROGRAM_ID (O)	Text 35	SW Program identifier
CB_TRUST (FK, O)	Text 35	Indicates whether the watershed is associated with the Chesapeake Bay (CB) Trust restoration project.
MONITORING_LOCATION_LATITUDE (NN)	Num	Monitoring location latitude in decimal degrees with datum NAD83
MONITORING_LOCATION_LONGITUDE (NN)	Num	Monitoring location longitude in decimal degrees with datum NAD83
LOCATION_DESCRIPTION (O)	Text 255	Narrative description of the monitoring location
DRAIN_AREA (O)	Num	Drainage area (in acres) to monitoring location
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency.
COMMENTS_ICPRB (O)	Text 255	Comments entered by ICPRB about the data.

## OUTFALLS

This table provides information about outfalls associated with MS4 permit monitoring.

Field Name	Type/ Size	Description
MDE_MONITORING_LOCATION_ID (FK, NN)	Text 35	A unique monitoring station identifier either reported by the MS4 permittee or generated for this database. Example: AA94MSI000008. Relates to primary table <b>MONITORING_SITES</b> .
OUTFALL_ID (PK, U, NN)	Text 35	A unique MDE primary outfall identifier
LOCAL_OUTFALL_ID (O)	Text 35	Jurisdiction's outfall identifier
OUTFL_DIM (O)	Num	Outfall dimension value
OUTFL_DIM_UNIT (O)	Text 10	Outfall dimension unit
OUTFL_TYPE (FK, O)	Text 5	Outfall type. Example: culvert (CV), headwall (HW). Relates to domain table <b>dOutfall_Type</b> ,
OUTFL_MATL (FK, O)	Text 5	Outfall material type. Examples: Reinforced concrete pipe (RCP), corrugated metal pipe (CMP). Relates to domain table <b>dOutfall_Material</b> .
OUTFL_YEAR (NN)	Num	Year outfall was constructed
OUTFL_DRAIN (O)	Num	Drainage area to outfall (acres)

Field Name	Type/ Size	Description
OUTFALL_LATITUDE (NN)	Num	Outfall location latitude in decimal degrees with datum NAD83
OUTFALL_LONGITUDE (NN)	Num	Outfall location longitude in decimal degrees with datum NAD83
OUTFALL_LOCATION_DESCRIPTION (O)	Text 255	Narrative description of the outfall location
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency

## PROJECT

Every event for which data is reported must have a record in the Project table.

Field Name	Type/ Size	Description
COLLECTING_AGENCY_ID (PK, NN)	Text 4	An identifier of the agency conducting the activity. Examples: Anne Arundel County (AACO), State Highway Administration (SHA). Relates to domain table <b>dAgency</b> .
PROJECT_ID (PK, U, NN)	Text 35	A unique identifier for the project. Format: AGENCY_ID + MONITORING_REQUIREMENT + location abbreviation. Example: AACO_WRM_PP.
PROJECT_NAME (O)	Text 200	A unique name for the project. Example: Anne Arundel County MS4 Watershed Restoration Monitoring at Parole Town Center
PROJECT_DESCRIPTION (O)	Text 255	Provides a description of the project's purpose and/or a summary.
MONITORING_REQUIREMENT (NN)	Text 35	Tracks the specific monitoring requirement at a station. Examples: WRM, SWM. Relates to domain <b>dMonitoring_Requirement</b> .
SAMPLING_DESIGN_TYPE (NN)	Text 20	Specifies the sampling design type for a Project. Examples: Targeted, Random
PERMIT_NUMBER (NN)	Text 11	MS4 permit number issued by MDE.

## TAXA\_COUNT

This table contains raw benthic counts submitted by the MS4 permittees. The data can be used to calculate benthic metrics and indices.

Field Name	Type/ Size	Description
ACTIVITY_ID (FK, NN)	Text 35	Identifier related to a monitoring activity. Relates to primary table <b>ACTIVITY</b> .
SAMPLE_NUMBER (NN)	Text 3	Allows for marking duplicate or QC samples. Examples: 0, 1 where 1 identifies a duplicate sample.
TAXON (FK, NN)	Text 50	Unique taxonomic identification name. Usually benthic macro-invertebrates are identified to genus. Relates to domain
LIFE_STAGE (FK, O)	Text 5	Description of a specimen's life stage. Examples: Adult, Larva, Juvenile. Relates to domain table <b>dLifeStage</b> .
RESULT_VALUE (NN)	Num	Number of individuals counted

Field Name	Type/ Size	Description
RESULT_UNIT (FK, NN)	Text 12	Count
EXCLUDED (O)	Text 3	Non-unique taxa (i.e., parent taxon with one or more child taxa present in sample). If "Y", do not include in taxa richness metric calculations.
COMMENTS_GENERAL (O)	Text 255	General comments provided by the collecting agency
COMMENTS_ICPRB (O)	Text 255	Comments entered by ICPRB about the data.

## Data Domain Tables

This section describes the domain tables associated with the primary tables.

### dActivity\_Type

This domain table provides information about the type of sample collected during an activity and relates to the **ACTIVITY** table.

ACTIVITY_TYPE	Activity_Type_Name	Description
BEN	Biohabitat	Benthic monitoring only
BH	Biohabitat	Concurrent benthic and habitat monitoring
BHI	Biohabitat	Concurrent benthic, habitat monitoring, and in-situ monitoring
BI	Biohabitat	Concurrent benthic and in-situ monitoring
CHEM	Chemical	Chemical monitoring at MS4 outfall and in stream sites
HAB	Biohabitat	Habitat monitoring only
HI	Biohabitat	Concurrent habitat and in-situ monitoring
INST	In-situ	In-situ water quality samples collected in conjunction with biological and/or habitat monitoring.
PHY	Physical	Geomorphologic stream assessments conducted between MS4 outfall and in stream sites.

### dAgency

This domain table lists the sampling agencies in the **PROJECT** table.

AGENCY_ID	Agency_Name
AACO	Anne Arundel County
BACI	Baltimore City
BACO	Baltimore County
CACO	Carroll County
CHCO	Charles County
FRCO	Frederick County
HACO	Harford County
HOCO	Howard County
MOCO	Montgomery County
PGCO	Prince George's County
SHA	State Highway Administration

### dFFGroup

This domain table relates to the **dMaster\_Taxa\_List** table. The functional feeding group designation refers to the type of food resource a benthic macroinvertebrate utilizes in a stream.

FFG_CODE	FFG_Name
COL	Collector
FIL	Filterer
PIE	Piercer
PRE	Predator
SCR	Scraper
SHR	Shredder

### dHabit

This domain table relates to the **dMaster\_Taxa\_List** table. Benthos receive a habit/behavior assignment based on their locomotion or behavior in relation to their habitat.

HABIT_CODE	Habit_Name
bu	Burrower
cb	Climber
cn	Clinger
dv	Diver
sk	Skater
sp	Sprawler
sw	Swimmer

### dIndex\_Habitat

This domain table relates to the **INDEX\_HABITAT** table and defines the index that was calculated.

INDEX_CODE	Index_Description
PHI	MBSS Physical Habitat Index
RBP	EPA's Rapid Bioassessment Protocol

### dLifeStage

This domain table relates to the **TAXA\_COUNT** table and defines the life stage of a collected benthic organism.

LIFE_STAGE_CODE	Life_Stage_Name
ADL	Adult
GRP	Group
IMM	Immature
INS	Instar
LAR	Larvae
UNK	Not Specified
PUP	Pupae

## dLandUse

This domain table provides MDP land use codes and associated descriptions. It will be connected to the MONITORING\_SITE table in the future.

LU_CODE	Landuse_Name	Description
11	Low Density Residential	Detached single family/duplex dwelling units, yards, and associated areas. Areas of more than 90 percent single family/duplex dwelling units, with lot sizes less than five acres but at least one-half acres (.2 dwelling units/acre to 2 dwelling units/acre).
12	Medium Density Residential	Detached single family/duplex, attached single unit row housing, yards, and associated areas. Areas of more than 90 percent single family/duplex units and attached single unit row housing, with lot sizes of less than one-half acre but at least one-eighth acre (2 dwelling units/acre to 8 dwelling units/acre).
13	High Density Residential	Attached single unit row housing, garden apartments, high rise apartments/condominiums, mobile home and trailer parks. Areas of more than 90 percent high density residential units, with more than 8 dwelling units/acre.
14	Commercial	Retail and wholesale services. Areas used primarily for the sale of products and services, including associated yards and parking areas.
15	Industrial	Manufacturing and industrial parks, including associated warehouses, storage yards, research laboratories, and parking areas.
16	Institutional	Elementary and secondary schools, middle schools, junior and senior high schools, public and private colleges and universities, military installations (built-up areas only, including buildings and storage, training, and similar areas) churches and health facilities, correctional facilities, and government offices and facilities that are clearly separable from the surrounding land cover.
17	Extractive	Surface mining operations, including sand and gravel pits, quarries, coal surface mines, and deep coal mines. Status of activity (active vs. abandoned) is not distinguished.
18	Open Urban Land	Urban areas whose use does not require structures, or urban areas where non-conforming uses characterized by open land have become isolated. Included are golf courses, parks, recreation areas (except associated with schools or other institutions), cemeteries, and entrapped agricultural and undeveloped land within urban areas.
191	Large Lot Subdivision (Agriculture)	Residential subdivisions with lot sizes less than 20 acres but at least 5 acres, with a dominant land cover of open fields or pasture.
192	Large Lot Subdivision (Forest)	Residential subdivisions with lot sizes less than 20 acres but at least 5 acres, with a dominant land cover of deciduous, evergreen or mixed forest.
21	Cropland	Field and forage crops.
22	Pasture	Land used for pasture, both permanent and rotated: grass.
23	Orchards/Vineyards/Horticulture	Areas of intensively managed commercial bush and tree crops, including areas used for fruit production, vineyards, sod and seed farms, nurseries, and green houses.
24	Feeding Operations	Cattle or hog feeding lots, poultry houses, and holding lots for animals, and commercial fishing areas (including oyster beds).
241	Feeding Operations	Cattle or hog feeding lots, poultry houses, and holding lots for animals.
242	Agricultural Building	Breeding and training facilities, storage facilities, built-up areas associated with a farmstead, small farm ponds, and commercial fishing areas.
25	Row and Garden Crops	Intensively managed track and vegetable farms and associated areas.
41	Deciduous Forest	Forested areas in which the trees characteristically lose their leaves at the end of the growing season. Included are such species as oak, hickory, aspen, sycamore, birch, yellow poplar, elm, maple, and cypress.



LU_CODE	Landuse_Name	Description
42	Evergreen Forest	Forested areas in which the trees are characterized by persistent foliage throughout the year. Included are such species as white pine, pond pine, hemlock, southern white cedar, and red pine.
43	Mixed Forest	Forested areas in which neither deciduous or evergreen species dominate, but in which there is a combination of both types.
44	Brush	Areas that do not produce timber or other wood products but may have cut-over timber stands, abandoned agriculture fields, or pasture. These areas are characterized by vegetation types such as sumac, vines, rose, brambles, and tree seedlings.
50	Water	Rivers, waterways, reservoirs, ponds, bays, estuaries, and ocean.
60	Wetlands	Forested and non-forested wetlands, including tidal flats, tidal and non-tidal marshes, and upland swamps and wet areas.
71	Beaches	Extensive shoreline areas of sand and gravel accumulation, with no vegetative cover or other land use.
72	Bare Exposed Rock	Areas of bedrock exposure, scarps, and other natural accumulations of rock without vegetative cover.
73	Bare Ground	Areas of exposed ground caused naturally, by construction, or other cultural processes.
80	Transportation	Transportation features include major highways, light rail or metro stations and large "Park „N Ride" lots, generally over ten acres in size. Major highways were defined as those appearing on the State Highway maps as Controlled Access Highways or Primary Highways

### dMetrics\_Benthic

This domain table provides descriptions of benthic metrics calculated by the MS4 jurisdictions and relates to the **METRIC\_BENTHIC** table.

BENTHIC_METRIC	Description	Metric_Unit	Metric_Score
Beck	Beck's Biotic Index	index	
ndipt	Richness (i.e. number) Diptera taxa	count	
nephem	Richness (i.e. number) of Ephemeroptera taxa	count	1 (low), 3, or 5 (high)
nept	Richness of EPT (Ephemeroptera, Plecoptera, Tricop	count	1 (low), 3, or 5 (high)
nint	Richness of intolerant taxa	count	1 (low), 3, or 5 (high)
nsrape	Richness of scraper taxa	count	1 (low), 3, or 5 (high)
ntaxa	Taxa richness	count	1 (low), 3, or 5 (high)
pchiron	Relative abundance (i.e. percent) of Chironomidae	percent (1 - 100)	1 (low), 3, or 5 (high)
pclimb	Relative abundance of climbers taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
pcling	Relative abundance of clingers taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
pcoll	Relative abundance of collector taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
pdipt	Relative abundance of Diptera taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
pephem	Relative abundance of Ephemeroptera taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
pintol_urb	Relative abundance of intolerant urban taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
psrape	Relative abundance of scrapper taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
pswim	Relative abundance of swimmer taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
ptany	Relative abundance of Tanytarsus taxa in sample	percent (1 - 100)	1 (low), 3, or 5 (high)
ptol	Relative abundance of tolerant taxa in sample	percent (1 - 100)	
totind	Total number of individuals (aka total count)	count	
totsrape	Abundance of scrapper taxa	count	

### dMonitoring\_Requirement

This domain table describes the monitoring requirement for activities. It relates to the **PROJECT** table.

MONITORING_REQUIREMENT	Description
LID	Low Impact Development (LID) technology monitoring
OMB	Biomonitoring not related to MS4 permits
ORM	Other Watershed Restoration Monitoring
SWM	SWM Effectiveness
TFM	Trust Fund Monitoring
UNK	Unknown
WRM	MS4 Watershed Restoration Monitoring
WRM/TFM	Watershed Restoration and Trust Fund Monitoring

### dOutfall\_Material

This domain table provides information about the outfall material at monitoring locations. It relates to the **OUTFALLS** table.

OUTFL_MATL	Description
ASRP	Aluminum Spiral Rib Pipe
ACCOMP	Asphalt Coated Corrugated Metal Pipe
BCCMP	Bituminous Coated Corrugated Metal Pipe
CIP	Cast Iron Pipe
CONC	Concrete
CMP	Corrugated Metal Pipe
HDPE	High Density Polyethylene
PVC	Polyvinyl Chloride (PVC) Pipe
RCP	Reinforced Concrete Pipe
STR	Stream
SPP	Structural Plate Pipe
TCP	Terracotta Pipe
UNK	Unknown
VC	Vitrified Clay
OTH	Other

### dOutfall\_Type

This domain table provides information about the outfall type at monitoring locations. It relates to the **OUTFALLS** table.

OUTFL_TYPE	Description
CV	Culvert
ES	Endsection
EW	Endwall
HW	Headwall
IN	Inlet
MH	Manhole
PP	Projecting Pipe
OTH	Other

**dParameter\_Chemical**

This domain table defines the chemical parameters in the **ASSESSMENT\_CHEMICAL** table.

CHEMICAL_PARAMETER	Description	Unit
BOD	Biochemical Oxygen Demand (BOD5)	mg/l
COND_FLD	In-situ Conductance	umho/cm
DEPTH	Total rainfall depth	inch
DO_FLD	In-situ Dissolved Oxygen	mg/l
DURATION	Length of storm event	hour
ECOCCL	Enterococci	MPN/100
ECOLI	E. coli	MPN/100
HARD	Hardness	ug/l
INTENSITY	DEPTH / DURATION	in/hr
NO23	Nitrite plus Nitrate	mg/l
pH	pH	std units
pH_FLD	In-situ pH	std units
TCU	Total Copper	ug/l
TDS_FLD	In-situ Total Dissolved Solids	mg/l
TKN	Total Kjeldahl Nitrogen	mg/l
TP	Total Phosphorus	mg/l
TPB	Total Lead	ug/l
TPH	Total Petroleum Hydrocarbons	mg/l
TSQVOL	Total Storm Flow Volume	gal
TSS	Total Suspended Solids	mg/l
TURB_FLD	In-situ Turbidity	NTU
TZN	Total Zinc	ug/l
WTemp	Water Temperature	deg c

**dParameter\_Habitat**

This domain table clarifies the habitat parameters in the **ASSESSMENT\_HABITAT** table.

HABITAT_PARAMETER	Habitat_Parameter_Name	Permissible Value
AESTHET	Aesthetics (aka trash rating) score	0 - 20
BANKS	Bank stability score	0 - 20
BANKS_SC	Bank stability scaled score	
BANKV	Bank vegetative protection score	0-20
CHALT	Channel alteration score	0 - 20
CHFLOW	Channel flow status (% channel filled with water) score	0 - 20
CHSIN	Channel Sinuosity score	0 - 20
EMBED	Embeddedness score	0 - 20
EMBED_P	Embeddedness (%)	0 - 100
EMBED_SC	Embeddedness scaled score	agency dependent
EPIFAUN	Epifaunal substrate score	0 - 20
EPIFAUN_SC	Epifaunal substrate scaled score	agency dependent
HABITAT	Habitat score	
HABITAT_DESCRIP	Qualitative description of sample	1 - 4

HABITAT_PARAMETER	Habitat_Parameter_Name	Permissible Value
HABITAT_SC	Habitat scaled score	agency dependent
INSTRHAB	Instream habitat structures score	0 - 20
INSTRHAB_SC	Instream habitat structures scaled score	agency dependent
MDEPTH	Maximum depth in sample reach (cm)	measured value
POOLQUAL	Pool/glide/eddy quality score	0 - 20
POOLSUB	Pool Substrate Characterization	0 - 20
POOLVAR	Pool Variability	0 - 20
QUALI_DESCRIP	Descriptive value of habitat	1 - 4
REMOTE	Remoteness score	0 - 20
REMOTE_SC	Remoteness scaled score	agency dependent
RIFF	Frequency of riffles score	0-20
RIFFQUAL	Riffle/run quality score	0 - 20
RIFFQUAL_SC	Riffle/run quality scaled score	agency dependent
RIP_WID	Riparian buffer width (m)	measured value
RIPZW	Riparian vegetative zone width score	0-20
SEDEP	Sediment deposition score	0 - 20
SHAD_P	Shading (%)	1 - 100
SHAD_SC	Shading scaled score	agency dependent
VEL_DPTH	Velocity/depth diversity score	0 - 20
WOOD	Number of instream woody debris score	0 - 20
WOOD_SC	Number of instream woody debris scaled score	agency dependent

#### dParameter\_Physical

This domain table describes the parameters that may be stored in the **ASSESSMENT\_PHYSICAL** table.

PHYSICAL_PARAMETER	Description	Unit
Abkf	Bankfull Cross-sectional Area: The area of the bankfull channel, estimated as the product of bankfull width and mean depth	sq ft
Qbkf	Bankfull Discharge	cfs
Ebkf	Bankfull Elevation	ft
dmbkf	Bankfull Maximum Depth: The maximum depth of the bankfull channel, or the difference between the thalweg elevation and the bankfull discharge elevation	ft
dbkf	Bankfull Mean Depth: The mean depth of the bankfull channel	ft
Wbkf	Bankfull Width: the width of the channel at the elevation of bankfull discharge or at the stage that defines the bankfull channel	ft
Wbkf_dbkf	Bankfull Width-to-depth ratio	
Wfpa	Floodprone Area Width: the width of the channel at a stage of twice the maximum depth	ft
Slope	Channel slope at bankfull stage	%
K	Sinuosity: ratio of the stream length versus the valley length or the valley slope divided by the channel slope.	
TW	Thalweg or deepest elevation along active channel	ft
ER	Entrenchment Ratio: the ratio of the width of the flood prone area (Wfpa) versus bank-full width (Wbkf).	none
D50	Median particle size of stream channel	mm
DrainageArea	Drainage Area	sq mile
BEHI	Bank Erosion Hazard Index (Very low, Low, Moderate, high, very high, extreme)	narrative
NBS	Near Bank Stress (Very low, Low, Moderate, high, very high, extreme)	narrative

PHYSICAL_PARAMETER	Description	Unit
ROSGEN	Rosgen stream type (Very low, Low, Moderate, high, very high, extreme)	narrative
Channel_Type	Channel Type	narrative
Valley_Type	Valley Type	narrative

### dSiteCriteria

This domain table specifies the site selection criteria. Relates to the **MONITORING\_SITE** table.

CIRTERIA_CODE	Description
F	Fixed
LF	Likely fixed
LR	Likely random
R	Random
T	Targeted
TM	Targeted for MS4 Watershed Restoration Monitoring
UNK	Unknown

### dStrata

Physiographic region (i.e., Coastal Plain, Piedmont). Needed to calculate benthic metrics from raw taxa counts. Relates to the **MONITORING\_SITE** table

STRATA	Description
CP	Coastal Plain
NCP	Northern Coastal Plain
P	Piedmont
UNK	Unknown

### dStatistical\_Base

This domain table describes the methods used to calculate values for the chemical assessment. The table relates to the **ASSESSMENT\_CHEMICAL** table.

RESULT_VALUE_TYPE	Description
FWA	Flow weighted average (pH and water temp only)
EMC0	Flow weighted averages for three discrete samples representative of a storm using zero (0) for any discrete samples recorded at less than the detection limit.
EMCdt	Flow weighted averages for three discrete samples representative of a storm using the detection limit value (dt) for any discrete samples recorded at less than the detection limit.
OBS	Observed value

## Database Relationship Diagram.

