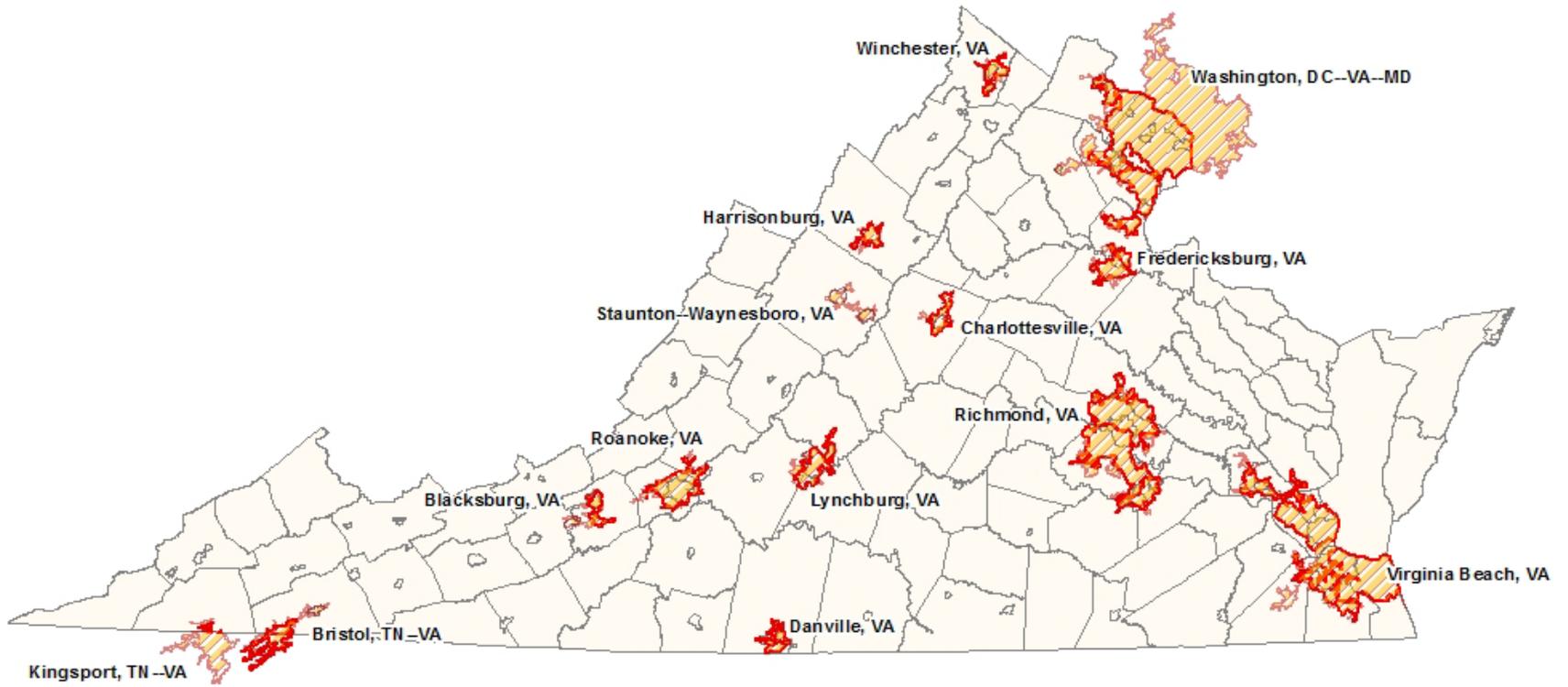




DATA MANAGEMENT FOR A MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4)

**Mid-Atlantic Quality Assurance Workshop
Chris Swanson
February 08, 2017**

MS4 PROGRAM OVERVIEW



MS4 PROGRAM OVERVIEW

All right-of-way & property within Census Urbanized Areas (CUA)

> 20,000 centerline miles

~ 1,800 square miles of right-of-way

VDOT maintenance facilities within CUA

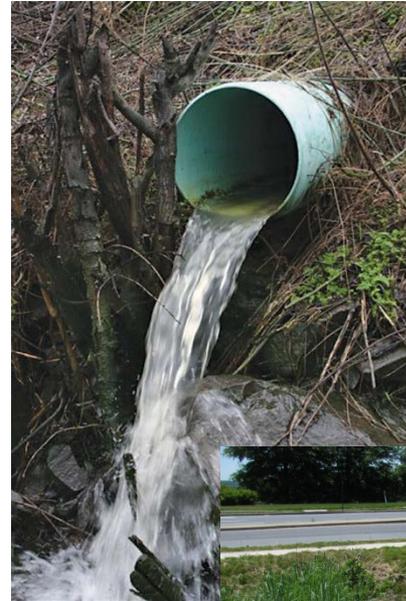
- 34 Area Headquarters
- 9 Residency Complexes
- 5 District Complexes
- 3 Central Office Bldgs.
- 17 Rest Areas
- 7 Storage Areas
- 2 Weigh Stations
- 22 Residual Properties
- 40 Park & Ride Lots
- Bridge & Tunnel Facilities

MS4 PROGRAM OVERVIEW

Among other things, requires:

VDOT to maintain an **accurate** storm sewer system map showing location of MS4 outfalls, including **any reports of such illicit (pollutant) discharge**

VDOT to maintain an **updated electronic database** of BMPs, including the location, the date brought online, and the date of the most recent inspection



MS4 PROGRAM OVERVIEW

Topic of presentation

- How we collect the MS4 data
- How we utilize this information
 - Permit requirements and business needs

Focus on data collection using outfalls as an example

INITIAL INVENTORY EFFORTS

DATA COLLECTION

Data to collect:

- Spatial Information
- Physical Attributes
- Condition Assessment
- Indicators for illicit discharge

~21,000 miles of roadway to inventory



INITIAL INVENTORY EFFORTS

OFFICE SCREENING

- Predicts the most likely location of “potential” discharges
- Consistency
- Data Sources:
 - VDOT LRS (VDOT roads information)
 - USGS National Hydrologic Data Set (NHD)
 - NWI – National Wetlands Inventory Data Set
- Collected points/features from other cities, counties, towns or consultants

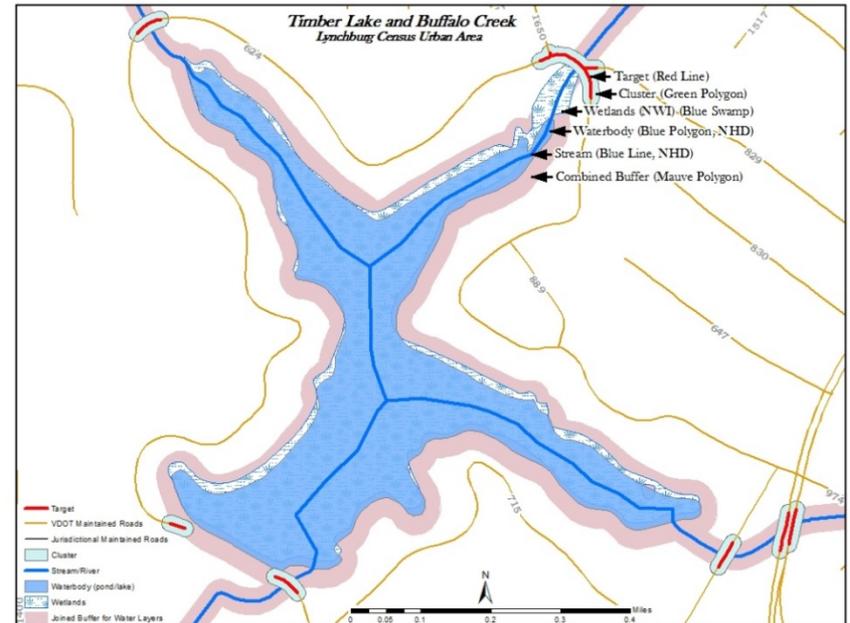
INITIAL INVENTORY EFFORTS DEVELOPING GIS MODEL

Hydrology layers include:

- Bluelines (streams/rivers)
- Waterbodies (ponds, lakes)
- NWI

Roadway layers:

- Linear Referencing System (LRS)



INITIAL INVENTORY EFFORTS COMBINE HYDROLOGY LAYERS



INITIAL INVENTORY EFFORTS COMBINE HYDROLOGY LAYERS



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INITIAL INVENTORY EFFORTS COMBINE HYDROLOGY LAYERS



INITIAL INVENTORY EFFORTS LESSONS LEARNED

Dynamic changes

- Roadway Data
- Census Urbanized Areas

Determining owner/operator of road segments

- Right of Way
- Maintenance easements

Complex road segments

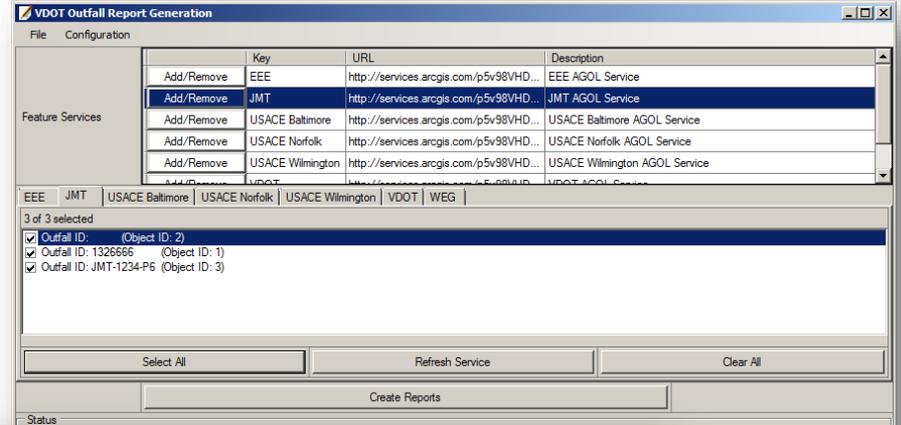
- Springfield Interchange in Northern Virginia

Collection of outfalls on non-centerline assets

- Outlets of stormwater BMP's

INITIAL INVENTORY EFFORTS ENHANCING DATA COLLECTION

- Real time data
- Standardized field collection
- Leverage VDOT's existing AGOL Subscription
- Use ESRI's Collector app
- Use of iPad or Android devices (Phone/Tablet)



Outfall Reconnaissance Inventory Field Sheet

Section 1: Team Data

Investigator: Ten Abdella	Team ID: _____
Today's date: 10/10/2013	Rainfall (in) Last 24 hours: 0 Last 48 hours: 0
Temperature (°F): 0	GPS Unit: _____ GPS SN or ID: _____
Camera: _____	Camera SN or ID: _____

Section 2: Background Data

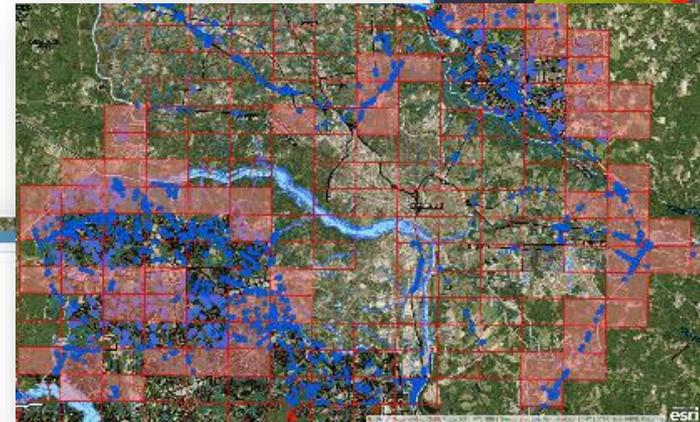
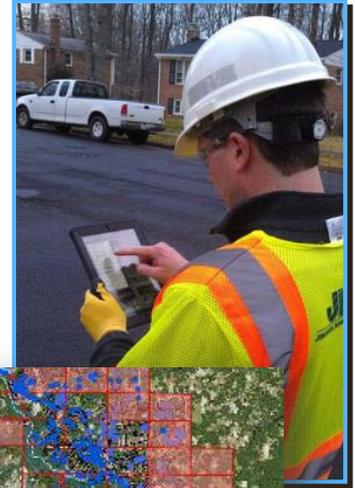
Subwatershed: Neshico Creek	Outfall ID: JMT-1234-P6
	Time: 1:49 PM
	Latitude: 38.6158 Longitude: -77.2658
Photo #:	MS4 Outfall (Yes/No) No
1. JMT-1234-P6 1.jpg	Or
2. JMT-1234-P6 2.jpg	POD (Yes/No) No
3. _____	ID of County Structure _____
4. _____	Is POD a MS4 Interconnection (YES/No) No
5. _____	ID of County Outfall _____
6. _____	
Note: More than one photo is required to properly communicate conditions at IDDE locations.	Notes (e.g., origin of outfall, if known, such as SWM Basin): _____
Land Use in Drainage Area (Check all that apply):	
<input checked="" type="checkbox"/> VDOT	<input type="checkbox"/> Open Space
<input type="checkbox"/> Industrial	<input type="checkbox"/> Institutional
<input type="checkbox"/> Ultra-Urban Residential	Other: _____
<input type="checkbox"/> Suburban Residential	Known Industries: _____
<input type="checkbox"/> Commercial	
Inventory Review Reason (Outfall Survey, QA/QC, IDDE, TMCL) Phase I	

MS4 Outfall Notes:

1. Because of IDDE call in and referrals not all outfalls/inventories will be in MS4 area. VDOT is logging all outfalls into a wetland, water body or stream on VDOT R/W as VDOT outfall. County Tax plans will be imported to assist in the R/W determination but it will be assumed that VDOT has a drainage easement to go around the end of any pipe/culvert or box culvert accepted for maintenance. A discharge point cannot be both a MS4 outfall and a POD.
2. If VDOT discharges stormwater inside of a targeted area of MS4 investigation and the discharge is not directly into the wetland, water body or stream on VDOT R/W the point will be captured as a Point of Discharge (POD) and the inventory and assessment completed.
3. If the POD is into a ditch, paved ditch or pipe then the POD is also a MS4 Interconnection (MS4I). If the POD is into a flood plain or natural wetland then the POD is not also a MS4I.

INITIAL INVENTORY EFFORTS ENHANCING DATA COLLECTION

- AGOL form design and field formatting
- AGOL viewing constraints with form on iPad
- Symbol Size (desktop vs iPad)
- Query of tables
- iPad functionality in field
- Weak or dropped signal
- Too bright of a day
- Slow connection
- Desktop Export Tool



ESRI ArcGIS Survey123	
Sec 1:	Global Subunit
Investigator	Arby Parks
Sec 2: Trunk ID	
Sec 3: Trolley	Brigit Ward
Sec 4: Rolefall	Monetta Marcelli
Sec 5: Rolefall	Monetta Marcelli
Sec 6: Rolefall	Monetta Marcelli
Sec 7: Rolefall	Monetta Marcelli
Sec 8: Rolefall	Monetta Marcelli
Sec 9: Rolefall	Monetta Marcelli
Sec 10: Rolefall	Monetta Marcelli
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Sec 99: Rolefall	Monetta Marcelli
Sec 100: Rolefall	Monetta Marcelli

WHAT ARE THE USES OF THIS DATA?

Can we use data for other purposes than illicit discharge tracking?

RETROFIT OPPORTUNITIES ERODED OUTFALLS

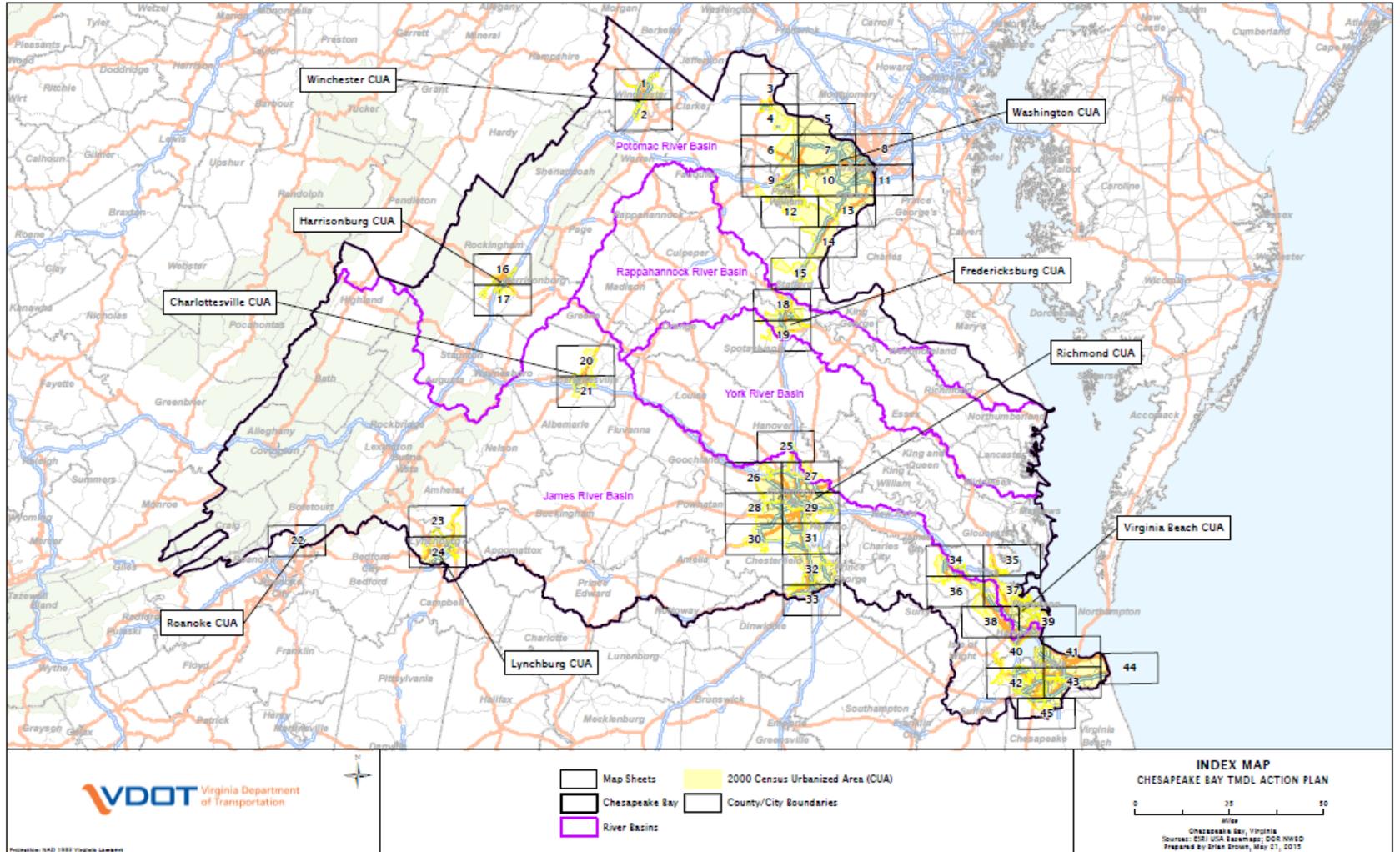
Changed our screening and characterization criteria

- Original purpose of change was to better manage illicit discharge efforts
- Other purpose utilize condition assessment for retrofit opportunities

Outfalls experiencing erosion due to contributing factors, such as increased imperviousness in upstream catchment areas

Outfall stabilization is similar in concept to Protocol 1 for stream restoration (prevented sediment) from the EPA CBPO

CHESAPEAKE BAY ACTION PLAN RETROFIT OPPORTUNITIES



CHESAPEAKE BAY ACTION PLAN RETROFIT OPPORTUNITIES

Action Plan Components

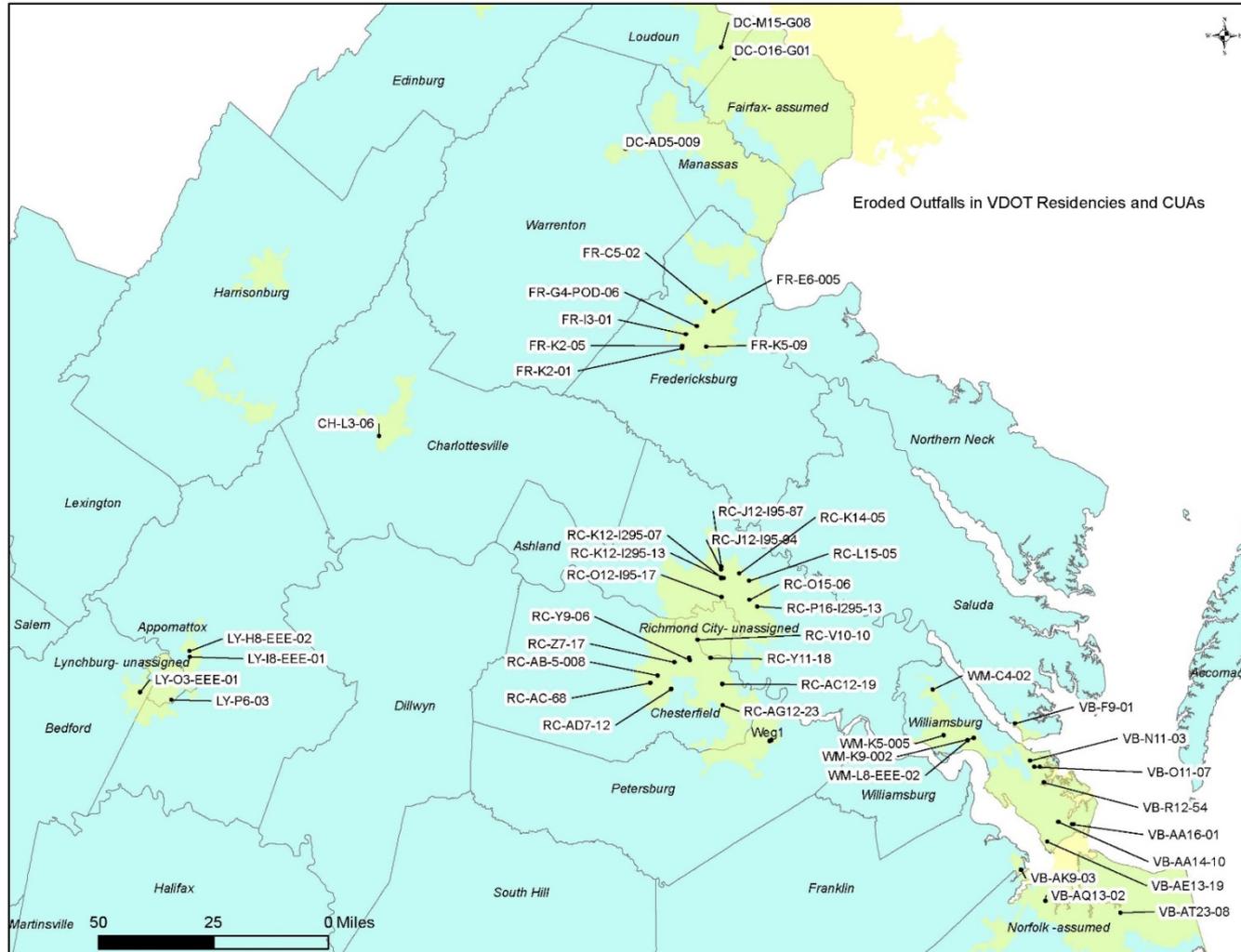
- Means and methods (such as management practices and retrofit programs) to meet required reductions and schedule

POC	River Basin	5% Reduction Required for VDOT's MS4 Permit (lbs/yr)
Nitrogen	James	896
	Potomac	2,395
	Rappahannock	116
	York	120
Phosphorus	James	249
	Potomac	359
	Rappahannock	27
	York	35
Sediment	James	115,185
	Potomac	315,811
	Rappahannock	9,870
	York	12,849

CHESAPEAKE BAY ACTION PLAN RETROFIT OPPORTUNITIES

- Redevelopment
- Stream Restoration and Stabilization
- **Outfall and Dry Channel Stabilization**
- Shoreline Erosion Control
- Land Cover Conversion
- Forest Buffers
- Street Sweeping
- Purchase of Nutrient Credits
- Structural BMP Enhancements and Retrofits

RETROFIT OPPORTUNITIES ERODED OUTFALLS



RETROFIT OPPORTUNITIES ERODED OUTFALLS



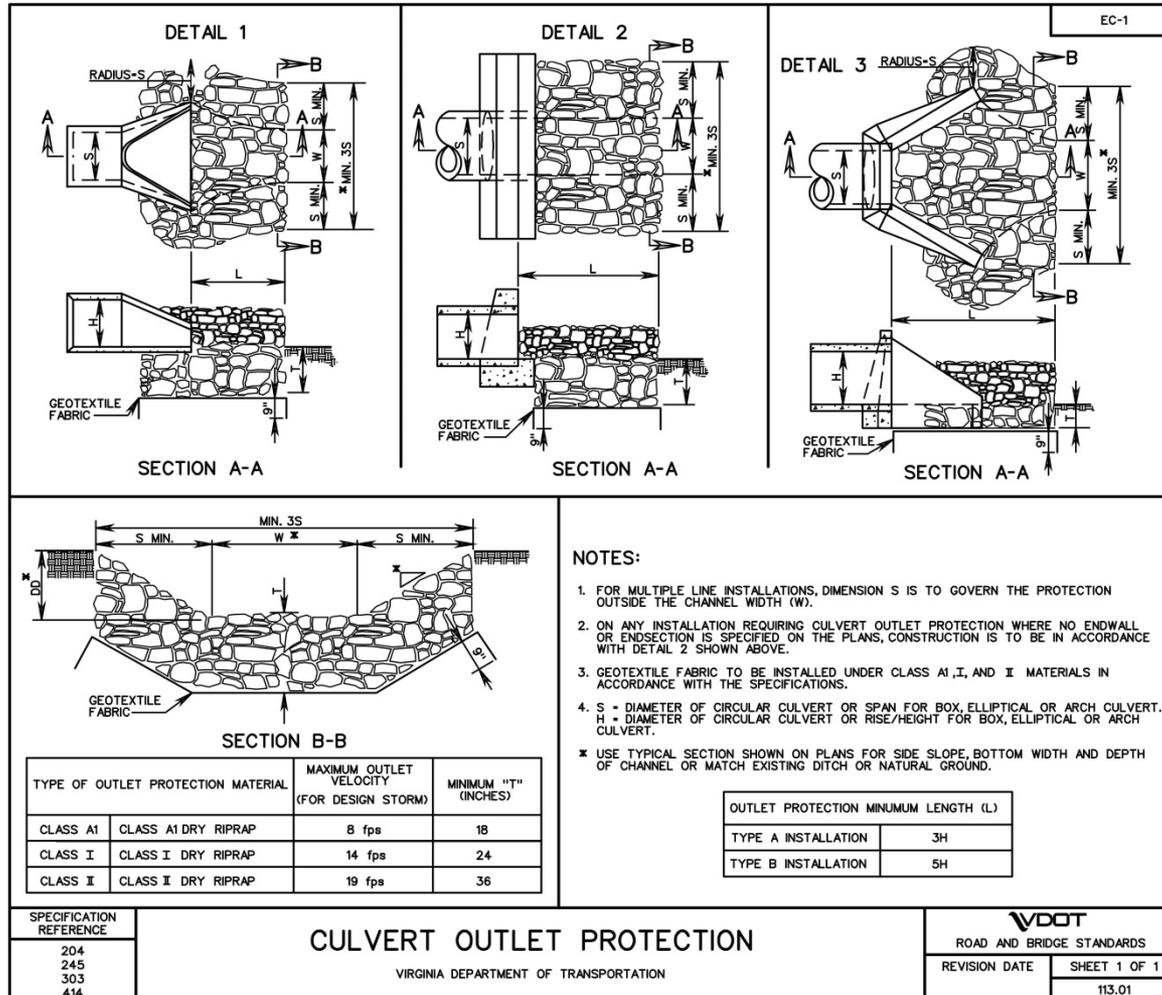
RETROFIT OPPORTUNITIES ERODED OUTFALLS



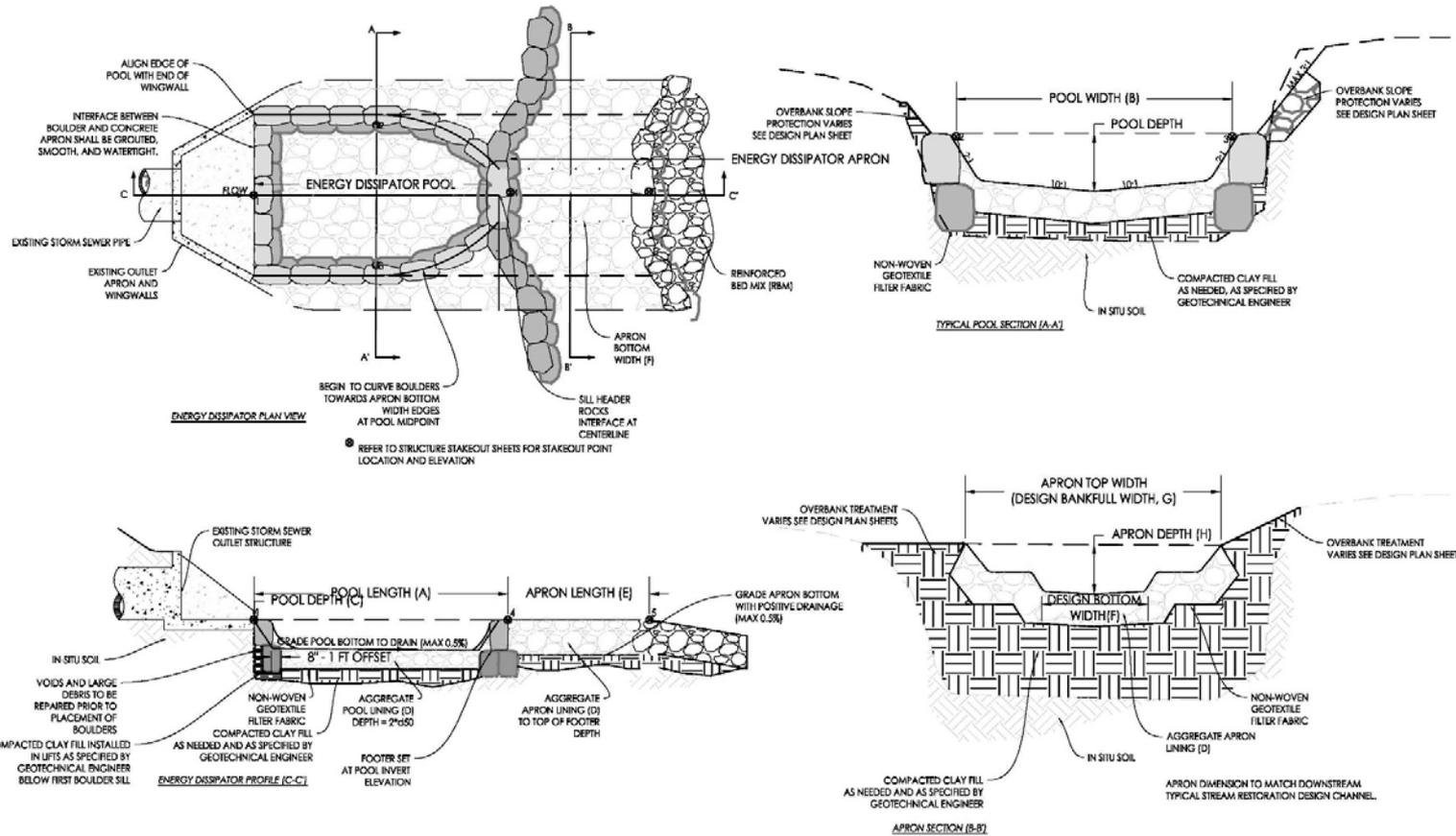
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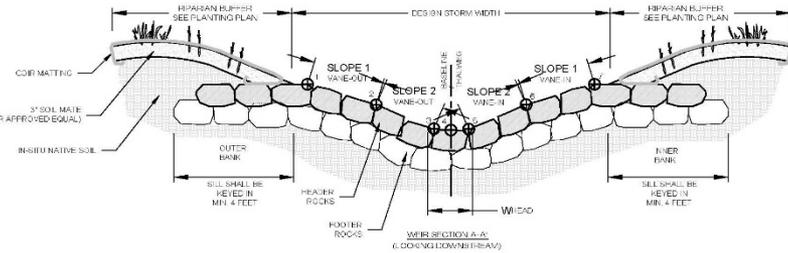
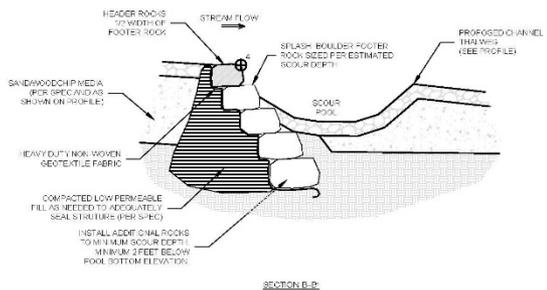
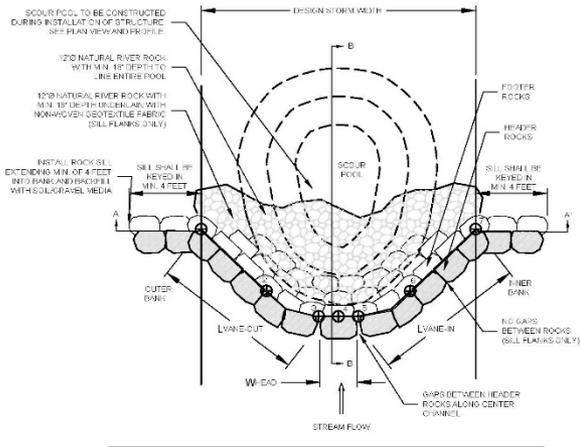
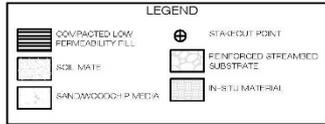
RETROFIT OPPORTUNITIES ERODED OUTFALLS



RETROFIT OPPORTUNITIES ERODED OUTFALLS



RETROFIT OPPORTUNITIES ERODED OUTFALLS



CONSTRUCTION NOTES

- EXCAVATE TRENCH ALONG THE BOTTOM OF THE STREAM BED AND TO THE DESIGN STORM ELEVATION IN THE STREAMBANK FOR THE CENTER SECTION AND WINGS OF THE VANE. THE TRENCH SHOULD BE PERPENDICULAR TO THE STREAM BANKS IN THE MIDDLE 1/3 DESIGN STORM WIDTH FOR THE CENTER SECTION AND EXCAVATED TO THE DESIGN ANGLE IN THE 1/3 DESIGN STORM WIDTH FOR EACH ARM. PLACE THE HOOK ROCKS AT THE END OF THE VANE ARM IN ORDER TO ENCOURAGE LATERAL FLOW INTO THE EXCAVATED SCOUR POOL. NOTE: VANE WINGS SHOULD BE PROPERLY TIED INTO THE BANK AT FIELD DETERMINED DESIGN STORM ELEVATION.
- PLACE ONE OR TWO COURSES OF FOOTER BOULDERS (FOOTER DEPTH SPECIFICATIONS PROVIDED PER REACH ON PLAN AND PROFILE SHEETS).
- PLACE VANE ROCKS ON TOP OF FOOTER ROCKS SO THAT EACH HALF OF THE VANE ROCK RESTS ON ONE HALF OF A FOOTER ROCK BELOW. OFFSET THE VANE ROCK IN THE UPSTREAM DIRECTION AND PLACE SO THEY SLOPE SLIGHTLY AGAINST THE FLOW DIRECTION.
- EXTEND THE STRUCTURE (I.E. SILL ROCKS) INTO THE BANK A MINIMUM OF 4 FEET AND ARMOR UPSTREAM AND DOWNSTREAM AS NEEDED FOR STABILITY WITH RIP RAP AND COMPACTED FILL MATERIALS.
- AT THE DESIGN STORM ELEVATION, CREATE A SILL OF PLACED ROCK PERPENDICULAR TO THE STREAMBANK EXTENDING AWAY FROM THE VANE WING ARM. CONSTRUCT THE SILL PER VSRDM 4.5; CUT OFF SILLS AND LINEAR DEFLECTORS.
- SEAL THE STRUCTURE ON THE UPSTREAM SIDE, AS DESCRIBED BELOW.
- EXCAVATE THE SCOUR POOL TO THE DESIGN DEPTH AS SHOWN ON THE PROFILE SHEET.
- SAND/WOODCHIP MIX SPECIFICATIONS:
 - SAND SHALL COMPLY WITH AASHTO M6 REQUIREMENTS (0.02" - 0.04")
 - 1" SURFACE WOODCHIPS MIXED WITH SAND AT 30% BY VOLUME
- BOULDER SPECIFICATIONS: BOULDER MATERIAL SHALL BE TABULAR IN SHAPE TO MAXIMIZE INTERLOCKING. THE USE OF LIMESTONE OR CEMENT BASED STONE PRODUCTS IS PROHIBITED. THE BOULDER MATERIAL SHALL BE INSPECTED BEFORE IT IS PLACED.
- REINFORCED STREAMBED SUBSTRATE SPECIFICATIONS: SEE SHEET FOR MIX SPECIFICATIONS. MATERIAL SAMPLE FROM QUARRY OR SUPPLIER TO BE SUBMITTED FOR APPROVAL BY ENGINEER PRIOR TO INSTALLATION.
- IF FEASIBLE, INSTALL SAND/WOODCHIP MIX SYSTEM AFTER UPSTREAM AREA IS STABILIZED, OTHERWISE FLOWS MUST BE DIRECTED AROUND SYSTEM TO AVOID CONTAMINATION.
- SYSTEM SHOULD UNDER NO CIRCUMSTANCE BE USED AS A SEDIMENT CONTROL DEVICE DURING CONSTRUCTION UNLESS APPROVED BY THE ENGINEER. UPSTREAM CONTROLS REQUIRED DURING CONSTRUCTION.
- THE SYSTEM SHALL NOT BE FINALIZED UNTIL ALL UPSTREAM CONSTRUCTION IS COMPLETE AND ALL DISTURBED AREAS ARE STABILIZED AND EROSION AND SEDIMENT CONTROL MEASURES HAVE BEEN REMOVED.
- SEDIMENT CONTROLS WHEN POSSIBLE SHALL HAVE REINFORCED SILT FENCE ALONG THE TOE OF THE OUTLET FOR THE BOTTOM POOL. A BYPASS FOR UPSTREAM RUNOFF ACROSS THE SYSTEM IS NEEDED UNTIL THE DRAINAGE AREA IS PERMANENTLY STABILIZED. RIFLES AND POOL SHALL BE STABILIZED AT THE END OF EACH WORK DAY.
- IF BEDROCK IS PRESENT AT THE CHANNEL INVERT, FOOTER ROCK SHALL STILL BE REQUIRED UNLESS APPROVAL FOR ELIMINATION OF FOOTER ROCK IS OBTAINED FROM THE ENGINEER/DESIGNER.

EXAMPLE: OUTFALL STABILIZATION MEASURE 5 - REGENERATIVE CONVEYANCE

RETROFIT OPPORTUNITIES CATEGORY 1



RETROFIT OPPORTUNITIES CATEGORY 2



RETROFIT OPPORTUNITIES CATEGORY 3



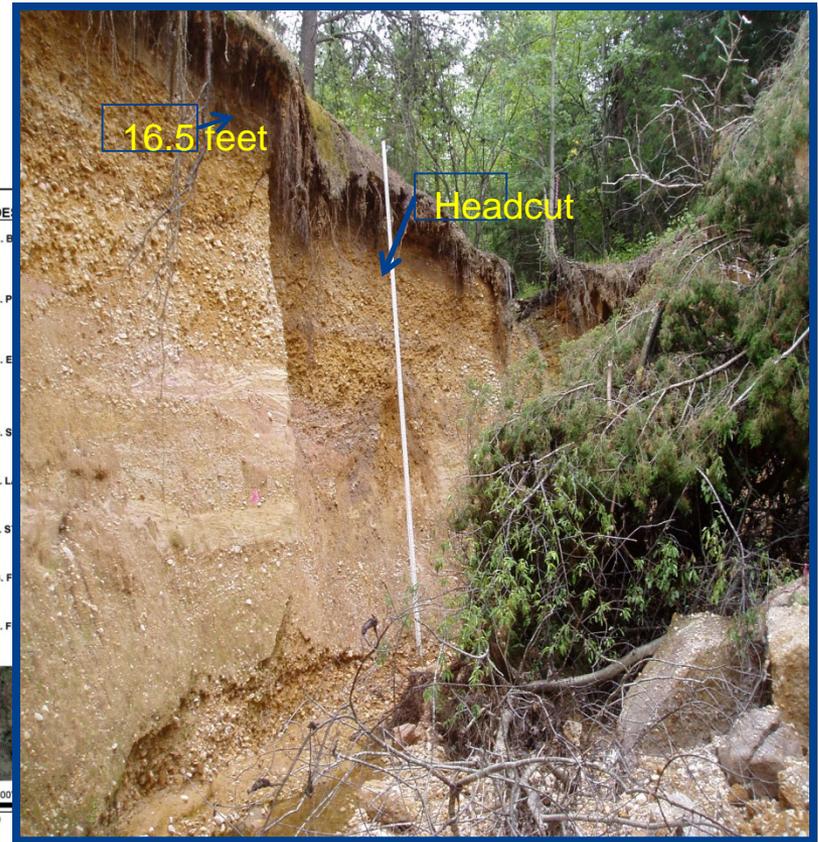
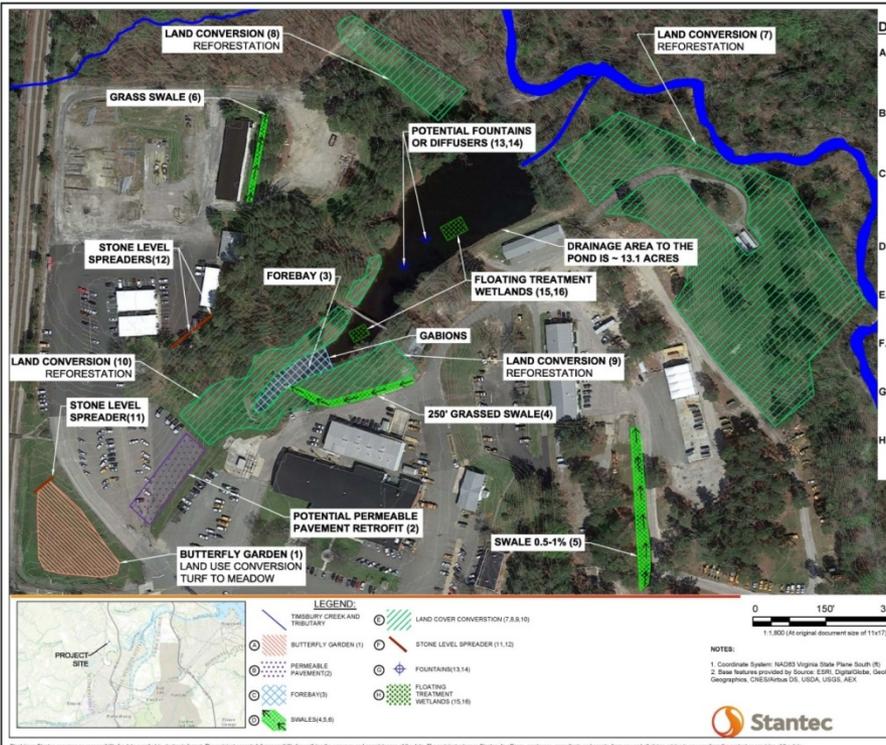
OTHER DATA SOURCES THAT COULD BE UTILIZED

- Redevelopment
- **Stream Restoration and Stabilization (Maintenance Facility)**
- Outfall and Dry Channel Stabilization
- Shoreline Erosion Control
- Land Cover Conversion
- Forest Buffers
- Street Sweeping
- Purchase of Nutrient Credits
- **Structural BMP Enhancements and Retrofits (SWM Facility Data)**

OTHER DATA SOURCES THAT COULD BE UTILIZED

Maintenance Facility Data

SWM Facility Data



VIRGINIA DEPARTMENT OF TRANSPORTATION
 NEW GRANT PROPOSAL
 Figure No. 1
 Title: **DRAFT**
 BMP OPPORTUNITIES AT RICHMOND DISTRICT COMPLEX
 Page 01 of 01

WHERE ARE WE HEADED?

Similar data for SWM Facilities and Maintenance Facilities
 Inventory assets during plan development and project delivery
 Improved mobile applications

- Better Inspection Forms
- Establish Workflows

Consider migration of assets into Department's asset management system



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