An Exelon Company

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February 2017

STORMWATER TREATMENT MEASURES DESIGN REPORT

Benning Road Facility
3400 Benning Road, NE
Washington, DC 20019

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STORMWATER TREATMENT MEASURES DESIGN REPORT

Hydrologic and Hydraulic Model

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1.0 INTRODUCTION

AECOM has prepared this Stormwater Treatment Measures Design Report (Design Report) on behalf of Potomac Electric Power Company (Pepco) to describe the proposed stormwater treatment measures for Pepco's Benning Road facility (the Site), located at 3400 Benning Road NE, Washington, DC. The general Site location is shown on **Figure 1-1**.

Pepco has employed various Best Management Practices (BMPs) over the past seven years to reduce metals and total suspended solids (TSS) concentrations in stormwater discharges from the facility. Pepco has tasked AECOM to identify and design stormwater treatment measures to supplement the BMPs to help ensure consistent compliance with the effluent limits for metals and TSS identified in the facility's National Pollutant Discharge Elimination System (NPDES) permit. The purpose of this report is to describe the treatment measures at a design level.

1.1 Scope

AECOM has been tasked with reviewing available stormwater data, screening and evaluating treatment options, and designing treatment measures to reduce the concentrations of metals (specifically cadmium, copper, iron, lead, nickel, and zinc) and TSS prior to discharge at Outfall 013. All work will be performed in accordance with the applicable District Department of Energy & Environment (DOEE) and the U.S. Environmental Protection Agency (USEPA) guidance documents.

Specifically, the development of this document included the following activities:

- Data gathering and review
- Hydraulic and hydrologic modeling
- Identification of pollutant load sources or hotspots
- Design of treatment measures
- Identification of implementation considerations and limitations
- Development of a proposed implementation schedule

This document provides the final selection of specific areas at the Site which have been targeted for stormwater treatment (referred to as "Hotspots") and the design of associated treatment measures. Please note that the drawings and specification packages will go through further refinement as part of permitting and procurement process. Therefore, these elements are currently designated as 65% design.

1.2 Organization

This report is organized into the following sections:

- Section 1 Introduction (this section)
- Section 2 Project Background
- Section 3 Hydraulic and Hydrologic Modeling
- Section 4 Pollutant Load Summary
- Section 5 Design
- Section 6 Implementation Considerations
- Section 7 Limitations
- Section 8 Schedule

Figures, tables and supporting appendices are provided following Section 8.

2.0 PROJECT BACKGROUND

The 77-acre Site is bordered by a District of Columbia Solid Waste Transfer Station to the north, Kenilworth Maintenance Yard which is owned by the National Park Service (NPS) to the northwest, the Anacostia River to the west, Benning Road to the south, and residential areas to the east and south (across Benning Road). Most of the Site is comprised of the Benning Service Center, which involves activities related to construction, operation and maintenance of Pepco's electric power transmission and distribution system serving the Washington, DC area. The Site is also the location of three substations serving Pepco's transmission and distribution system. The Site was formerly the location of the Benning Road Power Plant, which was permanently shut down on June 1, 2012. Demolition and removal of the power plant building and related infrastructure commenced in 2014, and all demolition and Site restoration activities were completed in May 2015, with the exception of the removal of concrete basins for the former cooling towers, which are scheduled to be removed within the next four months.

The majority of stormwater runoff from the facility is conveyed through a 48-inch concrete trunk line which widens to 54 inches before it discharges to the Anacostia River via Outfall 013. Pepco has employed various BMPs to control the concentrations of metals and suspended solids in stormwater discharges, including installation and maintenance of storm drain inlet controls and removal of accumulated sediment from the facility's storm drain pipe during annual cleanouts. The treatment measures described in this report will provide additional reduction of metal contaminants in stormwater discharged at Outfall 013 to achieve consistent compliance with the facility's NPDES permit limits.

2.1 Regulatory Compliance History

2.1.1 NPDES Permit

The facility's NPDES permit (No. DC0000094) was last renewed in July of 2009. At that time, the Benning Generating Station and Power Plant were still in operation. The 2009 permit included for the first time specific discharge limits on the concentration of certain metals such as copper, lead, and zinc based on Total Maximum Daily Load (TMDL) allocations that had been established for the Upper Anacostia River subsequent to the previous permit (which was issued in November of 2000). As explained in the Fact Sheet prepared for the 2009 permit renewal, USEPA expected that compliance with these new limits would be accomplished using BMPs and USEPA required that the BMPs necessary to meet these new numerical limits be in place within three years after the effective date of the permit, unless Pepco could demonstrate that additional time was necessary to meet the limits.

In accordance with the 2009 permit requirements, Pepco submitted a TMDL implementation plan to USEPA outlining the various BMPs to be employed at the facility to reduce metals concentrations in stormwater discharges. The plan called for implementation in three phases. Phase I included storm drain inlet maintenance. Phase II included metals management (e.g., removing unnecessary stored metal, improving general housekeeping measures such as repair and maintenance of secondary containment structures and covering dumpsters). Phase III included future recommendations for additional BMPs and low impact development structures (LIDs) if necessary to meet the permit requirements.

The Phase I and Phase II control measures were designed and implemented between 2010 and 2012. These measures were effective in achieving significant reductions in metal concentrations in stormwater discharged from the facility compared to the baseline concentrations prior to the 2009 permit renewal. In particular, based on the stormwater sampling conducted in January 2013 following the completion of Phase I and Phase II control measures, copper concentrations were reduced by 73 percent and zinc concentrations were reduced by 87 percent. Despite these reductions, the BMPs employed to that point were not sufficient to meet the new numeric permit limits for copper and zinc. As a result, Pepco implemented Phase III of the TMDL Implementation Plan in accordance with a supplemental compliance plan submitted to USEPA in December 2014.

The Phase III plan included the following specific actions:

- Identify and address conditions, activities and/or operations at Benning Service Center that may be significant contributors to metals in stormwater.
- Evaluate and potentially enhance existing storm drain inlet controls.
- Investigate potential groundwater infiltration to the storm drain system.
- Conduct targeted sampling at storm drain inlets to identify locations where metals loading is greatest and where additional controls can be employed.

Pepco has completed the four elements of the Phase III plan. A closed-circuit television (CCTV) inspection of the main storm drain conducted in June 2015 and of the lateral storm drains, or tributaries, in June 2016 identified several locations where substantial sedimentation had accumulated within the storm drain pipe and locations with defects that allow infiltration of groundwater. Pepco completed cleaning of the main storm drain pipe in August 2015, which resulted in removal of approximately 47 cubic yards of accumulated sediment, and thereafter completed patching/repairs of several identified defects in the storm drain system. Removal of this accumulated sediment appears to have further improved the quality of the stormwater discharges at Outfall 013. Pepco completed four rounds of targeted stormwater sampling following the storm drain cleanout between September 2015 and March

2016 and AECOM completed three rounds of additional sampling between June 2016 and August 2016. As summarized in Section 2.2 and 2.3, the results of these targeted sampling events form the basis for the selection of Hotspots for targeted treatment and the design of treatment measures.

2.1.2 Consent Decree

On January 13, 2017, a Consent Decree was filed with the US District Court for the District of Columbia that will resolve an enforcement action by the United States against Pepco for alleged violations of the permit effluent limitations for metals and TSS in stormwater discharges through Outfall 013 into the Anacostia River. Among other requirements, the Consent Decree obligates Pepco to design, construct and operate a system for the treatment of stormwater to be discharged at Outfall 013. The treatment system described in this report is intended to satisfy this requirement of the Consent Decree.

2.2 Data Review and Summary

2.2.1 Stormwater Sampling and Analysis

Seven rounds of targeted stormwater sampling and analysis were performed at the Site between September 2015 and August 2016. These events included four Pepco sampling events from September 2015 to March 2016, and three AECOM sampling events from June to August 2016. In addition, six quarterly rounds of compliance stormwater sampling and analysis were performed at the Site between September 2015 and December 2016. Each of the targeted and compliance sampling events were undertaken during a qualifying storm event, as defined by the NPDES Permit.

Although historical sampling data from Outfall 013 is available from the quarterly NPDES monitoring requirements, the targeted and compliance sampling data collected after the August 2015 cleanout of the storm drain system is more representative of current conditions. Historical data was collected prior to the demolition of the fuel tank and power plant areas. Therefore, only targeted and compliance analytical data collected after the August 2015 storm drain cleanout have been considered for the treatment system design.

Stormwater samples were analyzed by USEPA Method 200.7 for metals and Standard Methods (SM) 2540D for TSS. Based on the seven rounds of stormwater sampling and analysis, copper, iron, and zinc were identified as the primary metals of concern for the stormwater discharged at Outfall 013. The findings of the stormwater sampling and analysis are presented in Appendix A of the Final Conceptual Design Report (AECOM, 2016).

2.2.2 Flow Rate Sampling

Limited flow rate measurements were collected during the July 2016 and August 2016 sampling events in order to better calibrate the stormwater model. AECOM utilized portable velocity meters (Hach FH950) to measure velocity at select locations. Up to three velocity measurements were collected from the targeted stormwater sample locations as well as additional locations on the main trunk line. The velocity measurements were utilized to calibrate the stormwater model.

2.2.3 Media Evaluation and Treatability Study

The identified metals of concern, copper, iron, and zinc, are commonly precipitated into their respective oxides. As a result, the design of the treatment measures will include precipitation and filtration to remove solids as well as adsorption using sorptive media (e.g., Contech StormFilter®) to remove dissolved metals. AECOM completed a sorptive media evaluation which included Zeolite, granular activated carbon (GAC), CSF leaf media, MetalRx leaf media, BioChar, and Modified Peat. Based on the findings of the media evaluation, AECOM selected GAC, Zeolite, and Zeolite + Peat for the laboratory bench-scale media treatability study to provide a basis of selecting the initial media to be used by sorptive media devices when the design is implemented.

All three solid filtration media were effective in removing dissolved metals from stormwater. However, AECOM has selected Zeolite blended with GAC. When compared to the other sorptive media, Zeolite has a much greater capacity to adsorb metals and was observed to be most effective for short contact times. Blending GAC with the Zeolite will provide improved efficiency at the relatively low contaminant loadings characteristic of current stormwater flows discharging at Outfall 013.

In addition, the treatability study concluded that much of the metals contamination was associated with the suspended solids fractions of the water; therefore an effective water treatment system should include a particle removal step to reduce the amount of solids being discharged. The findings of the treatability study are presented in Appendix C of the Final Conceptual Design Report (AECOM, 2016).

2.2.4 Inlet and Topographic Survey

AECOM conducted an inlet survey of the storm drain structures that contribute to the discharge at Outfall 013. Detailed invert information, such as pipe coordinates, elevation, size, and material was collected for the inlet and outlet pipes. Coordinate and elevation information from rims of manhole and inlet structures were collected along with invert elevations of connecting pipes within the manhole and inlet structures. AECOM conducted a survey of Site topography at 1-foot contours, including utilities, buildings, sidewalks, driveways, gravel surfaces, vegetated areas, fences, spot elevations, storm water inlets, curb inlets, top of grate, and other major visible site improvements. The Maryland State Plane of the 2011 North

American Datum (NAD 83/2011) was used as the horizontal control datum and the District of Columbia Department of Public Works Datum (DC DPW) was used as the vertical control datum.

The topographic survey data was used by Pepco to revise drainage area boundaries. These revised drainage area boundaries were incorporated into the designation of hotspots and subsequent treatment system design. This information is essential to sizing the equipment and siting each treatment system. The findings of the inlet and topographic survey were utilized to generate the design presented in this report.

2.3 Final Hotspot Selection

Over the course of this project, the locations of Hotspots for targeted treatment of stormwater have been updated based on additional analytical data, inlet and topographic survey data, and continued revisions of the model. **Table 2-1** presents a cross-reference between the final Hotspot designations and the Hotspot designations in the Conceptual Design Report (November 2016).

Table 2-1: Revised Hotspot Identifications Crosswalk

Final Hotspot ID	Site Location	Sub-basin ID	Contributing Locations	Original Hotspot ID
1	Transformer Test Shop	17E	Building #54	1B
		17A-17D	Inlets 42-46	1C
2	Salvage Yard	10A, 10B, 31	Inlets 65, 66, and 68	4
3	Former Fuel Tank Area	6A, 6B	Inlets 2, 3, 4, 5, 7	3
		6C	Building #35, Inlet 108	1A
4	Former Power Plant Area	2	Inlets 15, 17, 18, 27	2

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3.0 HYDRAULIC AND HYDROLOGIC MODELING

AECOM developed an existing conditions hydrology model to estimate the discharges from the 1-inch and the 1-year storm events at different study points at the Site including the areas identified as source areas for the high metal concentrations during the Site visit. The developed hydrology model was used to size the proposed treatment systems and to estimate the anticipated impacts on the concentrations of metals in stormwater at Outfall 013 from the approximate initial surface runoff of a 1-inch (85th percentile) storm event. In accordance with guidance from the District Department of Energy and Environment (DOEE), the hydrology model was also used to estimate the first flush volume from a 1-inch storm event for the targeted areas to demonstrate the effectiveness of the proposed treatment systems in meeting permit limits at Outfall 013. These conditions are selected based on the DOEE stormwater guidance and NPDES sampling protocols which are presumed to measure peak contaminant concentrations during the design storm events.

The hydrology model was developed using the Environmental Protection Agency's Stormwater Management Model version 5.1 (EPA-SWMM 5.1; USEPA, 2015) and the DOEE storm event design criteria in accordance with the Final Stormwater Management Guidebook (DOEE, 2013) and the NPDES permit sampling requirements. The hydrology model was created for the entire Pepco Site using the spatial data provided by Pepco, current Geographic Information System (GIS) datasets from the Washington, DC Office of the Chief Technology Officer (OCTO) and the precipitation data from the National Oceanic and Atmosphere Administration (NOAA) Atlas 14.

Thirty-three drainage areas were delineated for the hydrologic analysis based on the drainage area data provided by AMEC and based on the current topographic conditions at the Site (evaluated using ArcGIS 10.1). Three of the drainage areas were further divided into sub-basins to provide design flows at locations with potential for implementing treatment measures to remove metals. The impervious area for the facility was updated based on Site AutoCAD data, the Pepco Benning Road RI/FS impervious area figure, imagery from 2015, and the field investigation. Since demolition of the power plant, facility impervious area has decreased due to replacing asphalt areas with loose gravel. **Figure 3-1** includes the Site drainage areas. Figure 4-2 of the Hydrologic, Hydraulic and Pollutant Load Analysis Report (**Appendix A**) provides the updated pervious and impervious surface cover for the facility.

The 24-hour Soil Conservation Service (SCS) rainfall distribution was used to model rainfall, the infiltration for pervious areas at the Site was calculated using the SCS Runoff Curve Number (RCN) methodology as described in the Natural Resources Conservation Service (NRCS) Technical Release

(TR-55) manual and the dynamic wave equation was used for routing in the storm drain pipes. Hydrologic response of the three existing Low Impact Development (LID) projects was simulated using the EPA-SWMM LID Controls option.

A detailed description of specific data sources used in the development of the hydrology model is provided in **Appendix A**. Hydrologic simulations were conducted for the 1-inch and 1-year storm events and the resulting maximum storm event flows for the delineated drainage areas are also included in **Appendix A**.

Based on the field investigation and sampling data, several potential areas of concern were identified as focus areas where stormwater treatment systems may be necessary. These potential treatment measures were included in the hydrology model to evaluate the effects of the treatment measures and ensure that District Department of Energy and Environment design requirements (DOEE, 2013) related to the maintenance or decrease of the discharges from the 2- and 15-year storm events are met. The hydrology model was also used to estimate the first flush volume from a 1-inch storm event for the focus areas following DOEE guidance. **Appendix A** provides the maximum storm event flows where treatment measures are proposed to be implemented. Based on the findings of the Hydrologic and Hydraulic Report (**Appendix A**), **Table 3-1** presents the flow rates for a 1-inch storm event, which is the proposed design storm event.

Table 3-1: Modeled Flows at Hotspot Areas

Hotspot	Site Location	Location Description	Peak Flow for 1-inch 24-hour storm event	
			(cfs)	(gpm)
1	Transformer Test Shop	Building #54 (Sub-basin 17E)	1.11	498.2
		Inlets 42-46 (Sub-basin 17A	0.6	269.3
		Inlets 42-46 (Sub-basin 17B)	0.31	139.1
		Inlets 42-46 (Sub-basin 17C)	0.16	71.8
2	Salvage Yard	Inlets 65, 66, 68 (Sub-basin 10B)	0.6	269.3
		Inlets 65, 66, 68 (Sub-basins 31)	0.62	278.3
3	Former Fuel Tank Area	Building #35, Inlets 2, 3, 4, 5, 7 (Sub-basins 6B)	4.43	1,988.3
		Inlet 10 (Sub-basins 6C)	0.21	94.3
4	Former Power Plant Area	Inlets 15, 17, 18, 27 (Sub-basin 2)	2.46	1,104.1

Notes:
cfs = cubic feet per second
gpm = gallons per minute

The EPA-SWMM model produced runoff estimates suitable for design for the focus areas. Proposed treatment measures have been modeled as storage areas with specified storage and ratings curves based on the specifications from the manufacturer of the system components.

The specific data sources that were used for the model include:

1. Topography (used to create drainage areas and calculate slopes)
    a. Surveyed topography provided in AutoCAD by PEPCO.
    b. Contour data surveyed by AMT (2016) and provided by Pepco.
    c. 1 meter Digital Elevation Model (DEM) grid available from the USGS.
    d. 2 foot contours from the District of Columbia.
2. Drainage Areas
    a. Drainage areas updated by AMEC based on the Site plan originally prepared for the NPDES Permit Renewal in April 2005.
    b. The drainage areas provided by AMEC were split into smaller segments, sub-basins, so flows could be provided at focus design areas.
3. Impervious area (see Figure 3-1 of **Appendix A**)
    a. Surveyed areas provided in AutoCAD by PEPCO.
    b. The preliminary impervious areas calculated as part of the Draft Remedial Investigation Report for the Benning Road Site (February 2016).
    c. Imagery from 2015 by Google Earth and the field investigation were used to update the impervious areas.
4. Invert elevations
    a. Storm Sewer plan and profile for the main line created by Merestone Consultant, Inc., and provided by PEPCO.
    b. Inlet data for the storm drain structures, including invert and lateral pipes elevations, surveyed by AMT (2016) and provided by Pepco.   .
5. Spatial locations of storm drains, inlets, and manholes for main line and laterals
    a. Spatial data provided by AMEC, digitized from Site Plan for NPDES Permit Renewal (completed by Malcolm Pirnie, April 2005) and updated based on existing conditions).
    b. Aerial imagery and information gathered from the field investigation were used to verify the spatial data provided by AMEC.
6. Soil Data
    a. The Natural Resources Conservation Service (NCRS) soil survey geographic database (SSURGO).
7. Lift Station and Oil Water Separator (upstream of MP 201)

   a. The system schematic provided by PEPCO was used to estimate the hydraulic properties of the existing system.
8. Land Cover for Pervious Areas (required for curve numbers and manning's n values)
   a. Estimated based on aerial imagery and photographs from the field investigation.
9. Calibration of the Hydrology Model
   a. Flow data collected at some locations at the facility on July 28, 2016 and August 21, 2016 storm events and the hourly precipitation data for the two storm events at Washington/Ronald Reagan National Airport obtained from NOAA's Quality Controlled Local Climatological Data (QCLCD) were used to calibrate the hydrology model. The parameters that were modified for calibration are the RCN and the corresponding depression storage on pervious area inputs based on the highly urban setting of the Site. **Appendix A** includes the details of the calibration methodology.

4.0 MASS BALANCE

4.1 Mass Loading Calculations

The pollutant loading evaluation was conducted using the compiled data set from the completed stormwater sampling events and the SWMM model of the 1-inch rainfall event. This data set is appropriate for gauging point source loads, or Hotspots, of particular pollutants and represents the best information available to date. It is important to note the median and maximum loadings for all pollutants were modeled in the SWMM software. These loads were modeled as occurring at measured concentrations throughout the entire storm duration instead of through a factored or scaled approach. As a result, the pollutant loads reported by the SWMM model are conservatively high compared to actual expected loading over the duration of the storm event.

The modeled loads were tabulated based on pollutant type, pollutant form (total or dissolved) and drainage area source. A summary of pollutant loading in the form of drainage area percent contribution was created and used to verify the locations of high pollutant loading (Hotspots). In instances where no data existed for drainage areas contributing to Outfall 013, median and maximum concentrations equal to one-half of the highest detection limit value for each pollutant reported by the testing laboratory were used in the load tabulation. This evaluation resulted in some redistribution of pollutant loading; however, there was no change to the identified Hotspot locations as loads from those locations remained elevated with respect to the rest of the site. As noted in Section 2.3 above, a total of four Hotspots were identified with Hotspot 1 located at the most upstream point of the main trunk line which is adjacent to the Kenilworth Office Building #54 and Building #57on the southeast corner of the site. Hotspot 4, the most downstream Hotspot, is located downstream of inlet 17 on a lateral line located west of the lift station and oil water separator.

Samples collected at two locations from the main trunk line, manhole 57 (located at the downstream end of drainage area 19 on the east side of the Building #75) and manhole 37 (located downstream of manhole 57, within drainage area 11 and south of Building #68), were used to evaluate connectivity between measured and modeled loads. Measured loads in the trunk line at manholes 57 and 37 were compared to the sum of the modeled loads from the upstream drainage areas tributary to each of the two manholes. The majority of the resulting ratios were within a range of values indicative of acceptable connectivity.

The model loads were adjusted using compliance sampling analytical data for Outfall 013 from the last six quarters of sampling, two quarters of 2015 and all four quarters of 2016. Median and maximum discharge concentrations were calculated from the Outfall 013 data for each pollutant. These values were then used to scale the conservative, model-produced pollutant loads using the percent load distribution that had been modeled in the SWMM software.

Following this step, a pollution reduction analysis was completed. The adjusted maximum total loads for copper, iron, zinc, and TSS as well as the maximum dissolved loads for the metals listed were increased by a factor of 1.5 to 2.0 to provide a minimum safety factor of 1.5 in the load reduction step. Cadmium, nickel, and lead are consistently discharged in stormwater runoff at Outfall 013 at levels well below the NPDES discharge limits; therefore, these metals were not analyzed as part of the pollutant reduction step. However, the proposed stormwater treatment systems will also work to remove these metals, both in total and dissolved form.

The pollutant loading evaluation utilized reduction factors which were appropriate for the following Contech® stormwater treatment technologies chosen for the treatment system at the site: DownSpout StormFilter™ and StormFilter®, both of which are used to remove dissolved parameters, as well as the Jellyfish® Filter, which is used to target removal of total suspended solids (TSS) and total metals.

A bench scale treatability study, as described in AECOM's Conceptual Design Report (November 2016), was performed using stormwater from the Site to identify the best adsorptive media for the application. Results of the bench scale treatment study indicated that Zeolite A and granular activated carbon (GAC) were the most effective at removing a range of dissolved pollutants. Based on the study results, Zeolite A blended with GAC were specified as a combined adsorptive media for use in the DownSpout StormFilter™ and StormFilter® units for the project.

Jellyfish® Filter units will be placed upstream of the StormFilter® units. This will serve to enhance the ability of the StormFilter® units to remove the dissolved metals portion in the site runoff. Jellyfish® Filter units will act to remove TSS and particulate metals thus reducing competition for available adsorption sites in the StormFilter® media. The range of pollutant reduction factors for the StormFilter® media and Jellyfish® Filter units, as described in Contech publications, found in review of other literature, and measured in the bench scale media evaluation testing, is presented in **Table 4-1**.

Table 4-1: Stormwater Treatment System Pollutant Reduction Factor Ranges

Unit Type	Contech® Jellyfish® (Filtration)				Contech® StormFilter® (Adsorption)		
Source	Total Copper	Total Zinc	TSS	Other metals	TSS	Total Copper and Zinc	Dissolved Copper and Zinc
Literature Review	86%-90%	51%-70%	86%-90%	64%-81%	25%-50%	34%-70%	8%-65%
Contech® Publications	>80%	>50%	89%	--	--	--	--
Bench Scale Study Results[1]	--	--		--	--	55%-100%	60%-96%

[1]Reported bench scale study reduction range results are also representative of total and dissolved iron and lead reductions.

Table 4-2 outlines the estimated reduction factors that were applied to the pollutants at each Hotspot based on arrangement of the Jellyfish® and StormFilter® units, which will be used in combination at each Hotspot. This sequential arrangement of the treatment units acts to compound the reduction factors. The unit reduction factors chosen for application in the pollutant reduction model were generally more conservative when compared to the literature review and bench scale ranges identified in **Table 4-1**.

Table 4-2: Applied Pollutant Reduction Factors

Pollutant	Jellyfish®[1]	StormFilter®[1]
Copper	80%	60%
Iron	50%	60%
Zinc	50%	60%
TSS[2]	89%	--

[1]Estimated reduction factors may differ from actual reductions observed due to various site-specific conditions and facility operations.
[2] Estimated reduction factor for TSS is applicable to 20 microns or greater.

Results of the conservative pollutant load reduction analysis indicate that the proposed stormwater treatment system design should be effective to reduce pollutant loadings of copper, iron, zinc, and TSS to below the permitted NPDES discharge levels. Based on the modeled storm event, the applied pollutant reduction factors presented in **Table 4-2** would also be representative of the anticipated percent removal of metals concentrations in stormwater discharges. Therefore, it has been estimated that following treatment the metals and TSS concentrations in stormwater will be below the permitted NPDES discharge levels at Outfall 013.

Table 4-3 below summarizes the fractional percentages of existing, pre-treatment loads for copper, iron, zinc, and TSS as calculated using the approach described in this document.

Table 4-3: Initial Load Distribution – Before Treatment

Hotspot		Sub-basin ID	Copper		Iron		Zinc		TSS	
			Median	Max	Median	Max	Median	Max	Median	Max
1	Transformer Test Shop	17A – 17E	7%	12%	7%	8%	12%	9%	6%	7%
2	Salvage Yard	10A, 10B, 31	7%	4%	1%	<1%	3%	1%	3%	6%
3	Former Fuel Tank Area	6A, 6B, 6C	14%	32%	49%	47%	27%	72%	37%	55%
4	Former Power Plant Area	2	8%	13%	15%	29%	6%	4%	11%	24%
All Hotspots			36%	61%	72%	86%	48%	86%	57%	92%
All Other Areas			64%	39%	28%	14%	52%	14%	43%	8%
Outfall 013			100%	100%	100%	100%	100%	100%	100%	100%

1. Based on Median and Maximum Values from SWMM Model and Mass Balance Calculations.
2. Fraction is with respect to total load.

Table 4-4 summarizes the fractional percentages of estimated, post- treatment loads for copper, iron, zinc, and TSS as calculated using the approach described in this document.

Table 4-4: Final Estimated Load Distribution – After Treatment

Hotspot		Sub-basin ID	Copper		Iron		Zinc		TSS	
			Median	Max	Median	Max	Median	Max	Median	Max
1	Transformer Test Shop	17A – 17E	1%	4%	5%	8%	6%	6%	<1%	5%
2	Salvage Yard	10A, 10B, 31	2%	1%	1%	<1%	2%	1%	1%	5%
3	Former Fuel Tank Area	6A, 6B, 6C	3%	11%	36%	42%	17%	60%	40%	42%
4	Former Power Plant Area	2	2%	4%	11%	26%	4%	3%	12%	18%
All Hotspots (estimated)			8%	20%	53%	76%	29%	70%	53%	70%
All Other Areas (estimated)			92%	80%	47%	24%	71%	30%	47%	30%
Outfall 013 (estimated)			100%	100%	100%	100%	100%	100%	100%	100%

1. Based on Median and Maximum Values from SWMM Model and Mass Balance Calculations.
2. Fraction is with respect to total load.
3. Based on estimated reductions provided by Contech®.

5.0 DESIGN

5.1 Overview of Design Criteria

Based on the analytical results of targeted sampling, the following design criteria have been developed for localized treatment of metals at the individual Hotspots in order to reduce the contaminant loading at Outfall 013. Contaminant concentrations and NPDES discharge limits at Outfall 013 are summarized in **Table 5-1** below.

Table 5-1: Permit Concentration Limits for Outfall 013

Metals	NPDES Discharge Limits for Outfall 013		Maximum Concentration for Outfall 013
	Daily Maximum (mg/l)	Monthly Average (mg/l)	Total Conc. (mg/l)
Cadmium	0.00495	0.00208	0.00025
Copper	0.01344	0.00524	0.0222
Iron	1.0	0.69	2.2
Lead	0.06458	0.05660	0.013
Nickel	0.117	0.073	0.005
Zinc	0.11718	0.07311	0.175
TSS	100	30	25

Note:

- Maximum concentrations are peak concentrations observed at Outfall 013 during the quarterly NPDES sampling. Maximum concentrations are the peak concentrations reported from six sampling events from 09/2015 through 12/2016.
- The grey shaded metals include the primary metals of concern (copper, iron, and zinc) observed at concentrations greater than the NPDES discharge limits. Non-shaded metals were observed at concentrations less than the NPDES discharge limits.

5.2 Overview of Design Development

Selection of stormwater management treatment measures follows a systematic decision tree which incorporates Site conditions, flow rates for the first flush portion of storm events, contaminants of concern, and the state of contamination (i.e. dissolved or suspended solids). Design efforts have focused on treatment measures at the Hotspots, as close to the source of contaminants as is practical. This approach offers the following advantages:

1. Independent system failures do not risk discharge exceedances to the same extent as a single, centralized system;
2. Focused systems may be customized to specific local contaminants;

3. Focused systems allow application of risk based safety factors when designing remedies; and
4. Focused systems will improve attention to problem areas on-site, increasing the likelihood of identifying and eliminating contaminant sources.

The following treatment designs have been developed based on the stormwater analytical data and modelling data for each of the identified Hotspots. Each treatment recommendation is based on the contaminants and conditions specific to each Hotspot which contribute to elevated discharges at Outfall 013.

5.3 Treatment Design

The water quality treatment measures for this project have been designed to reduce pollutant loads from a 1-inch storm event for stormwater runoff collected by on-site inlets and catch basins, which drain via an underground separate storm drain system and discharge at Outfall 013 (see C0101, Existing Drainage Area Map). Stormwater treatment will be provided at the four Hotspots using combinations of Contech® DownSpout StormFilter™, Jellyfish® Filter, and StormFilter® stormwater treatment systems. As described in Section 2.3, the Hotspot locations and treatment methods were determined based on facility-wide stormwater sampling performed in 2015 and 2016 and the resulting pollutant contamination loads.

DownSpout StormFilter™ systems will be installed at the existing loading dock roof downspouts on the west face of Building #56 to provide filtration of roof runoff determined to have high concentrations of dissolved metals such as zinc, copper, and lead. This treatment measure is a passive, aboveground, pretreatment system that utilizes StormFilter® cartridges.

All new inlets and manholes installed as part of the treatment system will be equipped with Jellyfish® Filters to collect and/or treat stormwater runoff from surface areas that are predominantly impervious, in both inline and offline configurations, in order to remove TSS, oil, and floatable trash from stormwater at pollutant source locations. This treatment measure is an underground, pretreatment system that utilizes membrane filtration cartridges.

StormFilter® stormwater treatment devices will be installed as large underground concrete vaults that house a large number of rechargeable, self-cleaning, media-filled cartridges that will trap particulates and absorb pollutants such as dissolved metals, hydrocarbons, nutrients, metals, and other common pollutants found in stormwater runoff. The filter media in the StormFilter® cartridges will be customized at each hotspot to target site-specific pollutants. This treatment measure is the primary water quality treatment technology at each of the Hotspot locations.

In order to construct and install the underground Jellyfish® Filter and StormFilter® systems and supporting storm drain infrastructure, selective site clearing, grubbing, and demolition will be required. Asphalt and concrete pavement will be saw-cut and removed to a minimal depth and footprint to allow for excavation, trenching, and sheeting and shoring (to be determined by the Contractor). Excavated materials shall be sampled for petroleum hydrocarbons, metals, Polycyclic Aromatic Hydrocarbons (PAHs), and Polychlorinated biphenyls (PCBs) at a minimum. Any soil that cannot be reused as backfill shall be stored temporarily on-site in containers provided by Pepco for disposal by Pepco.

New storm drain piping, for conveyance and storage of stormwater, and new flow splitters and manholes will be required upstream from the new StormFilter® structures in order to divert the 1-inch storm to the StormFilter® structures and to reduce peak runoff flows, providing the appropriate level of filtration within the StormFilter® structures. Storm drain piping and structures have been designed in accordance with Appendix F (Stormwater Conveyance System Design), Appendix G (Design of Flow Control Structures), and Appendix H (Acceptable Hydrological Methods and Models) of the DOEE SWMG.

Site and utility work will involve installing and testing new storm drain piping and new storm drain and stormwater treatment structures, including but not limited to all equipment, cartridges, underdrains, weir walls, manhole access covers, inlet and outlet pipe connections, etc. Subbase material will be placed below new piping and utility structures, and trenches and excavations will be backfilled per standard District of Columbia requirements. Structures will be anchored as needed due to the water table level on-Site (method of anchoring to be determined by the Contractor and to comply with the 2009 District of Columbia Department of Transportation (DDOT) Design and Engineering Manual). Concrete and asphalt pavement surfaces will be replaced in kind, and in line and grade. Permanent stabilization will be provided in existing pervious areas that are to be replaced, in kind and in line and grade.

Before breaking ground the Contractor will be required to contact DOEE to schedule a pre-construction meeting with the DOEE Inspector at the facility Site. DOEE standard Erosion and Sediment Control (ESC) measures found in the 2003 Soil ESC Handbook will be utilized and routinely maintained by the Contractor for the full duration of construction in order to eliminate the potential for sediment generated by construction activities to enter the downstream storm drain system and in turn the Anacostia River. ESC measures will include, but not be limited to, straw bale dikes; silt fence; standard, at grade, and curb inlet protection (in conjunction with the existing filter bag inlet protection currently in place and maintained by Clean Venture, under contract to Pepco, on all existing inlets); dewatering and filtering practices; and dust control. Construction vehicles will be restricted from driving in areas of exposed soil and will be brushed clean using a broom prior to leaving the construction zone.

Stormwater Performance Requirements set forth in the DOEE SWMG and in Section 520 (Stormwater management: Performance Requirements for Major Land-Disturbing Activity) of Chapter 5 (Water Quality and Pollution) of Title 21 (Water and Sanitation) of the DC Municipal Regulations (DCMR) are exempted per DCMR Section 517 (Stormwater Management: Exemptions) as follows:

- Section 517.2: The project is being conducted solely to install BMPs in compliance with a Court-Approved Consent Decree and in compliance with a NPDES permit;
- Section 517.3: The project is a land-disturbing activity that consists solely of cutting a trench for utility work and related replacement of pavement and does not involve reconstruction of any DDOT roadways.

A description of each Hotspot and its specific, prescribed pretreatment and water quality treatment devices is provided below with reference to the Civil Design 65% Submittal plan set.

5.3.1 Hotspot 1: Transformer Test Shop

Hotspot 1 is located in the southeast portion of the Site. This location was chosen as the area contributes significant levels of zinc, in both total and dissolved forms, and copper to a lesser extent, but still high levels. Elevated concentrations of copper (total and dissolved), total iron, and zinc (total and dissolved) were frequently present in stormwater samples collected from runoff in this area. The treatment at Hotspot 1 consists of StormFilter™ units to treat runoff from the loading dock roof (sub-basin 17E) which sheds significant levels of zinc and copper. Zinc and copper removal rates, via the downspout media filters, are reported by Contech to be sufficient to achieve necessary discharge concentrations.

Discharge from the downspout StormFilter™ units transitions to surface flow, combines with flow from sub-basin 17D, then enters a Jellyfish® Filter for removal of portions of TSS and total metals.

Stormwater from each of sub-basins 17A through 17C is treated by a Jellyfish® Filter to be located in each sub-basin's grated inlet. Stormwater from these units will flow to the main trunk to combine with discharge from the unit that treats the combined flow from sub-basins 17D and 17E. The combined discharge from sub-basin 17 flows to a StormFilter® unit for removal of the dissolved fraction prior to entering the main trunk line.

The full treatment design for this Hotspot is included in the Civil Design 65% Submittal plan set (**Appendix B**). A summary of the pretreatment and water quality treatment components is presented below.

Refer to C0106 for the following pretreatment systems:

- Four (4) new DownSpout StormFilter™ systems including one (1) standard filtration cartridge,
- One (1) new 48" dia. flow splitter manhole and 96" dia. Jellyfish® Filter manhole combination, and
- Three (3) new Jellyfish® Filter grate inlet structures.

Refer to C0107 for the following water quality treatment system:

- One (1) new High Density Polyethylene (HDPE) pipe detention storage pipe system including:
  - one (1) 72" dia. flow splitter manhole,
  - one (1) 12" section of HDPE low flow pipe,
  - a series of serpentine-aligned 36" HDPE storage pipes,
  - one (1) 6" section of HDPE flow restricting outlet pipe, and
- One (1) new StormFilter® stormwater treatment device including 61 - 27"-tall, media-filled cartridges.

5.3.2 Hotspot 2: Salvage Yard

Hotspot 2 is located in a relatively central part of the Site. This area is a contributor of elevated levels of total and dissolved copper as well as dissolved zinc. The treatment at Hotspot 2 consists of Jellyfish® Filter units for stormwater flows from Sub-basin 10A and Sub-basin 31. Downstream of the Jellyfish® Filter unit, flows from Sub-basins 10A, 10B, and 31 are combined and routed through a StormFilter® unit for removal of the dissolved fraction prior to entering the main trunk line.

The full treatment design for this Hotspot is included in the Civil Design 65% Submittal plan set (**Appendix B**). A summary of the pretreatment and water quality treatment components is presented below.

Refer to C0108 for the following pretreatment systems:

- Two (2) new Jellyfish® Filter grate inlet structures.

Refer to C0108 for the following water quality treatment systems:

- Two (2) new 48" dia. flow splitter manholes, and
- One (1) new StormFilter® stormwater treatment device including 31 - 27"-tall, media-filled cartridges.

5.3.3 Hotspot 3: Former Fuel Tank Area

Hotspot 3 is located near the former fuel tank area in a relatively central part of the Site. This area is a contributor of all pollutants except for possibly the dissolved form of zinc. The percentage of Site-wide total pollutant loading (total and dissolved) for which this sub-basin is responsible varies by metal of concern. The treatment at this location includes a Jellyfish® Filter at Inlet 108 (Sub-basin 6C) followed by the combination of flows from Sub-basins 6A, 6B, and 6C that will be split in half with each half routed through a Jellyfish® Filter and StormFilter® combination unit arranged to remove TSS and related metals from the stormwater prior to entering the main trunk line.

The full treatment design for this Hotspot is included in the Civil Design 65% Submittal plan set (**Appendix B**). A summary of the pretreatment and water quality treatment components is presented below.

Refer to C0108 for the following pretreatment systems:

- One (1) new Jellyfish® Filter grate inlet structure,
- One (1) new 60" dia. flow splitter manhole,
- One (1) new 96" dia. Jellyfish® Filter manhole, and
- One (1) new 120" dia. Jellyfish® Filter manhole.

Refer to C0108 for the following water quality treatment systems:

- One (1) new StormFilter® stormwater treatment device including 44 - 27"-tall, media-filled cartridges, and
- One (1) new StormFilter® stormwater treatment device including 61 - 27"-tall, media-filled cartridges.

5.3.4 Hotspot 4: Former Power Plant Area

Hotspot 4 is located just east of the former power plant footprint in the northwestern portion of the Site. This area contributes to high loading of both total and dissolved copper, iron, nickel, and TSS.

The treatment at Hotspot 4 is a combination of Jellyfish® Filter and StormFilter® placed between Inlet 17 and Inlet 27 arranged to remove TSS and related metals from the stormwater prior to entering the main trunk line.

The full treatment design for this Hotspot is included in the Civil Design 65% Submittal plan set (**Appendix B**). A summary of the pretreatment and water quality treatment components is presented below.

Refer to C0109 for the following pretreatment systems:

- One (1) new 48" dia. flow splitter manhole, and
- One (1) new 72" dia. Jellyfish® Filter manhole.

Refer to C0109 for the following water quality treatment systems:

- One (1) new StormFilter® stormwater treatment device including 51 - 27”-tall, media-filled cartridges.

Figure 4-1 provides a Site layout with each hotspot area identified.

5.4 Other Design Considerations

In addition to this Stormwater Treatment Measures Project, Pepco is planning to install two stormwater retention projects and has recently finished construction on a storage shed for out-of-service transformers awaiting disposal.

One of the two stormwater retention treatment projects is a green infrastructure project in the area of the former power plant. This project has two objectives. One objective is to eliminate the discharge of stormwater from the facility to the Anacostia River via Outfall 101. The second objective is to capture, retain, and treat on-site the stormwater that otherwise would have been discharged via Outfall 101 through the use of green stormwater management infrastructure. This green retention feature will rely on the water quality and water quantity (volume) control benefits provided by vegetation and soil. The retention feature will consist of one or more shallow, depressed, vegetated systems, potentially also including some deeper areas to meet storage capacity requirements. It will be designed to promote natural processes which are well documented to provide water quality treatment benefit, including direct settlement, adsorption, and biological processes including vegetative uptake of pollutants. It is anticipated that stormwater overflows from the retention feature will be appropriately managed by directing the overflow or excess volume of water to the main storm sewer system (at a point to be determined as part of the detailed design of this project).

The second stormwater retention project will be located in the footprint of the former cooling towers, and is intended to treat the surface runoff from the area around the former cooling towers. This project will have both retention upstream and will discharge downstream of the existing lift station and oil/water separator and the planned water quality treatment system for Hotspot 4.

Construction of the Transformer Storage Shed was recently completed. This structure will be used to stage transformers and other electrical equipment removed from service on Pepco’s electric distribution system awaiting disposal. Use of this shed for this purpose is expected to reduce the metal concentrations in stormwater at discharge area 17, where such equipment previously was stored in areas exposed to storm events.

In addition, Pepco will continue to maintain the inlet controls and other stormwater BMPs implemented at the Site.

5.5 Design Conclusions

Data analysis performed to evaluate Hotspot contributions applied the 1-inch design storm event maximum flow values and the median and maximum concentration values from focused sampling events at the various stormwater inlets and manhole locations. The model of contaminant loadings indicates that greater than two thirds of contaminants measured at Outfall 013 are captured within the four Hotspots. Data input to the model likely overestimates contaminant loading because the sampling data reflected maximum loading periods of storm events yet is modeled to occur during the entirety of the storm up to attaining peak flow. Based on the model and pollutant load analysis, if treatment at these four Hotspots achieves manufacturer's estimated contaminant reduction, then the overall treatment at the Hotspots is expected to sufficiently reduce stormwater contaminant loading to achieve consistent compliance with the NPDES permit limits at Outfall 013 for design storm events.

6.0 IMPLEMENTATION CONSIDERATIONS

6.1 Agency Oversight and Permitting

6.1.1 Federal

The Consent Decree established a schedule for deliverables and approvals for the Stormwater Treatment Measures Project. To date, USEPA has reviewed and approved the following project documents for the Stormwater Treatment Measures Project:

- Draft Design Basis Report, February 2016
- Draft Conceptual Design, May 2016
- Final Conceptual Design, November 2016

This Design Report provides the final Hotspot selection and the design of associated treatment measures. This Report is subject to review and approval by EPA, and the subsequent installation, testing, and operation of the treatment system will be subject to EPA oversight pursuant to the Consent Decree. Furthermore, compliance with the Consent Decree and 2009 NPDES Permit are applicable throughout the Stormwater Treatment Measures Project.

6.1.2 District of Columbia

On December 28, 2016, Pepco and AECOM met with Elias Demessie of the DOEE for pre-application meeting to discuss the Stormwater Treatment Measures Project at the Benning Road Facility. A summary of the project background, scope of the project, compliance rationale, and proposed water quality treatment BMPs was presented by Pepco and AECOM to DOEE.

DOEE described the permitting and approval procedures. For this project, a building/construction permit from the District of Columbia Department of Consumer and Regulatory Affairs (DCRA) and an ESC permit from the DOEE to construct the new treatment measures and supporting structures will be required. Pepco and AECOM also noted that the project is:

- being conducted for the sole purpose of installing pollution controls in accordance with a Consent Decree negotiated between the USEPA and Pepco and in compliance with the NPDES permit; and
- a land-disturbing activity that consists solely of cutting a trench for utility work and related replacement of pavement, does not involve reconstruction of roadway or other redevelopment, and all work lies within Pepco property.

Following this meeting, Pepco and AECOM submitted a Project Narrative and Existing Conditions Plan to DOEE.

Pepco and AECOM requested that the DOEE make a determination regarding a land-disturbance exemption from Stormwater Treatment Performance Requirements per the DC DOEE Stormwater Guidebook and DC Municipal Regulations Chapter 21-5, Water Quality and Pollution; 21-517 Stormwater Management: Exemptions.

On January 6, 2017, following a discussion with DOEE's Stormwater Division, Elias Demessie granted Pepco's request for a land-disturbance exemption from the performance requirement as per Section 517.3 of the DC Municipal Regulations Chapter 21-5, Water Quality and Pollution. Following approval of the exemption, Pepco and AECOM began application preparation for a DCRA Building Permit (including filing fees) and a DOEE ESC permit.

6.2 Operation and Maintenance

Selected treatment measures include particulate removal, sorptive media filters, and combinations thereof. The use of particulate filters in combination with media filters is designed to improve the duration of media efficacy by capturing fine particulates which would otherwise blind the sorptive media. Based on manufacture's literature, particulate filters capture 80 to 90 percent of particles and could thereby reduce total metals by 50 to 75 percent. The Contech Jellyfish ®, a particulate filter, was selected to achieve necessary particulate reductions. The Contech StormFilter®, a sorptive media filter, was selected to reduce particulate contamination and absorb dissolved metals. The sorptive media cartridges will contain Zeolite blended with GAC to absorb dissolved metals. While the actual percent removal will vary based on the metals of concern, a review of available literature estimates that sorptive media filters will remove 34%-70% of total copper and zinc. Sorptive media volumes have been sized for change outs no more frequently than two times per year, based on manufacturer recommendations.

As per Inspection and Maintenance Manuals for Jellyfish ® and StormFilter® from Contech®, pollutants must be removed periodically so that the treatment performance of the control technology maintains its full efficiency and effectiveness. Regular inspection and maintenance are required to insure proper functioning of the system. Maintenance frequencies and requirements are Site specific and dependent on the pollutant load characteristics. Maintenance activities may be required in the event of an upstream chemical spill or due to excessive sediment loading from Site erosion or extreme storm events. Contech suggests inspecting the system after each major storm event.

Based on recommendations from Contech, AECOM proposes the following inspection schedule:

- Upon completion of construction activities to install the treatment systems and prior to putting the treatment systems into service. Remove any construction debris or construction-related sediment within the device. Repair any damage to system components.
- Two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and confirm proper functioning of the system.
- Inspection frequency in subsequent years will be determined based on the O&M Plan developed in the first year of operation. Minimum inspection frequency will be at least once per year.
- Inspections will also be performed following each major storm event and immediately after any upstream spill.

Based on recommendations from Contech, AECOM proposes the following maintenance activities:

- Remove any oil, floatable trash, and debris
- Remove any collected sediments
- Remove, rinse, and re-install the filter cartridges.
- Replace filter cartridge tentacles (as needed for Jellyfish Filter®)
- Replace sorptive media cartridges (as needed for StormFilter®)
- Containerize any waste materials generated during maintenance activities.

The combined treatment system is expected to include four (4) Downspout StormFilter® units, ten (10) Jellyfish ® filter units, and five (5) StormFilter® units. The estimated number of Jellyfish ® cartridges is 80 and it is anticipated that two inspection and maintenance events will be necessary per year. The estimated number of StormFilter® cartridges is 220 and it is anticipated that the cartridges will need to be replaced every five years. **Appendix C** includes Inspection and Maintenance Manuals for the selected BMPs.

6.3 Performance Testing

Initial acceptance testing will be conducted during a qualifying storm event during the first quarter following completion of construction and placement of the treatment system into operation. Influent and effluent samples will be collected at each treatment system component and submitted for laboratory analysis of dissolved and total metals and TSS. Analytical results for influent and effluent samples will be compared to calculate site-specific removal percentages for each treatment component at each Hotspot. System performance will be deemed acceptable if (a) the site-specific removal percentages equal or exceed the pollutant reduction factors presented in **Table 4-2** above, or (b) effluent concentrations otherwise indicate that the concentrations of metals and TSS in stormwater at Outfall 013 will be below the permitted NPDES discharge levels.

Following initial acceptance testing, influent and effluent samples will be collected at each Hotspot during a qualifying storm event at least once every 180 days to ensure that system performance remains acceptable.

7.0 LIMITATIONS

The design was based on several assumptions as noted below. Some of the assumptions noted below present an uncertainty, while others could provide an added factor of safety.

Data Collection

- Given the age of the system, as-built drawings of the storm drain system are not available. Inlet and topographic surveys, closed-circuit television inspections, and historical knowledge were used to recreate the storm drain profiles of site-wide storm drain system. Following the identification of Hotspots, two additional field survey efforts were performed to verify or revise inlet and topographic data including elevations, diameters, and connections. System conditions which could not be verified or revised were identified as determined according to records (DATR).
- Multiple rounds of analytical results collected during September 2015 and December 2016 constitute the dataset upon which the design was based. The data was collected by multiple parties and to fulfill multiple objectives. The nature of the limited dataset could pose an uncertainty with respect to the prediction of removal rates.
- The design assumed that stormwater samples collected during qualifying storm events were representative of the Site conditions.

Modeling

- A detailed topographic survey with 1-foot contour intervals was completed at each of the four Hotspots. However, inferred topography based on previously collected survey data and available aerial imagery were used for other areas for modeling purposes.
- The proposed design storm event approximates the flow associated with the initial surface runoff of a 1-inch (85th percentile) storm event.

Design

- The media evaluation and bench scale treatability study were performed based on a snapshot of analytical concentrations observed during one of the targeted sampling activities. Long-term field pilot tests or longer startup periods are often used to avoid uncertainties arising from variability in stormwater chemical makeup.

- The efficiency and effectiveness of selected treatment technologies may vary due to site-specific conditions and has only been approximated based on available literature, Contech publications, and the bench-scale media treatability study.
- Collapsed and corroded corrugated metal piping will be removed from sub-basins 2, 6, 10 and 17 to eliminate a likely source of metals and suspended solids in stormwater flows which could compromise downstream treatment devices.
- All the excavated material will be sampled for Petroleum Hydrocarbons, Metal, Polycyclic Aromatic Hydrocarbons (PAHs), and Polychlorinated biphenyls (PCBs) at a minimum. Any soil that cannot be reused as backfill shall be containerized in containers provided by Pepco for disposal by Pepco.

Some of the uncertainties discussed above are typically managed through additional data collection. Due to the tight design and implementation schedule and relatively dry rainy season, opportunities for additional data collection have been limited. The uncertainties were/should be managed as follows:

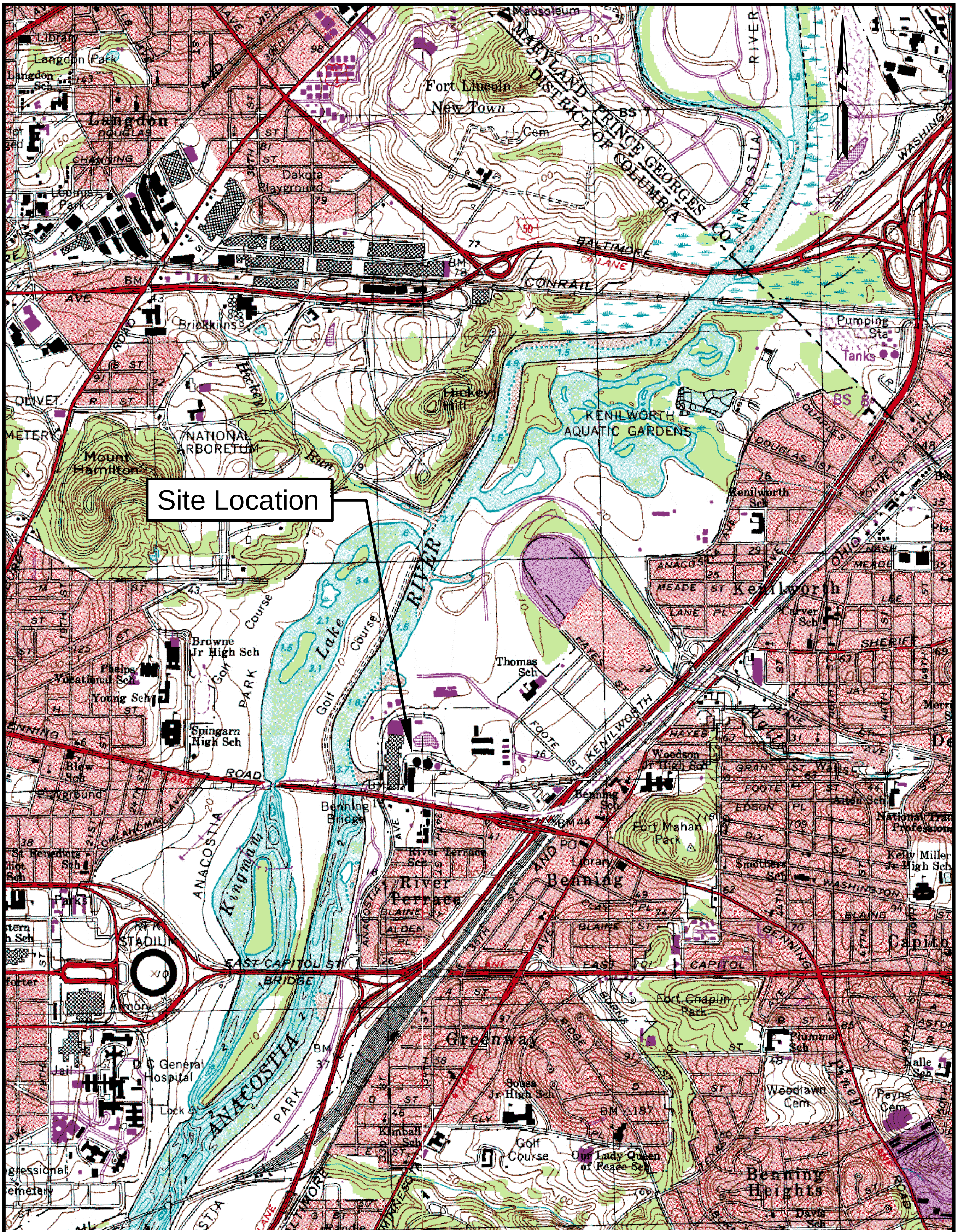
- A factor of safety was introduced into the design process by doubling the calibrated metal loads during the pollution reduction analysis.
- Benefits from any future additional BMPs were not accounted for. This would result in an additional factor of safety.
- Additionally, a longer iterative performance monitoring and fine-tuning of system operations may be necessary to further address the uncertainties.
- Treatment systems will be operated and maintained in accordance with manufacturer's specifications and recommendations.

8.0 SCHEDULE

Following submittal of the Design Report, the project schedules will entail obtaining permits and approvals, procurement of a construction contractor and long lead items, and construction and installation of the treatment measures at the four Hotspots. While permitting and approval activities are already underway, procurement activities will begin following submission of this Design Report. The full project schedule is presented as **Appendix D**.

An Exelon Company

Figures



AECOM

Source:
USGS 7.5 Minute Topographic Map
Washington East Quadrangle

0 1000 2000 4000
SCALE IN FEET

Stormwater Treatment Measures Design Report Benning Road Facility 3400 Benning Rd., NE Washington, DC 20019		Site Location Map	
DATE: 02/06/2017	DRAWN BY: LAD	CHECKED BY: RD	Project Number 60490030	FIGURE 1-1

Drainage Area	Area (Acre)	Impervious Area (Acre)	Discharge Structure	Hotspot No.
Drainage Area 01	4.47	0.61		
Drainage Area 02	6.04	1.82	I27	4
Drainage Area 03	1.73	0.21		
Drainage Area 04	0.91	0.12		
Drainage Area 05	2.27	1.64		
Drainage Area 06A	1.00	0.61	I09	3
Drainage Area 06B	8.39	3.80	I07/I08	
Drainage Area 06C	0.20	0.15	I108	
Drainage Area 07	2.34	0.63		
Drainage Area 08	0.55	0.49		
Drainage Area 09	2.27	1.47		
Drainage Area 10A	0.76	0.22	I66	2
Drainage Area 10B	0.42	0.27	I65	
Drainage Area 11	0.89	0.34		
Drainage Area 12	2.27	1.90		
Drainage Area 13	0.06	0.00		
Drainage Area 14	6.09	4.69		
Drainage Area 15	3.35	3.30		
Drainage Area 16	1.71	1.67		
Drainage Area 17A	0.70	0.51	I42	1
Drainage Area 17B	0.49	0.40	I43	
Drainage Area 17C	0.38	0.29	I44	
Drainage Area 17D	0.58	0.37	I45	
Drainage Area 17E	1.07	1.01	I46/I47	
Drainage Area 18	2.03	1.82		
Drainage Area 19	0.91	0.86		
Drainage Area 20	7.21	1.83		
Drainage Area 21	0.80	0.30		
Drainage Area 22	2.17	1.68		
Drainage Area 23	2.44	0.80		
Drainage Area 24	2.61	1.97		
Drainage Area 25	0.60	0.30		
Drainage Area 26	1.13	0.82		
Drainage Area 27	4.35	0.64		
Drainage Area 28	1.45	1.00		
Drainage Area 29	0.43	0.11		
Drainage Area 30	0.75	0.29		
Drainage Area 31	0.57	0.55	I68	2
Drainage Area 32	0.85	0.85		
Drainage Area 33	0.23	0.00		

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.
NAME:
LICENSE NO.: SARAH J. NAPIER
EXPIRATION DATE: PE905830 08/31/2018

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

DESCRIPTION | CORR | CHKD | APPD | APPD | APPD | APPD
REVISIONS

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SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

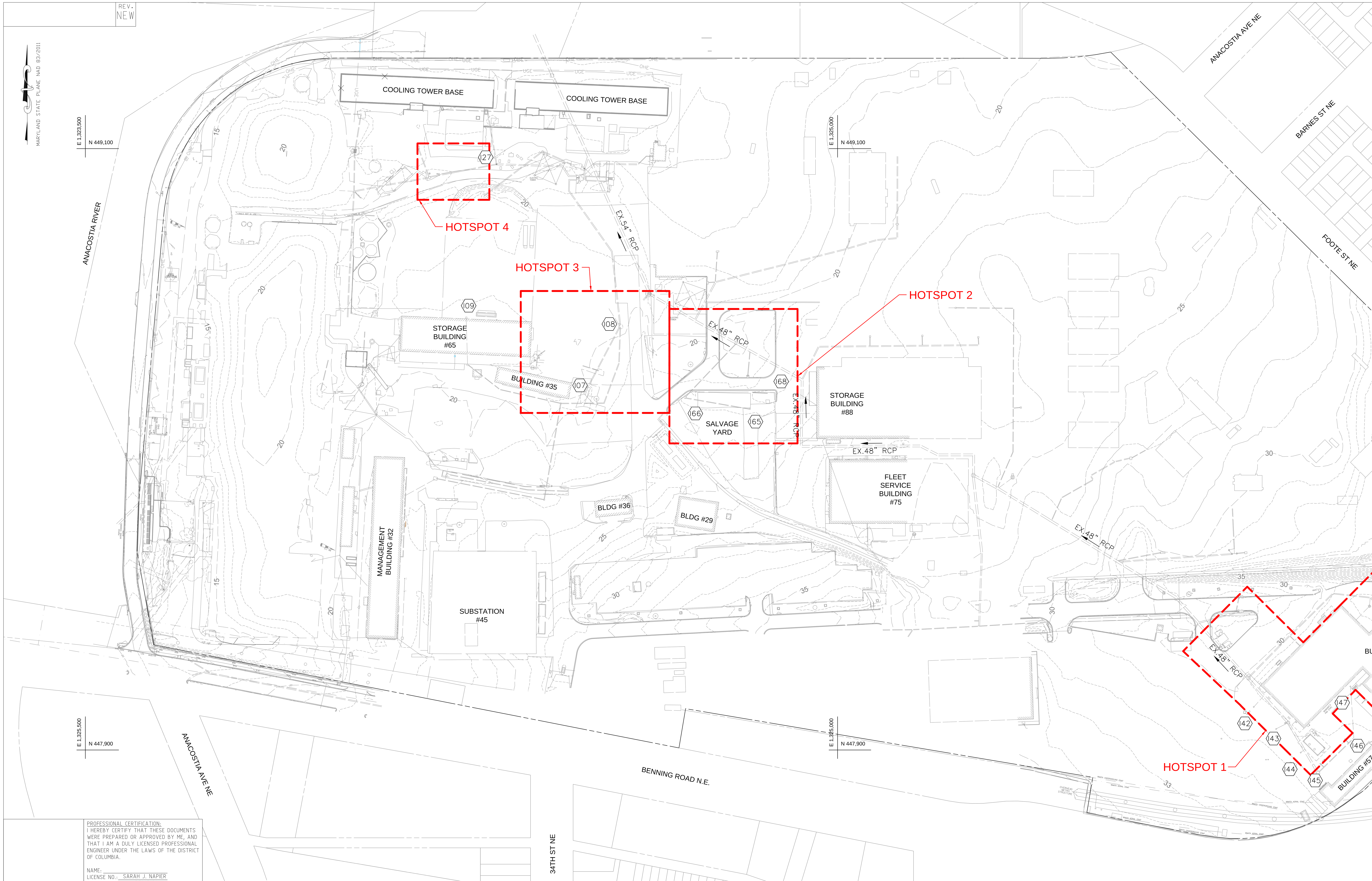
BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

EXISTING DRAINAGE AREA MAP

POTOMAC ELECTRIC POWER CO.

FIGURE 3-1

REV. NEW



GENERAL NOTES

1. HORIZONTAL DATUM: MARYLAND STATE PLANE NAD 83/2011
2. VERTICAL DATUM: DISTRICT OF COLUMBIA DEPARTMENT OF PUBLIC WORKS
3. PROPERTY LINES AND EASEMENT LINES SHOWN HEREON ARE BASED ON A COMPILATION OF FIELD EVIDENCE, RECORD INFORMATION, AND DRAWINGS PROVIDED BY OTHERS. THEIR LOCATION IS APPROXIMATE FOR GRAPHICAL PURPOSES ONLY. NO BOUNDARY SURVEY WAS PERFORMED.
4. THE UNDERGROUND UTILITIES INDICATED HEREON ARE DERIVED FROM A COMBINATION OF PLANS SUPPLIED BY VARIOUS UTILITY COMPANIES AND QUALITY LEVEL "B" UTILITY DESIGNATION. THE LOCATION OF THESE UTILITIES SHOULD BE CONSIDERED APPROXIMATE AND OTHER UTILITIES MAY EXIST WHICH HAVE NO RECORD DATA OR ARE UNDETECTABLE WITH CONVENTIONAL METHODS. NO GUARANTEE OR WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF UTILITY INFORMATION PROVIDED HEREON. UTILITIES LABELED (DATR) ARE SHOWN BASED UPON "DATA ACCORDING TO RECORDS". NOTE: UTILITIES LOCATED BY SUBSURFACE UTILITY ENGINEERING METHODS ARE LABELED "SUE" HEREON
5. CONTOUR INTERVAL IS ONE (1) FOOT.
6. STORM DRAIN INLET NUMBERS SHOWN IN CIRCLES ARE TAKEN FROM THE AMEC DRAINAGE AREA MAP PROVIDED FOR THE SITE, INLET NUMBERS SHOWN IN HEXAGONS ARE TAKEN FROM THE PREVIOUS AMT TOPOGRAPHIC SURVEY FOR THE AREA.
7. STORM INVERT INFORMATION FOR STRUCTURES THAT ARE INACCESSIBLE DUE TO EXISTING INLET PROTECTION ARE TAKEN FROM PREVIOUS SURVEYS
8. STORM DRAIN CONNECTIONS ARE BASED ON FIELD OBSERVATION AND EXHIBITS PROVIDED BY AECOM. NO CONSTRUCTION PLANS, LIMITED AS-BUILT PLANS, OR UTILITY LOCATION INFORMATION WAS PROVIDED TO AMT.
9. NAVD88=DCDPW-0.08' (+/-)
10. SOME INFORMATION FOR THE MAIN STORM DRAIN OUTFALL WAS TAKEN FROM A PLAN PREPARED BY MERESTONE CONSULTANTS INC, DATED APRIL 7, 2015, AND PROVIDED TO AMT BY AECOM.

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.
NAME:
LICENSE NO.: SARAH J. NAPIER
EXPIRATION DATE: PE905830
08/31/2018

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

OVERALL EXISTING CONDITIONS PLAN

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP / DATE: 01/27/17	ENGR.: SJN / SCALE: 1"=80'	CLASS
						FIGURE 4-1		REV. NEW

REV. NEW

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Appendix A
Hydrologic, Hydraulic and Pollutant Load Analysis Report

Prepared for:
Pepco
Washington, D.C.

Prepared by:
AECOM
Beltsville, Maryland
January 2017

HYDROLOGIC AND HYDRAULIC AND POLLUTANT LOAD ANALYSIS REPORT (FINAL)

Benning Road Facility
3400 Benning Road, NE
Washington, DC 20019

Hydrologic, Hydraulic and Pollutant Load Analysis Report (FINAL)

Benning Road Facility

3400 Benning Road, NE

Washington, DC 20019

PREPARED FOR:

Potomac Electric Power Company
701 9th Street, NW
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January 2017

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HYDROLOGIC, HYDRAULIC AND POLLUTANT LOAD ANALYSIS REPORT
(FINAL)

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Acronyms

AMEC	AMEC Foster Wheeler
BMPs	best management practices
cfs	cubic feet per second
EPA	Environmental Protection Agency
GIS	Geographic Information System
IDF	Intensity Duration Frequency
LID	Low Impact Development
NAVD 88	North American Vertical Datum of 1988
NCRS	Natural Resources Conservation Service
NOAA	National Oceanic and Atmosphere Administration
NPDES	National Pollutant Discharge Elimination System
OCTO	Office of the Chief Technology Officer
Pepco	Potomac Electric Company
RCN	Runoff Curve Number

SCS	Soil Conservation Service
SWMM 5.1	Storm Water Management Model version 5.1

1 INTRODUCTION AND PURPOSE

AECOM performed a hydrologic, hydraulic and pollutant load analysis for the Potomac Electric Company (Pepco) Benning Road Facility (the Site) in preparation for the design of a stormwater treatment system aimed at removing metals from site runoff in accordance with the facility's 2009 National Pollutant Discharge Elimination System (NPDES) permit requirements.

The results of this modeling will be used to identify the various treatment measures that will comprise the overall treatment system and estimate the anticipated impacts of these measures on the discharge to the Anacostia River. The treatment measures will be added to the model during design to evaluate their effects on the discharge to the Anacostia.

The model for the Pepco facility was developed using the Environmental Protection Agency's Storm Water Management Model version 5.1 (EPA-SWMM 5.1; EPA, 2015). Data used for modeling included spatial data provided by Pepco, current Geographic Information System (GIS) datasets from the Washington, DC Office of the Chief Technology Officer (OCTO), and precipitation data from the National Oceanic and Atmosphere Administration (NOAA) Atlas 14. The total drainage area for the site is 77.5 acres, of which approximately 40 acres (52 percent) are impervious. Stormdrain discharge data collected during two 28 July 2016, and 21 August 2016 was used to calibrate the model developed for this study. The analytical data collected as a part of the seven sampling events from September 2015 through August 2016 was used as the event mean concentration to analyze the metal concentrations in the stormwater runoff at the site.

The model was created for the entire Site to allow flexibility to accommodate additional data availability in the future and design modifications as needed. Although the entire facility is represented in the model, the model currently only accounts for flows at the specific hotspot areas identified during the field investigation (as discussed in the AECOM 2016 Conceptual Design Report). Proposed treatment measures will be modeled in the future as storage areas with storage volumes and ratings curves based on the specifications from the manufacturers of the treatment system components.

2 SITE DATA

After reviewing project requirements, and understanding the project goals and objectives, specific data needs for this modeling effort were identified and collected. The data sets used in the hydrologic and hydraulic modeling are described in this section.

2.1 Topography

Surveyed topographic data was provided by Pepco for the main stormdrain line, the western portion of the facility, where the demolished power plant once was and the southeast portion of the facility where the transformer test shop and Kenilworth Office Building and Building 57 are located. The vertical datum for this survey is the District of Columbia Department of Public Works datum, which is approximately 0.08 foot above the North American Vertical Datum 1988 (NAVD 88). The District of Columbia OCTO provided a 2-foot contour topographic GIS shapefile. The vertical datum for the topographic data is NAVD 88. The National Elevation Dataset 1-meter raster from the U.S. Geologic Survey was downloaded for the site, and is also in NAVD 88. The topographic data were used to modify the drainage basin divides provided by AMEC Foster Wheeler (AMEC), and to calculate flow paths. Two changes were made to the drainage areas provided by AMEC that modified the drainage areas for the effected basins by less than 10 percent. Several of the drainage areas were also split into sub-basins to provide flows at focus design areas. A detailed description of the drainage basin delineation is provided in Section 4.

2.2 Soil Data

The Natural Resources Conservation Service (NCRS) soil survey geographic database (NRCS, 2009) was used to obtain GIS soil data coverage for the facility drainage area.

2.3 Impervious Cover

The AutoCAD data for the western and southeastern portion of the facility included information related to impervious cover (e.g., building and roads) and a preliminary impervious cover analysis was performed as part of the remedial investigation/feasibility study (RI/FS) performed by AECOM (2015). The District of Columbia OCTO also provided an impervious cover GIS shapefile that includes the facility area. The impervious cover was updated using 2015 aerial imagery and data collected during the field investigation. The facility impervious area has decreased due to the demolition of buildings and replacing asphalt areas with loose gravel over time. Compacted gravel (e.g., roads) has a hydrologic response of an impervious surface; however, loose gravel has a hydrologic response more closely resembling a pervious surface. Changes to documented impervious area are discussed in Section 4 of this report.

2.4 Land Cover for Pervious Areas

The land cover for the pervious areas at the facility was estimated based on aerial imagery and photographs from the field investigation. This information is required to estimate the pervious curve number, pervious depression storage, and the pervious Manning Roughness Coefficient (Manning's n).

2.5 Curve Number and Manning's Roughness Coefficient

Rainfall infiltration losses were estimated using the Soil Conservation Service (SCS) Runoff Curve Number (RCN) method, which is a function of land use and soil type. The hydrologic method selected for this study calculates infiltration for pervious and impervious areas separately assuming that the impervious areas do not contribute any infiltration losses; therefore, the RCN values are for pervious areas only. Each of the pervious land cover categories has a different RCN value depending on the hydrologic soil group classification of the land, shown in Table 2-1. The pervious Manning's n was estimated based on the pervious cover, and a single assumed roughness coefficient was used for the impervious Manning's n.

Table 2-1: Pervious Cover Types and Corresponding RCN Values

Cover Type	Soil Type/ RCN				Manning's Roughness Coefficient
	A	B	C	D	
"Poor Condition" Open Space (grass cover <50%)	68	79	86	89	0.15
"Fair Condition" Open Space (grass cover 50% to 75%)	49	69	79	84	0.24
"Good Condition" Open Space (grass cover >75%)	39	61	74	80	0.24
Gravel	76	85	89	91	0.05
Impervious Area	Not Applicable: EPA-SWMM calculates impervious and pervious areas separately, and assumes there is no infiltration for impervious areas.				0.011

2.6 Spatial Location of Storm Drain Features

The locations of existing storm drain features were obtained from the detailed stormdrain survey conducted at the site for this study. The surveyed data was used for the inputs of storm drain features in the model. There were some stormdrain inlet locations which could not be accessed by the survey crew. The effects of lack of available data for these storm drain features instead of surveyed data on the hydrologic and hydraulic analysis are expected to be minimal. The surveyed information was checked with aerial imagery and information gathered from the field investigation, and simplified to meet the requirements of the hydrologic and hydraulic model.

2.7 Invert Elevations

Invert elevations for the main storm drain line were provided by Pepco via a sewer plan and profile created by Merestone Consultant, Incorporated in April 2015. The invert elevations along the main line (e.g., MH_33) were obtained from the survey data. The invert locations for storm drain features not located along the main storm drain lines were obtained from the survey conducted by AECOM for this project. Distances between features used for linear interpolation were calculated from the Merestone storm drain pipe geospatial data. Missing invert elevations of some lateral pipes not captured through the AECOM survey were extrapolated based on known invert elevations and the ground slope. The elevation provided for the main line farthest downstream was used at the outfall for the main line and is approximately 500 feet upstream of the Anacostia. The main line is relatively flat, with pipe slopes ranging from 0.2 to 2.3 percent, although there is a drop of approximately 6.16 feet from I_67 to I_37.

2.8 Lift Station and Oil/Water Separator

AECOM used data provided by Pepco for the lift station and oil/water separator to define the hydraulics of the combined system. Measured flow data at the lift station and oil/water separator were not provided. A schematic of the system and a cross section of inlet MP201 indicated that flow from the lift station is pumped to the oil/water separator, with overflow conveyed directly to MP201. The oil/water separator also discharges to MP201. Pepco indicated that the lift station can pump up to 500 gallons per minute to the oil/water separator. This flow rate is consistent with what would be expected from the two AFP 1042 M75 pumps located in the lift station.

2.9 Low Impact Development and Water Quality Devices

Information on the three Low Impact Development (LID) projects at the facility was provided in Appendix A of Pepco's 2011 Annual Report: "Benning Generating Station Low Impact Development and Best Management Practice Effectiveness Assessment." This included the contributing impervious drainage area and the LID feature geometry (e.g., surface dimensions and depth). Further information on the features was estimated from the field investigation.

Pepco provided AECOM with a section of the existing water quality device upstream of MP201 that collects runoff from drainage area 07. The cross section of this section and aerial imagery were used to estimate the geometry of the proposed device.

3 MODEL SELECTION

The hydraulic, hydrologic and pollutant load modeling was conducted using EPA-SWMM 5.1 (EPA, 2015). This was selected instead of other stormwater models (e.g., TR-55 or TR-20) because the facility is highly urbanized and EPA-SWMM 5.1 has the capability to model pollutant transport during storm events. EPA-SWMM calculates flow through storm drain pipes using the Hazen-Williams or Darcy-Weisbach equations for force mains, and the kinematic wave, hydrodynamic wave, or steady flow equations for non-pressurized flow. A site wide pollutant transport modeling was done using the event mean concentration (EMC) option of the EPA-SWMM. EPA-SWMM is also one of the preferred models of the EPA and is consistent with NPDES requirements. EPA-SWMM performs hydrologic calculations for drainage basins based on the geometry, slope, and land surface of each basin. For this study drainage basins will be referred to as drainage areas where they match previous Pepco basins, and as sub-basins where a drainage area is split to provide flows at focus design areas. The term drainage basins will be used to encompass the drainage areas and the sub-basins. The hydraulic calculations are performed based on the geometry of the storm drain system. Figure 3-1 displays the drainage map with 33 drainage areas, 12 sub-basins, 43 junctions, and 32 links modeled using EPA-SWMM.

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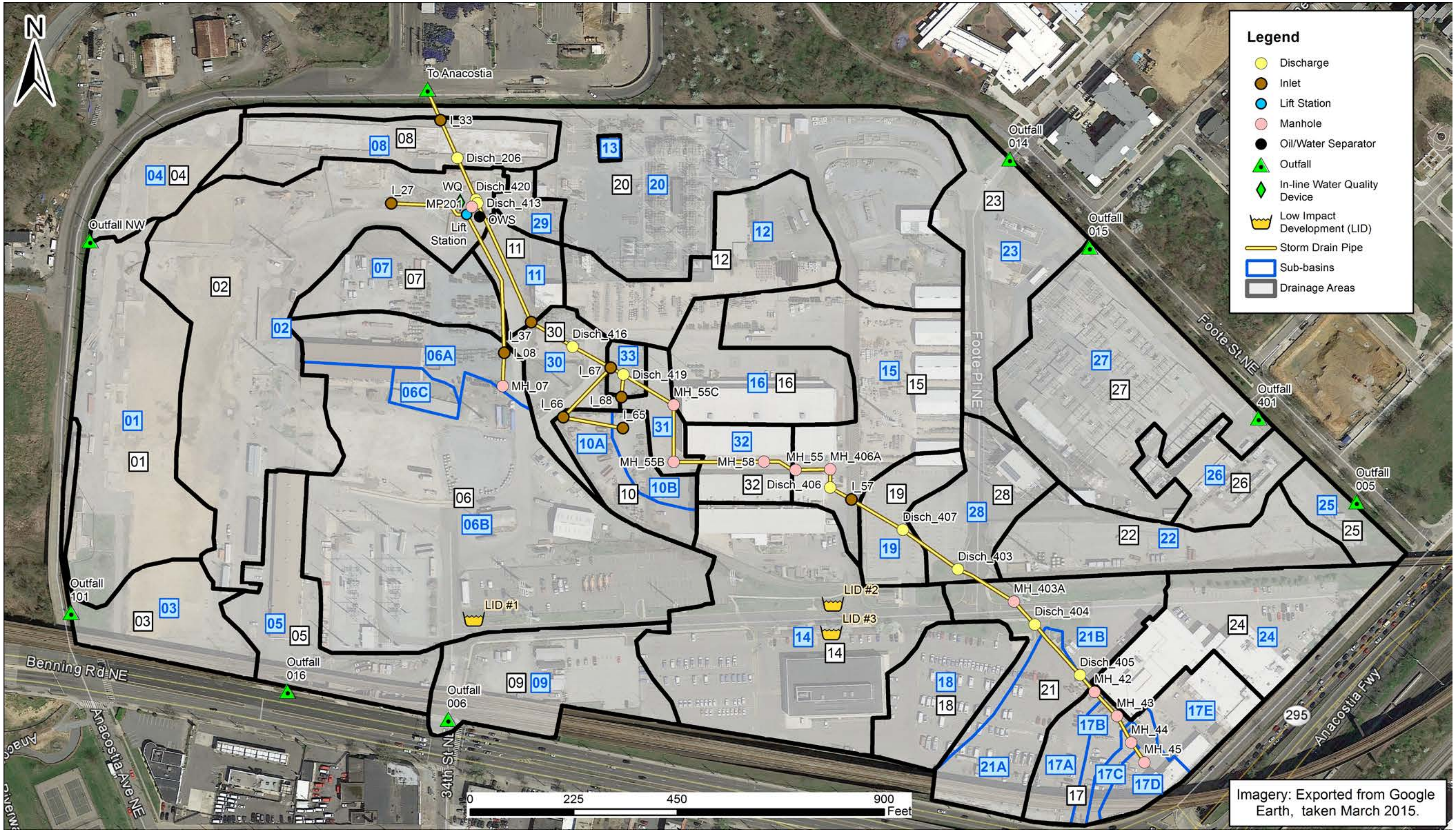

Figure 3-1: Pepco Benning Road Service Station Drainage Divide Map

4 WATERSHED PARAMETERS

EPA-SWMM is flexible modeling software with several options to model rainfall-runoff attributes. The modeling components were selected based on existing site conditions. The 24-hour Soil Conservation Service (SCS) rainfall distribution was used to model rainfall, the infiltration for pervious areas at the site was calculated using the SCS RCN methodology as described in the NRCS TR-55 manual (1986), the dynamic wave was used for routing in the storm drain pipes and the EMC function was used to calculate the pollutant washoff. The SCS rainfall distribution is considered to be a conservative estimate for rainfall and reasonable for design.

Hydrologic parameters required for the EPA-SWMM methodology selected include watershed-related parameters and precipitation data associated with design storms. Watershed-related input parameters include the RCN, depression storage, Manning's n, drainage area, percent imperviousness, slope, and the characteristic width. Pollutant load analysis input parameters include EMC for various metals in mg/l.

4.1 Drainage Area

The drainage basins (drainage areas and sub-basins), shown in Figure 3-1 were updated from the drainage areas provided by AMEC using existing elevation data from the survey conducted by AECOM in ArcGIS 10.1 (ESRI, 2012). Figure 4-1 compares the updated drainage areas with those previously documented for the facility. Boundary of 16 drainage areas was modified based on the location of storm drain inlets and the survey data such that they represent existing drainage conditions. Drainage areas 6, 10, and 17 and 21 were split into sub-basins to provide design flows at locations with potential for implementing BMPs to remove metals. Splitting these drainage areas provides flows at specific drainage areas of concern (e.g., the flow to a single catch basin with high concentrations of metals). It is often more cost effective to implement a small BMP for a specific area of concern than it is to treat a larger area that includes runoff that has low concentrations of contaminants.

The percent impervious cover for each drainage area and sub-basin was recalculated based on available data (discussed in Section 2). Table 4-1 provides a comparison of the drainage area and percent impervious cover calculated as part of this study with the values from the Malcolm Pirnie 2005 study updated by AMEC in September 2015. The sub-basin size and percent imperviousness were then input into the EPA-SWMM model for the hydrologic simulation.

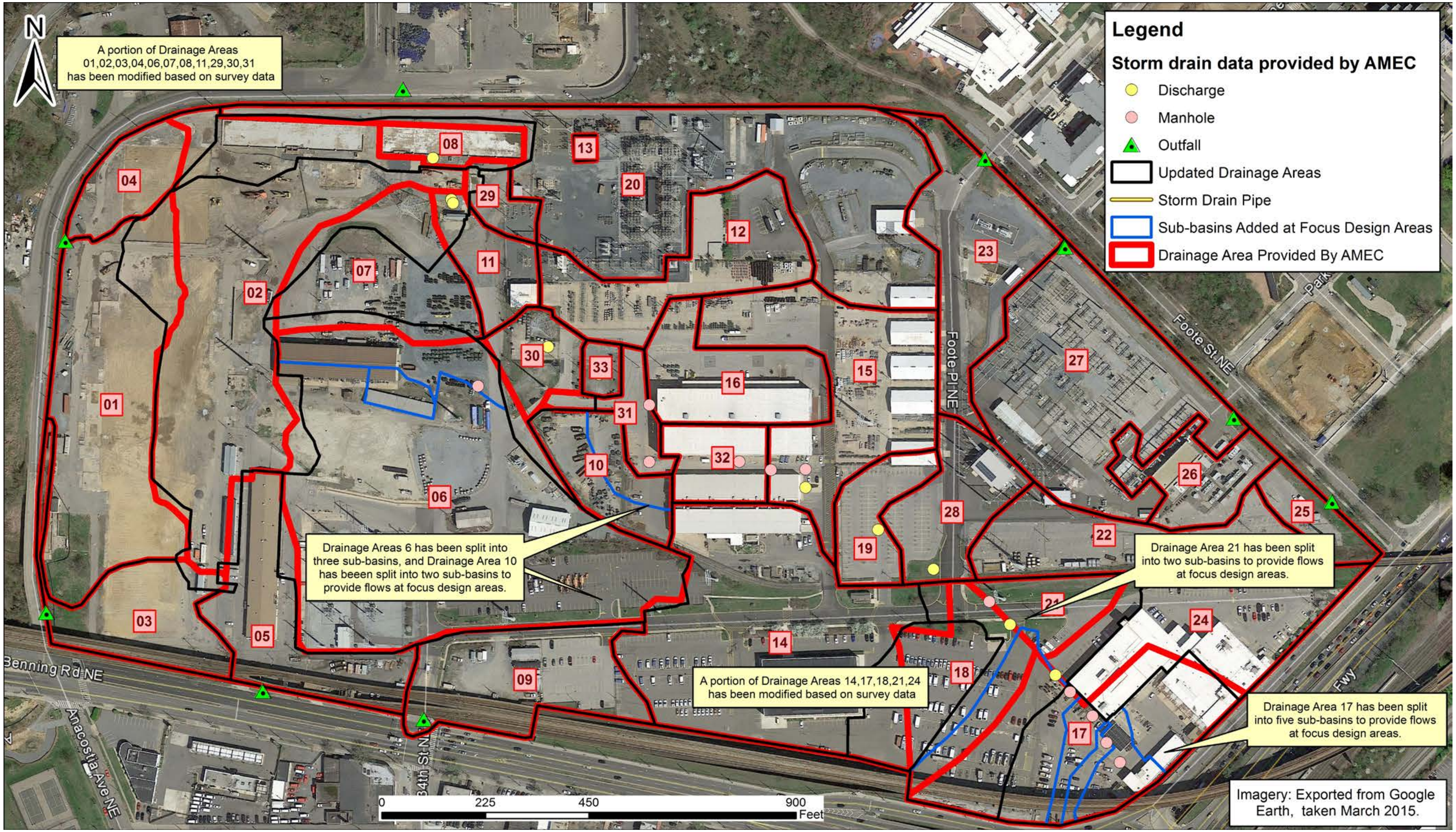

Figure 4-1: Pepco Benning Road Service Station Comparison with Previously Documented Drainage Areas

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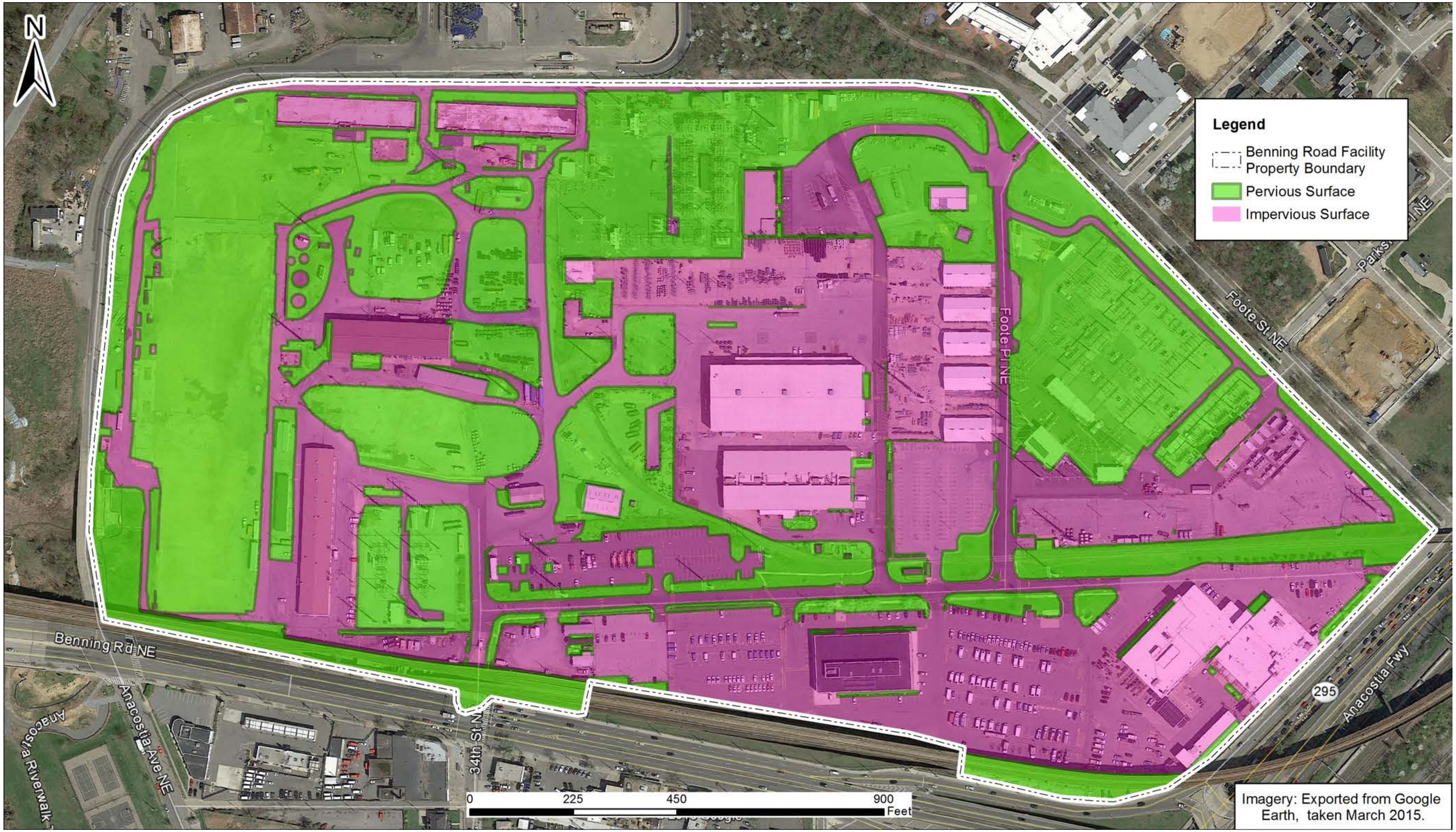

Figure 4-2: Site Pervious and Impervious Cover

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Table 4-1: Drainage Area and Impervious Cover

Updated Drainage Area and Impervious Cover			Drainage Area and Impervious Cover from Malcolm Pirnie, 2005 updated by AMEC September 2015[1]	
Drainage Area	**Area (Acres)**	**Percent Impervious (%)**	**Area (Acres)**	**Percent Impervious (%)**
Drainage Area 01	3.93	15.50%	6.99	Percent Impervious Not Provided.
Drainage Area 02	6.86	26.36%	6.45	
Drainage Area 03	1.63	10.93%	Drainage Area 1 was separated into three segments after 9/2015.	
Drainage Area 04	1.11	14.18%		
Drainage Area 05	2.04	73.39%	2.27	
Drainage Area 06	9.6	49.50%	9.59	70.50%
Sub-Basin 06A	*1.28*	62.07%	Not applicable, new sub-basin for focus design areas.	
Sub-Basin 06B	*8.19*	46.81%		
Sub-Basin 06C	*0.2*	*80.75%*		
Drainage Area 07	1.42	15.33%	2.33	20.90%
Drainage Area 08	1.84	61.83%	0.47	100.00%
Drainage Area 09	2.23	64.12%	2.27	99.80%
Drainage Area 10	1.18	40.30%	1.18	36.30%
Sub-Basin 10A	*0.76*	*27.72%*	*Not applicable, new sub-basin for focus design areas.*	
Sub-Basin 10B	*0.42*	*63.30%*		
Drainage Area 11	0.72	41.43%	0.88	72.40%
Drainage Area 12	2.27	83.60%	2.24	93.50%
Drainage Area 13	0.06	0.00%	0.06	0.00%

Updated Drainage Area and Impervious Cover			Drainage Area and Impervious Cover from Malcolm Pirnie, 2005 updated by AMEC September 2015[1]	
Drainage Area	**Area (Acres)**	**Percent Impervious (%)**	**Area (Acres)**	**Percent Impervious (%)**
Drainage Area 14	5.34	76.20%	6.14	88.60%
Drainage Area 15	3.35	98.40%	2.74	100.00%
Drainage Area 16	1.71	98.05%	2.34	100.00%
Drainage Area 17	2.39	82.66%	3.49	100.00%
Sub-Basin 17A	*0.6*	*74.87%*	*Not applicable, new sub-basin for focus design areas.*	
Sub-Basin 17B	*0.31*	*85.68%*		
Sub-Basin 17C	*0.16*	*77.84%*		
Sub-Basin 17D	*0.49*	*75.86%*		
Sub-Basin 17E	*0.83*	*92.10%*		
Drainage Area 18	1.47	91.55%	1.79	88.60%
Drainage Area 19	0.91	94.50%	0.9	96.60%
Drainage Area 20	6.69	23.18%	7.21	47.90%
Drainage Area 21	3.01	66.61%	0.8	38.10%
Sub-Basin 21A	*1.38*	*79.04%*	*Not applicable, new sub-basin for focus design areas.*	
Sub-Basin 21B	*1.63*	*56.09%*		
Drainage Area 22	2.17	77.62%	2.19	75.70%
Drainage Area 23	2.44	32.50%	2.42	77.60%
Drainage Area 24	2.52	77.23%	2.61	89.50%
Drainage Area 25	0.6	50.68%	0.59	66.90%

Updated Drainage Area and Impervious Cover			Drainage Area and Impervious Cover from Malcolm Pirnie, 2005 updated by AMEC September 2015[1]	
Drainage Area	**Area (Acres)**	**Percent Impervious (%)**	**Area (Acres)**	**Percent Impervious (%)**
Drainage Area 26	1.13	72.16%	1.12	94.00%
Drainage Area 27	4.35	14.79%	4.34	34.90%
Drainage Area 28	1.45	68.98%	1.48	97.30%
Drainage Area 29	0.34	24.04%	0.44	91.10%
Drainage Area 30	1.04	39.40%	0.76	58.80%
Drainage Area 31	0.48	97.90%	0.6	61.10%
Drainage Area 32	0.85	100.00%	0.86	100.00%
Drainage Area 33	0.23	0.19%	0.22	100.00%
Total	**77.49**	**52.00%**	**77.43**	*Unknown*

[1] AMEC updated the drainage areas for Drainage Area 1 and 2, and made no changes to the percent impervious.

4.2 Infiltration Parameters

Rainfall infiltration losses over pervious areas were estimated using the RCN. The RCN is used to represent drainage area properties including soil type and pervious cover type. No soil type is provided for the study area because it is on "Urban Land." It is reasonable to assume that Urban Land has been compacted extensively and behaves most similarly to hydrologic group D soils. Over 10 feet of gravel have been placed at the site of the demolished power plant (primarily in drainage areas 01, 02, 03, and 04), so the infiltration of pervious areas in this area is assumed to behave most similarly to hydrologic group A soils for the storm events modeled in this study. Table 4-2 provides the pervious RCN for each sub-basin. RCN is one of the calibration parameters and was used to calibrate the developed model based on the flow data collected during the storm events in July, 2016 and August 2016.

4.3 Depression Storage

Depression storage (also known as initial abstraction) is the surface storage of rainfall by interception, ponding, and surface wetting prior to infiltration or runoff. The impervious depression storage was selected using the SWMM manual recommendations (EPA, 2015) based on an ASCE publication, *Design and Construction of Urban Stormwater Management Systems* (1992). Depression storage for pervious areas was calculated using the method outlined in TR-55 (NRCS, 1986):

$$\boldsymbol{I_a = 0.2S}$$

$$\boldsymbol{S = \frac{1,000}{RCN} - 10}$$

where I_a is the initial abstraction / depression storage (inches), and S is the potential maximum retention after runoff beings (inches). Since initial abstraction is depending on the runoff curve number, this is also one of the parameters that were modified during the calibration of the model.

4.4 Hydrograph Parameters

EPA-SWMM assumes drainage basins can be approximated as rectangles with a single characteristic width and slope. These two parameters, along with the pervious and impervious Manning's n values, were used to route rainfall runoff to the drainage basin outlet. The characteristic width was calculated by dividing the areas by the longest overland flow path within the drainage basin. Overland flow ends when a flow path either enters a storm drain system or channel, so the overland flow paths ended when entering the existing storm drain system.

Up to five representative flow paths were calculated for each drainage basin based on significant changes in flow path length. The maximum overland flow path was found for each drainage basin, and the characteristic width was calculated by dividing the drainage basin area by the maximum overland flow path. Flows were calculated for specific storms using the Rational Method; however, it is not advisable to calibrate one model using the uncalibrated results of another model, particularly if the existing model is less sophisticated.

The upstream and downstream elevations for each representative flow path were calculated based on available data. A slope was calculated by dividing the change in elevation by the length of each flow path. The approximate drainage area was calculated for each representative flow path found in drainage basin, and an area weighted catchment slope was calculated.

The Manning's n values for pervious and impervious areas are used to estimate the travel time of runoff within a drainage basin in EPA-SWMM. The pervious Manning's n was estimated based on the pervious ground cover in each drainage basin, and a single value was assumed for all impervious cover. Table 4-2 provides the depression storage and Manning's n for each sub-basin.

4.5 Low Impact Development

The three LID projects at the facility were included in the model using the EPA-SWMM LID Controls. The LID Controls route a portion of impervious runoff from a sub-basin to a selected LID and store or route the runoff based on the LID geometry.

Table 4-3 summarizes the LID information input into EPA-SWMM.

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Table 4-2: Hydrologic Parameters for Sub-Basins

Drainage Basin ID	Downstream Junction	Area (acres)	Percent Impervious (%)	Characteristic Width (feet)	Slope (%)	Pervious Runoff Curve Number	Pervious Depression Storage (inches)[1]	Pervious Manning Roughness Coefficient[2]
Drainage Area 01	Outfall 101	3.93	15.5	679	2.89	76	0.63	0.05
Drainage Area 02	I_27	6.86	26.36	784	1.96	76	0.63	0.05
Drainage Area 03	Outfall 101	1.63	10.93	222	2.9	76	0.63	0.05
Drainage Area 04	Outfall NW	1.11	14.18	237	2.54	76	0.63	0.05
Drainage Area 05	Outfall 016	2.04	73.39	275	1.12	89	0.25	0.15
Sub-Basin 06A	I_08	1.28	62.07	396	1.73	84	0.38	0.24
Sub-Basin 06B	MH_07A	8.18	46.81	575	2.25	84	0.38	0.24
Sub-Basin 06C	MH_07A	0.2	80.75	185	0.05	84	0.38	0.24
Drainage Area 07	WQ1	1.42	15.33	232	0.15	89	0.25	0.15
Drainage Area 08	Disch_206	1.84	61.83	341	0.23	89	0.25	0.15
Drainage Area 09	Outfall 006	2.23	64.12	173	2.26	80	0.5	0.24
Sub-Basin 10A	I_66	0.76	27.72	83	1.22	89	0.25	0.15
Sub-Basin 10B	I_65	0.42	63.3	80	2.66	89	0.25	0.15
Drainage Area 11	Disch_413	0.72	41.43	203	0.54	89	0.25	0.15
Drainage Area 12	Disch_416	2.27	83.61	404	1.63	89	0.25	0.15
Drainage Area 13	I_33	0.06	0	36	1	89	0.25	0.15
Drainage Area 14	Disch_406	5.34	76.2	806	2	80	0.5	0.24
Drainage Area 15	I_57	3.35	98.4	476	1.05	89	0.25	0.15
Drainage Area 16	MH_55C	1.71	98.05	511	1.52	89	0.25	0.15
Sub-Basin 17A	MH_42	0.6	74.87	107	1.27	89	0.25	0.15

Drainage Basin ID	Downstream Junction	Area (acres)	Percent Impervious (%)	Characteristic Width (feet)	Slope (%)	Pervious Runoff Curve Number	Pervious Depression Storage (inches)[1]	Pervious Manning Roughness Coefficient[2]
Sub-Basin 17B	MH_43	0.31	85.68	59	1.41	89	0.25	0.15
Sub-Basin 17C	MH_44	0.16	77.84	36	1.47	89	0.25	0.15
Sub-Basin 17D	MH_45	0.49	75.86	121	1.2	89	0.25	0.15
Sub-Basin 17E	MH_45	0.83	92.1	290	1.87	89	0.25	0.15
Drainage Area 18	Disch_404	1.47	91.55	175	1.36	80	0.5	0.24
Drainage Area 19	I_57	0.91	94.52	160	1.73	80	0.5	0.24
Drainage Area 20	I_33	6.69	23.18	228	0.55	89	0.25	0.15
Sub-Basin 21A	Disch_404	1.38	79.04	139	1.16	80	0.5	0.24
Sub-Basin 21B	Disch_404	1.63	56.09	227	4.66	80	0.5	0.24
Drainage Area 22	Disch_403	2.17	77.62	166	0.65	80	0.5	0.24
Drainage Area 23	Outfall 014	2.44	32.54	231	1.28	80	0.5	0.24
Drainage Area 24	Disch_405	2.52	77.23	369	0.72	80	0.5	0.24
Drainage Area 25	Outfall 005	0.6	50.68	155	0.24	80	0.5	0.24
Drainage Area 26	Outfall 401	1.13	72.16	142	0.83	89	0.25	0.15
Drainage Area 27	Outfall 015	4.35	14.79	289	1.29	89	0.25	0.15
Drainage Area 28	Disch_407	1.45	68.98	260	2.1	80	0.5	0.24
Drainage Area 29	Disch_413	0.34	24.04	110	1.35	89	0.25	0.15
Drainage Area 30	I_37	1.04	39.4	221	1.08	89	0.25	0.15
Drainage Area 31	I_68	0.48	97.9	85	2.76	89	0.25	0.15
Drainage Area 32	MH_58	0.85	100	378	0.36	89	0.25	0.15
Drainage Area 33	I_67	0.23	0.19	106	1.71	89	0.25	0.15

[1]The impervious depression storage was assumed to be 0.08 inch based on the EPA-SWMM 5.1 Manual (2015)
[2] The impervious Manning's Roughness Coefficient (Manning's n) was assumed to be 0.011 based on the EPA-SWMM 5.1 Manual (2015) and the NRCS TR-55 Manual (1986)

Table 4-3: Low Impact Development (LID) Parameters

LID Name	LID Type[1]	EPA-SWMM LID Type	Surface Area (square feet)	Width of LID (feet)	Thickness of Filter Media (inches)	Contributing Impervious Area (Acres)	Sub-Basin	Basin Impervious Area (Acres)	Percent of Overall Sub-Basin Impervious Area Treated
LID 1	Bioswale	Bioretention	845	6.5	30	0.298	Sub-Basin 6B	3.83	7.87%
LID 2	Rain Garden	Bioretention	630	18	39	0.097	Drainage Area 15	3.30	2.94%
LID 3	Infiltration Bed	Infiltration Trench	8,392	10[2]	24[3]	0.256	Drainage Area 16	1.67	15.32%

[1] As described in Appendix A of the Pepco 2011 Annual Report: "Benning Generating Station Low Impact Development and Best Management Practice Effectiveness Assessment."
[2] Estimated based on aerial imagery and field investigation.
[3] The depth of filter media for LID 3 was not provided, so a conservative estimate of 24 inches was assumed.

4.6 Precipitation Data

Precipitation data used as input in the EPA-SWMM model include rainfall intensities from NOAA's Atlas 14 Precipitation Data Rainfall Intensity Duration Frequency (IDF) Curves. The rainfall depths for the 1-, 2-, 5-, 10-, and 15-year rainfall events were used to calculate the discharges during the 100-, 50-, 20-, 10-, and 7-percent-annual-chance events, respectively. The computed values from NOAA are shown in Table 4-4. The Type II SCS 24-hour rainfall distribution is a widely accepted conservative estimate for precipitation suitable for design. The SCS storm hyetographs were created using Autodesk Storm and Sanitary Analysis with a time interval of 6 minutes and exported to SWMM. A 1 inch storm was used to approximate the flow associated with the first flush.

Table 4-4: 24-Hour Duration Rainfall Depths

Return Period	NOAA Atlas 14 24-Hour-Depth, inches
1-year	2.61
2-year	3.15
5-year	4.05
10-year	4.84
15-year	5.30

4.7 Existing Water Quality Device

The water quality device upstream of MP201 is an underground concrete hydrodynamic separator with three separate storage areas connected by a series of weirs and orifices. A rating curve was not available for the water quality device, so it was modeled as three separate storage areas connected by two weirs and two orifices using the cross section provided by Pepco. Runoff flows from the device to MP201 via a 21-inch reinforced concrete pipe.

4.8 Hydraulic Routing Parameters

The runoff hydrographs from the drainage basins were devised to route flow either directly to an outfall (e.g., drainage area 05 and drainage area 23) or to a junction connected to the existing site storm drain system. Flow within the storm drain system was routed using the dynamic wave to the appropriate outfall. Table 4-5 provides a summary of the junction geometry used for this model, and Table 4-6 provides a summary of the storm drain pipe geometry. Based on the field investigation, it was assumed that when nodes overflow the water would pond over the node and re-enter the system once the hydraulic grade line dropped. This ponding would actually occur either at inlets or farther upstream in the watershed, but for modeling purposes was assumed to occur at the nodes. Free outfall boundary conditions were assumed, which would accommodate the minimum critical flow depth and the normal flow depth of the upstream conduits.

Table 4-5: Junction Invert Elevations and Rim Elevations

Junction Name	Invert Elevation (local datum, feet)	Rim Elevation (local datum, feet)
Anacostia River	0.6	16.7
Disch_206	1.81	15.42
Disch_403	19.05	12.74
Disch_404	21.06	7.36
Disch_405	22.1	8.43
Disch_406	16.09	9.73
Disch_407	17.65	8.68
MH_55C	12.7	9.79
Disch_413	2.98	14.25
Disch_416	11.57	7.51
Disch_419	12.36	7.47
Disch_420	2.87	14.36
Lift Station	4.72	12.08
MH_07A	11.12	9.64
I_08	11.05	7.35
I_33	0.75	16.48
I_37	6.06	11.19
MH_42	22.4	7.98
I_57	16.42	8.48
MH_58	14.8	12.1
I_67	12.22	6.88
MH_403A	20.5	8.94
MH_406A	15.84	10.67
MH_55B	13.85	11.41
MP201	3.29	12.82
OWS	0	0
I_66	17.99	3.5
I_65	18.77	2.63
MH_43	22.88	8.23
MH_44	23.29	8.36
MH_45	23.65	7.1
I_68	16.27	4.5
MH_55	15.4	12.37
I_27	5.87	10

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Table 4-6: Storm Drain Pipe Geometry Summary

Storm Drain Name	Upstream Junction	Downstream Junction	Invert Elevation (local datum feet)		Pipe Length (feet)	Pipe Diameter (inches)	Manning's n
			Upstream	Downstream			
Link_01	I_33	To_Anacostia River	0.75	0.62	74	54	0.012
Link_02	Disch_206	I_33	1.81	0.75	90	54	0.012
Link_03	Disch_420	Disch_206	2.87	1.81	99	54	0.012
Link_04	Disch_413	Disch_420	2.98	2.87	8	54	0.012
Link_06	I_37	Disch_413	6.06	2.98	284	54	0.012
Link_07	Disch_416	I_37	11.57	6.06	105	48	0.012
Link_08	I_67	Disch_416	12.22	11.57	94	48	0.012
Link_09	Disch_419	I_67	12.36	12.22	31	48	0.012
Link_10	MH_55C	Disch_419	12.7	12.36	128	48	0.012
Link_11	MH_55B	MH_55C	13.85	12.7	124	48	0.012
Link_12	MH_58	MH_55B	14.8	13.85	196	48	0.012
Link_13	MH_406A	MH_55	15.84	15.4	75	48	0.012
Link_14	Disch_406	MH_406A	16.09	15.84	40	48	0.012
Link_15	I_57	Disch_406	16.42	16.09	53	48	0.012
Link_17	Disch_407	I_57	17.65	16.42	130	48	0.012
Link_18	Disch_403	Disch_407	19.05	17.65	147	54	0.012
Link_19	MH_403A	Disch_403	20.5	19.05	141	54	0.012
Link_20	Disch_404	MH_403A	21.06	20.5	67	48	0.012
Link_21	Disch_405	Disch_404	22.1	21.06	148	48	0.012
Link_22	MH_42	Disch_405	22.4	22.1	49	48	0.012
Link_23	MP201	Disch_420	3.29	2.87	18	33	0.012
Link_25	MH_07A	I_08	11.12	11.05	71	18	0.012
Link_26	I_08	Lift Station	11.05	4.72	319	18	0.012
Link_27	I_66	I_67	17.99	12.22	150	12	0.024
Link_28	I_65	I_66	18.77	17.99	132	8.4	0.011
Link_29	MH_43	MH_42	22.88	22.4	71	48	0.012
Link_30	MH_44	MH_43	23.29	22.88	65	48	0.012
Link_31	MH_45	MH_44	23.65	23.29	51	48	0.012
Link_32	I_68	Disch_419	16.27	12.36	49	12	0.012
Link_33	MH_55	MH_58	15.4	14.8	74	48	0.012
Link_34	I_27	Lift Station	5.87	4.72	174	30	0.012
Link-06	WQ3	MP201	6	3.29	2.61	21	0.012

4.9 Calibration of the Model

Flow data was collected at some locations at the facility on July 28, 2016 and August 21, 2016 storm events. The hourly precipitation data for the two storm events at Washington/Ronald Reagan National Airport was obtained from NOAA's Quality Controlled Local Climatological Data (QCLCD). The August 21, 2016 storm event was selected for calibrating the SWMM model and the July 28, 2016 event was used to verify the results from calibrating the mode. Table 4-7 shows the precipitation data obtained from QCLCD to calibrate the model.

Table 4-7: Precipitation Data for Calibration

Event	Precipitation Data Obtained from QCLCD at Washington/Ronald Reagan Airport (inches)
July 28, 2016	0.27
August 21, 2016	0.69

The parameters that were modified for calibration are the RCN and the corresponding depression storage on pervious area inputs based on the highly urban setting of the site. Table 4-8 shows the modified runoff curve numbers and the depression storage parameters that were input in the model.

Table 4-8: Calibrated Parameters

Drainage Area	Runoff Curve Number After Calibration	Depression Storage on Pervious Areas After Calibration
Drainage Area 01	84	0.38
Drainage Area 02	84	0.38
Drainage Area 03	84	0.38
Drainage Area 04	84	0.38
Drainage Area 05	98	0.04
Sub-Basin 6A	92	0.17
Sub-Basin 6B	92	0.17
Sub-Basin 6C	92	0.17
Drainage Area 07	98	0.04
Drainage Area 08	98	0.04
Drainage Area 09	88	0.27
Sub-Basin 10A	98	0.04
Sub-Basin 10B	98	0.04
Drainage Area 11	98	0.04
Drainage Area 12	98	0.04
Drainage Area 13	98	0.04
Drainage Area 14	88	0.27
Drainage Area 15	98	0.04

Drainage Area	Runoff Curve Number After Calibration	Depression Storage on Pervious Areas After Calibration
Drainage Area 16	98	0.04
Sub-Basin 17A	98	0.04
Sub-Basin 17B	98	0.04
Sub-Basin 17C	98	0.04
Sub-Basin 17D	98	0.04
Sub-Basin 17E	98	0.04
Drainage Area 18	88	0.27
Drainage Area 19	88	0.27
Drainage Area 20	98	0.04
Sub-Basin 21A	88	0.27
Sub-Basin 21B	88	0.27
Drainage Area 22	88	0.27
Drainage Area 23	88	0.27
Drainage Area 24	88	0.27
Drainage Area 25	88	0.27
Drainage Area 26	98	0.04
Drainage Area 27	98	0.04
Drainage Area 28	88	0.27
Drainage Area 29	98	0.04
Drainage Area 30	98	0.04
Drainage Area 31	98	0.04
Drainage Area 32	98	0.04
Drainage Area 33	98	0.04

The calibrated model was run for the August 21, 2016 storm event and the model results were compared with the sampled flow data at three locations i.e. at MH_66, and I_27. The calibrated model was compared to the flow data collected at MH_66 on July 28, 2016. Because the storm events used for calibration are events with less than 1-inch rainfall, the discharges produced are low, which is consistent with the sampled data.

Table 4-9: Comparison of EPA SWMM Flows and the Sampled Flows

Location	August 21, 2016		July 28, 2016	
	EPA-SWMM Flow (cfs)	Sampled Flow (cfs)	EPA-SWMM Flow (cfs)	Sampled Peak (cfs)
MH_66	0.39	0.42	0.12	0.13
I_27	0.83	0.64	N/A	N/A

4.10 Pollutant Load Analysis Input

The EMC function was selected in the SWMM model to simulate the pollutant washoff during a storm event. The EMC data in mg/l was obtained from the storm sample data collected at different locations at the site for seven storm events from September 2015 through August 2016. The collected storm sample data was analyzed for total and dissolved concentration of cadmium, copper, iron, lead, nickel and zinc. The samples were also analyzed for total suspended solids (TSS). The concentrations of the analyzed metals and TSS were reported in mg/l. Instanced where the concentration of the metal was listed as “analyte not detected above a certain concentration” a concentration which is equal to half of the analyzed values was assumed. A median and a maximum value of the analyzed concentration data was computed and input in the SWMM model for each drainage basin where the samples were taken. For the drainage basins where the sample data was not collected, an EMC value of 0 was entered. The equation below shows the washoff rate that the model uses for the pollutant analysis.

$$W = C_1 * Q^{C2}$$

Where W is rate of washoff, C_1 is the washoff coefficient which is the EMC in mg/l, Q is the runoff rate in cubic feet per second and C_2 is washoff exponent which is equal to 1. Table 4-10 and Table 4-11 below provides the EMC data used for each drainage basin in the model.

Table 4-10: Median Event Mean Concentration Data

Pollutant	Washoff Coefficient or Event Mean Concentration (mg/l), C1													Washoff Exponent, C2
	Total Cadmium	Dissolved Cadmium	Total Copper	Dissolved Copper	Total Iron	Dissolved Iron	Total Lead	Dissolved Lead	Total Nickel	Dissolved Nickel	Total Zinc	Dissolved Zinc	Total Suspended Solids	
Drainage Area 01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 02	0.00075	0.00138	0.02863	0.0075	2.31	0.04	0.01025	0.005	0.04525	0.019	0.1145	0.0145	56.7	1
Drainage Area 03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 06A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 06B	0.00138	0.00138	0.01863	0.00813	2.825	0.02625	0.027	0.005	0.02	0.014	0.1858	0.01	69.8	1
Sub-Basin 06C	0.0025	0.00175	0.0125	0.0125	1.06	0.0375	0.005	0.00325	0.02	0.012	0.3635	0.168	17.9	1
Drainage Area 07	0.0025	0.0025	0.049	0.0125	1.4	0.05	0.017	0.005	0.02	0.02	0.28	0.038	140	1
Drainage Area 08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 10A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 10B	0.0025	0.0025	0.096	0.034	0.49	0.05	0.11	0.01	0.02	0.02	0.32	0.2	24	1
Drainage Area 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 12	0.00025	0.00025	0.02475	0.00458	1.145	0.0025	0.0595	0.005	0.01075	0.005	0.2475	0.0705	22.75	1
Drainage Area 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 16	0.00025	0.00025	0.0025	0.0025	0.17	0.0025	0.005	0.005	0.005	0.005	0.11	0.083	7.6	1
Sub-Basin 17A	0.0025	0.001	0.053	0.0125	3.1	0.05	0.04	0.005	0.02	0.02	0.44	0.071	60	1
Sub-Basin 17B	0.00238	0.00158	0.03238	0.012	2.045	0.043	0.0275	0.005	0.02	0.01625	0.2875	0.0695	71	1
Sub-Basin 17C	0.0025	0.0025	0.024	0.0125	0.69	0.05	0.015	0.005	0.02	0.02	0.15	0.055	50	1
Sub-Basin 17D	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 17E	0.00118	0.00081	0.00993	0.008	0.04375	0.03125	0.00188	0.00188	0.00688	0.00688	0.1456	0.1378	4.28	1
Drainage Area 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 21A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 21B	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Pollutant	Washoff Coefficient or Event Mean Concentration (mg/l), C1													Washoff Exponent, C2
	Total Cadmium	Dissolved Cadmium	Total Copper	Dissolved Copper	Total Iron	Dissolved Iron	Total Lead	Dissolved Lead	Total Nickel	Dissolved Nickel	Total Zinc	Dissolved Zinc	Total Suspended Solids	
Drainage Area 27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 31	0.002	0.001	0.087	0.0117	1.33	0.05	0.159	0.00563	0.02	0.02	0.43	0.065	34	1
Drainage Area 32	0.001	0.001	0.0181	0.00425	0.51	0.1	0.0124	0.01	0.02	0.02	0.195	0.0792	0	1
Drainage Area 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4-11: Maximum Event Mean Concentration Data

Pollutant	Washoff Coefficient or Event Mean Concentration (mg/l), C1													Washoff Exponent, C2
	Total Cadmium	Dissolved Cadmium	Total Copper	Dissolved Copper	Total Iron	Dissolved Iron	Total Lead	Dissolved Lead	Total Nickel	Dissolved Nickel	Total Zinc	Dissolved Zinc	Total Suspended Solids	
Drainage Area 01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 02	0.0025	0.005	0.111	0.0144	14.8	0.25	0.123	0.01	0.191	0.0288	0.42	0.028	655	1
Drainage Area 03	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 04	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 05	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 06A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 06B	0.004	0.016	0.1	0.038	9	0.748	0.22	0.01	0.156	0.021	2.9	2.6	560	1
Sub-Basin 06C	0.003	0.0025	0.028	0.014	3.34	0.05	0.025	0.005	0.039	0.02	0.548	0.349	166	1
Drainage Area 07	0.0025	0.0025	0.049	0.0125	1.4	0.05	0.017	0.005	0.02	0.02	0.28	0.038	140	1
Drainage Area 08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 10A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 10B	0.0025	0.0025	0.096	0.034	0.49	0.05	0.11	0.01	0.02	0.02	0.32	0.2	24	1
Drainage Area 11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 12	0.00025	0.00025	0.046	0.0072	2	0.0025	0.15	0.005	0.014	0.005	0.43	0.092	26	1
Drainage Area 13	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 16	0.00025	0.00025	0.0025	0.0025	0.17	0.0025	0.005	0.005	0.005	0.005	0.11	0.083	7.6	1
Sub-Basin 17A	0.0053	0.0025	0.2	0.05	7.55	0.1	0.13	0.01	0.02	0.02	1.5	0.14	340	1

Pollutant	Washoff Coefficient or Event Mean Concentration (mg/l), C1													Washoff Exponent, C2
	Total Cadmium	Dissolved Cadmium	Total Copper	Dissolved Copper	Total Iron	Dissolved Iron	Total Lead	Dissolved Lead	Total Nickel	Dissolved Nickel	Total Zinc	Dissolved Zinc	Total Suspended Solids	
Sub-Basin 17B	0.00475	0.0025	0.206	0.016	13	0.1	0.223	0.01	0.0363	0.02	2.06	0.14	511	1
Sub-Basin 17C	0.0025	0.0025	0.033	0.0125	1.9	0.05	0.016	0.005	0.02	0.02	0.17	0.079	80	1
Sub-Basin 17D	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 17E	0.0025	0.0025	0.04	0.035	0.192	0.05	0.005	0.005	0.02	0.02	0.48	0.37	10	1
Drainage Area 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 19	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 21A	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub-Basin 21B	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 23	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 25	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 27	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage Area 31	0.0025	0.0025	0.24	0.054	7.5	0.1	0.7	0.012	0.04	0.02	1.2	0.27	730	1
Drainage Area 32	0.001	0.001	0.0181	0.00425	0.51	0.1	0.0124	0.01	0.02	0.02	0.195	0.0792	0	1
Drainage Area 33	0	0	0	0	0	0	0	0	0	0	0	0	0	0

5 SUMMARY OF RESULTS

5.1 Sub-Basin and Node Results

Results of the hydrologic simulations for each drainage basin are summarized in Table 5-1. Results of the EPA-SWMM model are reported by drainage basin name. **Attachment A** summarizes the peak flows and elevations at nodes, and **Attachment B** displays the profile of the main storm drain line for each of the storm events. Results of the site wide pollutant loads for the 5 storm events are provided in Table 5-2. Pollutant Loads per individual drainage basins and links is provided in **Attachment D**. The locations of the drainage areas, sub-basins, junctions, and outfalls are shown in Figure 3-1.

Table 5-1: Summary of Hydrologic Analysis

Drainage Basin Name	Drainage Area (acres)	Peak Storm Event Flows (cubic feet per second)					
		1-inch	1-year	2-year	5-year	10-year	15-year
Drainage Area 01	3.93	0.84	6.68	9.83	15.21	19.55	22.09
Drainage Area 02	6.86	2.46	10.89	15.98	25.20	32.56	36.81
Drainage Area 03	1.63	0.25	2.49	3.67	5.77	7.55	8.58
Drainage Area 04	1.11	0.22	1.93	2.87	4.38	5.61	6.33
Drainage Area 05	2.04	2.11	6.32	7.77	10.23	12.39	13.66
Sub-Basin 06A	1.28	1.10	3.82	4.74	6.30	7.68	8.49
Sub-Basin 06B	8.19	4.43	16.18	20.80	28.37	35.19	39.24
Sub-Basin 06C	0.20	0.21	0.64	0.78	1.03	1.25	1.37
Drainage Area 07	1.42	0.49	1.91	2.46	3.42	4.31	4.84
Drainage Area 08	1.84	1.53	4.83	5.99	7.98	9.76	10.81
Drainage Area 09	2.23	1.73	5.37	6.82	9.26	11.42	12.69
Sub-Basin 10A	0.76	0.44	1.49	1.88	2.56	3.18	3.55
Sub-Basin 10B	0.42	0.46	1.36	1.66	2.18	2.63	2.90
Drainage Area 11	0.72	0.59	1.89	2.35	3.15	3.85	4.27
Drainage Area 12	2.27	2.73	7.74	9.44	12.27	14.76	16.21
Drainage Area 13	0.06	0.05	0.15	0.19	0.26	0.33	0.36
Drainage Area 14	5.34	4.13	12.59	15.71	20.81	25.50	28.58
Drainage Area 15	3.35	3.90	11.25	13.76	17.94	21.63	23.77
Drainage Area 16	1.71	2.26	6.09	7.38	9.52	11.39	12.48
Sub-Basin 17A	0.60	0.67	1.96	2.40	3.13	3.78	4.16
Sub-Basin 17B	0.31	0.38	1.06	1.30	1.68	2.02	2.22

Drainage Basin Name	Drainage Area (acres)	Peak Storm Event Flows (cubic feet per second)					
		1-inch	1-year	2-year	5-year	10-year	15-year
Sub-Basin 17C	0.16	0.19	0.54	0.66	0.86	1.04	1.14
Sub-Basin 17D	0.49	0.58	1.65	2.01	2.62	3.16	3.47
Sub-Basin 17E	0.83	1.11	2.97	3.59	4.63	5.54	6.07
Drainage Area 18	1.47	1.58	4.73	5.83	7.66	9.27	10.21
Drainage Area 19	0.91	1.09	3.12	3.81	4.95	5.95	6.54
Drainage Area 20	6.69	2.05	7.23	9.19	12.60	15.74	17.62
Sub-Basin 21A	1.38	1.25	3.86	4.84	6.47	7.91	8.76
Sub-Basin 21B	1.63	1.24	4.11	5.28	7.19	8.87	9.86
Drainage Area 22	2.17	1.67	5.35	6.76	9.16	11.28	12.53
Drainage Area 23	2.44	1.04	3.53	4.69	6.75	8.60	9.70
Drainage Area 24	2.52	2.31	7.08	8.89	11.87	14.50	16.04
Drainage Area 25	0.60	0.39	1.22	1.57	2.17	2.71	3.03
Drainage Area 26	1.13	1.10	3.35	4.14	5.47	6.65	7.34
Drainage Area 27	4.35	1.60	6.29	8.08	11.20	14.07	15.79
Drainage Area 28	1.45	1.32	4.13	5.20	6.95	8.49	9.39
Drainage Area 29	0.34	0.27	0.90	1.12	1.51	1.85	2.05
Drainage Area 30	1.04	0.85	2.72	3.39	4.54	5.56	6.16
Drainage Area 31	0.48	0.62	1.70	2.06	2.66	3.19	3.49
Drainage Area 32	0.85	1.09	2.99	3.63	4.69	5.63	6.17
Drainage Area 33	0.23	0.18	0.59	0.75	1.01	1.25	1.38

Table 5-2: Summary of Site Wide Pollutant Loads

Storm Event	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max	Med	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
1-inch	0.004	0.008	0.004	0.021	0.086	0.261	0.027	0.075	5.584	19.082	0.101	0.949	0.1	0.463	0.017	0.026	0.063	0.267	0.044	0.057	0.679	4.08	0.169	2.957	162.82	1037.007
1-Year	0.013	0.03	0.014	0.08	0.296	0.964	0.092	0.264	21.186	80.306	0.359	3.654	0.318	1.65	0.059	0.096	0.253	1.13	0.16	0.217	2.225	14.604	0.501	10.684	598.276	4243.519
2-Year	0.017	0.037	0.017	0.101	0.37	1.214	0.115	0.33	26.739	102.534	0.45	4.613	0.393	2.068	0.074	0.12	0.321	1.443	0.201	0.274	2.762	18.282	0.614	13.377	752.309	5400.093
5-Year	0.022	0.05	0.023	0.136	0.495	1.636	0.154	0.441	36.13	140.311	0.604	6.231	0.519	2.772	0.098	0.161	0.437	1.974	0.271	0.371	3.664	24.472	0.803	17.904	1012.412	7362.495
10-Year	0.027	0.062	0.028	0.167	0.606	2.011	0.188	0.539	44.465	173.968	0.741	7.666	0.631	3.396	0.12	0.198	0.541	2.448	0.333	0.456	4.462	29.946	0.97	21.904	1243	9108.61
15-Year	0.03	0.068	0.031	0.185	0.67	2.23	0.208	0.597	49.345	193.712	0.821	8.506	0.695	3.761	0.133	0.22	0.601	2.725	0.369	0.507	4.927	33.145	1.068	24.24	1377.926	10132.24

Med – Median
Max - Maximum

5.2 Comparison with 2005 SWMM Model Results

The results from this report were compared to 2005 SWMM model results provided by Pepco for a 24-hour rainfall depth of 4.77 inches. The 2005 model was completed prior to the demolition of the power plant on the west portion of the facility and used the Horton infiltration method (the current study uses the curve number methodology). Hydraulics were not computed as part of the 2005 SWMM study, and the computational algorithm has changed slightly from 2005 to 2016. Several small changes were also made to the drainage areas for the model created for this study based on detailed site elevation data (described in Sections 4 and 5), and to better accommodate the scope of this study.

The model created for this study was also run using a 24-hour rainfall depth of 4.77 inches to provide a basis to compare the two models (the 10-year rainfall depth used for analysis was 4.84 inches). The runoff depths using the model created for this study were generally within +/- 10-percent of the 2005 model, while the peak flow for the current model generally increased. The flows are most similar in sub-basins where there are no storm drain systems present (e.g., drainage area 25 and drainage area 27), and hence it appears that the previous study included the storm drain systems when calculating the overland flow path and characteristic width. Given this assumption, the current model will likely produce a higher flow rate that more accurately reflects runoff from the facility.

5.3 Model Validity Check Using Rational Method

The results of the calibrated model were checked against the Rational Method to verify the validity of results. The Rational Method is one of the most common uncalibrated equations to approximate peak discharge in urban areas. The most common form of the equation is as follows:

$$Q = CiA$$

where Q is the peak discharge (cubic feet per second), *i* is the rainfall intensity (inches per hour), A is the drainage area (acres), and C is an empirical runoff coefficient (McCuen, 1989). The rainfall intensity is based on the time of concentration in the watershed and must be converted to an equivalent hourly rate. Pepco currently uses the Rational Method to estimate the peak discharge at Outfall 13 (MH_33) for NPDES-qualifying storm events using a C value of 0.8. This value is slightly higher than what is typically assumed for commercial or industrial areas, but is reasonable given the compacted soils on site.

The peak flows were calculated using the Rational Method for Outfall 13 (MH_33), MH_66 (sub-basin 10A and 10B) and MH_07 (sub-basin 6B). The time of concentration was calculated using the method outlined in TR-55 (NRCS, 1986). Rainfall intensities were estimated for the rainfall events using the NOAA Atlas 14 IDF curves, and a C value of 0.8 was assumed. Table 5-3 shows the drainage areas, times of concentration, and rainfall intensities used, and Table 5-4 compares the peak flows from the Rational

Method and those calculated using EPA-SWMM. The times of concentration for flow to MH_66 (sub-basin 10A and 10B) and MH_07 (sub-basin 6B) were less than 5 minutes; however, the minimum storm duration provided by NOAA Atlas 14 (5 minutes) was used.

The flows calculated using the Rational Method were generally higher than those calculated using EPA-SWMM. The Rational Method is considered to be a conservative estimate for peak flow, so these results were expected. Due to a lack of infiltration and short times of concentration the Rational Method peak flow estimates for MH_66 (sub-basin 10A and 10B) and MH_07 (sub-basin 6B) were 14-percent to 120-percent higher than the EPA-SWMM estimates. The peak flow at MH_33 (Outfall 13) was similar for the two methods, with the Rational Method flows varying from 14 percent higher to 2 percent lower than the EPA-SWMM results. Given the complex hydraulic nature of the drainage area to MH_33 (Outfall 13), using a single time of concentration (as is done for the Rational Method) may underestimate the flow since the majority of the sub-basins would respond much more rapidly than the overall time of concentration. Based on this analysis, the magnitudes of the results are considered reasonable.

Table 5-3: Rational Method Parameters

Location	Contributing Drainage Area (acres)	Time of Concentration (minutes)	Rainfall Intensity for Return Period (inches/hour)				
			1-Year	2-Year	5-Year	10-Year	15-Year
I_33 (Outfall 13)	47.26	18	2.62	3.18	3.90	4.44	4.74
I_66 (Sub-Basin 10A and Sub-Basin 10B)	1.18	5	4.20	5.04	6.00	6.72	7.10
MH_07A (Sub-Basin 6B)	8.19	5	4.20	5.04	6.00	6.72	47.63

Table 5-4: Comparison of EPA-SWMM and Rational Method Flows

Return Period	I_33 (Outfall 13)			I_66 (Sub-Basin 10A and 10B)			MH_07A (Sub-Basin 6B)		
	EPA-SWMM Peak Flow (cfs)	Rational Method Peak Flow (cfs)	Percent Difference	EPA-SWMM Peak Flow (cfs)	Rational Method Peak Flow (cfs)	Percent Difference	EPA-SWMM Peak Flow (cfs)	Rational Method Peak Flow (cfs)	Percent Difference
1-Year	135.31	122	10%	2.85	4	-40%	16.82	28	-66%
2-Year	149.54	148	1%	3.35	4.8	-43%	21.57	33	-53%
5-Year	178.53	181	-1%	3.61	5.7	-58%	29.4	39	-33%
10-Year	196.77	206	-5%	3.89	6.3	-62%	36.43	44	-21%
15-Year	204.93	220	-7%	4.26	6.7	-57%	40.6	46	-13%

cfs = cubic feet per second

5.4 Flows at Focus Design Areas

Hydraulic results for flows into hotspot locations where treatment measures are proposed were identified during sampling efforts (see Conceptual Design Report, AECOM 2016) are summarized in Table 5-5. The contributing drainage area and percent impervious area can be used to calculate the recommended water quality volume, while the design flows will be used to size in-line treatment system components. An alternative analysis will be performed using the model to evaluate the effects of proposed treatment system alternatives in coordination with the design process. These treatment measures will be implemented into the model to verify that the 2-year and 15-year flows leaving the facility are maintained or decreased following District Department of the Environment design requirements (DDOE, 2013). The water quality treatment systems proposed at the site provide additional storage, so the amount of discharge leaving the facility is expected to decrease. **Attachment C** summarizes the first flush volumes (stormwater retention volume) and first flush flow estimates at focus design locations.

Table 5-5: Flows at Focus Design Areas Where BMPs Are Being Considered

Hot Spot	Location Description	Contributing Drainage Area (acres)	Drainage Area Percent Impervious (%)	Peak Storm Event Flows (cubic feet per second)					
				1-inch	1-year	2-year	5-year	10-year	15-year
1	Building #54 (Sub-basin 17E)	0.83	92.1	1.11	2.97	3.59	4.63	5.54	6.07
1	Inlets 42-44, MH 43 (Sub-basin 17A	0.6	74.9	0.6	0.67	1.96	2.4	3.13	3.78
1	Inlets 42-44, MH 43 (Sub-basin 17B)	0.31	85.7	0.31	0.38	1.06	1.3	1.68	2.02
	Inlets 42-44, MH 43 (Sub-basin 17C)	0.16	77.8	0.16	0.19	0.54	0.66	0.86	1.04
2	Inlets 65, 68 (Sub-basin 10B)	0.42	63.3	0.6	0.67	1.96	2.4	3.13	3.78
2	Inlets 65,68 (Sub-basins 31)	0.48	97.9	0.62	1.7	2.06	2.66	3.19	3.49
2	Inlets 69, 71 (Sub-basins 12)	2.27	83.6	2.73	7.74	9.44	12.27	14.76	16.21

Hot Spot	Location Description	Contributing Drainage Area (acres)	Drainage Area Percent Impervious (%)	Peak Storm Event Flows (cubic feet per second)					
				1-inch	1-year	2-year	5-year	10-year	15-year
4	Building #35, Inlets 2, 3, 4, 5, 7 (Sub-basins 6B)	8.19	46.8	4.43	16.18	20.8	28.37	35.19	39.24
4	Inlet 10 (Sub-basins 6C)	0.2	80.8	0.21	0.64	0.78	1.03	1.25	1.37
5	Inlets 15, 17, 18, 27 (Sub-basin 2)	6.86	26.4	2.46	10.89	15.98	25.2	32.56	36.81

6 CONCLUSION

The EPA-SWMM model produced runoff estimates suitable for design. However, the SWMM model estimates more conservative results for hot spot specific drainage areas than the conditions observed at the site. A U.S. Department of Agriculture's (USDA) Technical Release (TR) -55 methodology is used to estimate the design peak flows at the focus areas for design purposes. The results of this study will be used to identify stormwater treatment measures for the Site and to estimate expected metal removal rates. The treatment measure will be modeled in the future as storage areas with specified storage and ratings curves based on the specifications from the manufacturer of the treatment system components.

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Attachment A

Table A-1: 1-inch Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Disch_206	JUNCTION	1.81	3.62	12:03	37.51
Disch_403	JUNCTION	0.78	19.83	12:00	10.83
Disch_404	JUNCTION	0.84	21.9	12:00	9.18
Disch_405	JUNCTION	0.56	22.66	12:00	5.18
Disch_406	JUNCTION	1.66	17.75	12:00	20.57
Disch_407	JUNCTION	0.83	18.48	12:01	12.02
MH_55C	JUNCTION	1.94	14.64	12:02	23.44
Disch_413	JUNCTION	2.02	5	12:03	28.88
Disch_416	JUNCTION	1.4	12.97	12:02	27.28
Disch_419	JUNCTION	1.89	14.25	12:02	23.89
Disch_420	JUNCTION	1.69	4.56	12:03	36.05
Lift Station	JUNCTION	0.38	5.1	12:36	9.96
MH_07A	JUNCTION	7.59	18.71	12:35	4.64
I_08	JUNCTION	7.35	18.4	12:35	5.69
I_33	JUNCTION	2.38	3.13	12:03	39.57
I_37	JUNCTION	1.12	7.18	12:02	28.05
MH_42	JUNCTION	0.51	22.91	12:00	2.9
I_57	JUNCTION	1.55	17.97	12:01	16.75
MH_58	JUNCTION	1.4	16.2	12:01	21.54
I_67	JUNCTION	1.54	13.76	12:02	24.89
MH_403A	JUNCTION	0.7	21.2	12:00	9.15
MH_406A	JUNCTION	1.51	17.35	12:01	20.55
MH_55B	JUNCTION	1.28	15.13	12:01	21.55
MP201	JUNCTION	1.31	4.6	12:03	8.98
OWS	JUNCTION	0.01	0.01	13:42	1.27
I_66	JUNCTION	0.4	18.39	12:00	0.88
I_65	JUNCTION	0.43	19.2	12:00	0.46
MH_43	JUNCTION	0.4	23.28	12:00	2.24
MH_44	JUNCTION	3.15	26.44	12:00	1.87
MH_45	JUNCTION	2.79	26.44	12:00	1.68
I_68	JUNCTION	0.16	16.43	12:00	0.62
MH_55	JUNCTION	1.41	16.81	12:01	20.55
I_27	JUNCTION	0.96	6.83	12:00	2.46

Table A-1: 1-inch Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
To_Anacostia River	OUTFALL	1.81	2.43	12:03	39.57
Outfall 005	OUTFALL	0	0	0:00	0.39
Outfall 006	OUTFALL	0	0	0:00	1.73
Outfall 014	OUTFALL	0	0	0:00	1.04
Outfall 015	OUTFALL	0	0	0:00	1.6
Outfall 016	OUTFALL	0	0	0:00	2.11
Outfall 101	OUTFALL	0	0	0:00	1.09
Outfall 401	OUTFALL	0	0	0:00	1.1
Outfall NW	OUTFALL	0	0	0:00	0.22
WQ1	STORAGE	5.97	11.97	12:20	0.49
WQ2	STORAGE	4.28	10.28	12:20	0.31
WQ3	STORAGE	0.06	6.06	12:20	0.31

Table A-2: 1-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Disch_206	JUNCTION	5.55	7.36	12:02	128.53
Disch_403	JUNCTION	1.49	20.54	12:00	32.93
Disch_404	JUNCTION	1.6	22.66	12:00	27.78
Disch_405	JUNCTION	1.05	23.15	12:00	15.18
Disch_406	JUNCTION	3.67	19.76	12:01	61.02
Disch_407	JUNCTION	2.57	20.22	12:00	36.5
MH_55C	JUNCTION	4.19	16.89	12:01	67.12
Disch_413	JUNCTION	6.12	9.1	12:04	84.25
Disch_416	JUNCTION	2.72	14.29	12:01	78.24
Disch_419	JUNCTION	3.85	16.21	12:01	68.51
Disch_420	JUNCTION	5.87	8.74	12:04	143.37
Lift Station	JUNCTION	12.08	16.8	12:02	76.72
MH_07A	JUNCTION	9.85	20.97	12:06	16.82
I_08	JUNCTION	7.99	19.04	12:07	19.47
I_33	JUNCTION	5.23	5.98	12:04	135.17
I_37	JUNCTION	3.42	9.48	12:04	80.68
MH_42	JUNCTION	0.97	23.37	12:00	8.15
I_57	JUNCTION	3.64	20.06	12:01	49.64
MH_58	JUNCTION	3.3	18.1	12:01	63.03
I_67	JUNCTION	3.24	15.46	12:01	71.72
MH_403A	JUNCTION	1.34	21.84	12:00	27.67
MH_406A	JUNCTION	3.4	19.24	12:01	60.91
MH_55B	JUNCTION	3.56	17.41	12:01	62.34
MP201	JUNCTION	8.78	12.07	12:02	101.29
OWS	JUNCTION	0.01	0.01	5:00	1.32
I_66	JUNCTION	0.96	18.95	12:00	2.85
I_65	JUNCTION	2.63	21.4	11:55	1.36
MH_43	JUNCTION	0.73	23.61	12:00	6.22
MH_44	JUNCTION	3.28	26.57	12:00	5.16
MH_45	JUNCTION	2.92	26.57	11:59	4.62
I_68	JUNCTION	0.28	16.55	12:00	1.7
MH_55	JUNCTION	3.25	18.65	12:01	60.73
I_27	JUNCTION	10	15.87	12:10	10.89
To_Anacostia River	OUTFALL	3.42	4.04	12:04	135.31

Table A-2: 1-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Outfall 005	OUTFALL	0	0	0:00	1.22
Outfall 006	OUTFALL	0	0	0:00	5.37
Outfall 014	OUTFALL	0	0	0:00	3.53
Outfall 015	OUTFALL	0	0	0:00	6.29
Outfall 016	OUTFALL	0	0	0:00	6.32
Outfall 101	OUTFALL	0	0	0:00	9.16
Outfall 401	OUTFALL	0	0	0:00	3.35
Outfall NW	OUTFALL	0	0	0:00	1.93
WQ1	STORAGE	10.12	16.12	12:06	1.91
WQ2	STORAGE	4.7	10.7	12:06	1.91
WQ3	STORAGE	3.36	9.36	12:04	29.78

Table A-3: 2-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Disch_206	JUNCTION	7.03	8.84	12:07	140.59
Disch_403	JUNCTION	3.1	22.15	12:01	41.84
Disch_404	JUNCTION	1.83	22.89	11:59	34.54
Disch_405	JUNCTION	1.21	23.31	12:00	18.74
Disch_406	JUNCTION	5.34	21.43	12:01	70.55
Disch_407	JUNCTION	4.44	22.09	12:01	44.26
MH_55C	JUNCTION	5.51	18.21	11:59	79.73
Disch_413	JUNCTION	8.36	11.34	12:07	111.13
Disch_416	JUNCTION	3.09	14.66	12:00	93.8
Disch_419	JUNCTION	4.43	16.79	12:01	81.46
Disch_420	JUNCTION	8.19	11.06	12:07	154.41
Lift Station	JUNCTION	12.08	16.8	11:59	86.96
MH_07A	JUNCTION	11.68	22.8	12:06	21.58
I_08	JUNCTION	9.17	20.22	12:09	21.17
I_33	JUNCTION	5.94	6.69	12:07	149.28
I_37	JUNCTION	5.23	11.29	12:00	96.85
MH_42	JUNCTION	1.11	23.51	12:00	9.92
I_57	JUNCTION	5.41	21.83	12:01	57.66
MH_58	JUNCTION	5.31	20.11	11:59	73.65
I_67	JUNCTION	3.78	16	12:01	85.42
MH_403A	JUNCTION	1.67	22.17	12:01	34.64
MH_406A	JUNCTION	5.03	20.87	12:01	70.6
MH_55B	JUNCTION	5.5	19.35	11:59	73.64
MP201	JUNCTION	12.82	16.11	12:07	134.65
OWS	JUNCTION	0.01	0.01	3:19	1.31
I_66	JUNCTION	3.5	21.49	11:57	3.35
I_65	JUNCTION	2.66	21.43	12:00	1.66
MH_43	JUNCTION	0.83	23.71	12:00	7.56
MH_44	JUNCTION	3.31	26.6	12:00	6.27
MH_45	JUNCTION	2.95	26.6	11:59	5.61
I_68	JUNCTION	0.65	16.92	12:00	2.06
MH_55	JUNCTION	5	20.4	11:59	70.56
I_27	JUNCTION	10	15.87	12:06	15.97
To_Anacostia River	OUTFALL	3.59	4.21	12:00	149.54

Table A-3: 2-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Outfall 005	OUTFALL	0	0	0:00	1.57
Outfall 006	OUTFALL	0	0	0:00	6.82
Outfall 014	OUTFALL	0	0	0:00	4.69
Outfall 015	OUTFALL	0	0	0:00	8.07
Outfall 016	OUTFALL	0	0	0:00	7.77
Outfall 101	OUTFALL	0	0	0:00	13.35
Outfall 401	OUTFALL	0	0	0:00	4.14
Outfall NW	OUTFALL	0	0	0:00	2.86
WQ1	STORAGE	10.15	16.15	12:05	2.46
WQ2	STORAGE	4.93	10.93	12:03	2.63
WQ3	STORAGE	4.6	10.6	12:03	52.09

Table A-4: 5-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Disch_206	JUNCTION	9.01	10.82	12:00	166.09
Disch_403	JUNCTION	7.7	26.75	11:59	56.33
Disch_404	JUNCTION	6.13	27.19	12:00	46.43
Disch_405	JUNCTION	6.21	28.31	12:00	28.37
Disch_406	JUNCTION	9.02	25.11	12:02	87.73
Disch_407	JUNCTION	8.46	26.11	12:02	59.67
MH_55C	JUNCTION	7.09	19.79	12:01	98.40
Disch_413	JUNCTION	11.23	14.21	12:00	128.96
Disch_416	JUNCTION	4.32	15.89	12:01	115.49
Disch_419	JUNCTION	6.06	18.42	12:01	100.44
Disch_420	JUNCTION	10.8	13.67	12:03	178.39
Lift Station	JUNCTION	12.09	16.81	12:00	119.25
MH_07A	JUNCTION	15.36	26.48	12:07	29.40
I_08	JUNCTION	11.84	22.89	12:10	24.34
I_33	JUNCTION	7.23	7.98	12:03	178.10
I_37	JUNCTION	7.46	13.52	12:00	120.64
MH_42	JUNCTION	4.84	27.24	12:00	14.84
I_57	JUNCTION	9.26	25.68	12:02	77.06
MH_58	JUNCTION	7.52	22.32	12:01	91.31
I_67	JUNCTION	5.13	17.35	12:01	104.66
MH_403A	JUNCTION	6.64	27.14	11:59	48.74
MH_406A	JUNCTION	8.41	24.25	12:01	87.75
MH_55B	JUNCTION	7.07	20.92	12:01	91.31
MP201	JUNCTION	12.84	16.13	12:02	133.15
OWS	JUNCTION	0.01	0.01	0:44	1.38
I_66	JUNCTION	3.51	21.5	12:06	3.61
I_65	JUNCTION	3.25	22.02	12:06	2.18
MH_43	JUNCTION	3.89	26.77	12:00	20.57
MH_44	JUNCTION	3.49	26.78	12:01	8.23
MH_45	JUNCTION	3.19	26.84	12:01	7.25
I_68	JUNCTION	2.46	18.73	12:01	2.66
MH_55	JUNCTION	7.87	23.27	12:01	87.73
I_27	JUNCTION	10.01	15.88	12:07	25.20
To_Anacostia River	OUTFALL	3.87	4.49	12:00	178.53

Table A-4: 5-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Outfall 005	OUTFALL	0	0	0:00	2.17
Outfall 006	OUTFALL	0	0	0:00	9.26
Outfall 014	OUTFALL	0	0	0:00	6.75
Outfall 015	OUTFALL	0	0	0:00	11.20
Outfall 016	OUTFALL	0	0	0:00	10.23
Outfall 101	OUTFALL	0	0	0:00	20.99
Outfall 401	OUTFALL	0	0	0:00	5.47
Outfall NW	OUTFALL	0	0	0:00	4.38
WQ1	STORAGE	10.2	16.2	12:05	3.42
WQ2	STORAGE	7.08	13.08	12:00	11.94
WQ3	STORAGE	7.05	13.05	12:00	78.26

Table A-5: 10-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Disch_206	JUNCTION	9.67	11.48	12:01	180.87
Disch_403	JUNCTION	10.31	29.36	12:06	73.37
Disch_404	JUNCTION	8.61	29.67	12:06	59.3
Disch_405	JUNCTION	7.94	30.04	11:57	34.08
Disch_406	JUNCTION	11.84	27.93	12:06	96.14
Disch_407	JUNCTION	11.42	29.07	12:06	78.23
MH_55C	JUNCTION	9.12	21.82	12:05	105.79
Disch_413	JUNCTION	12.49	15.47	12:01	137.9
Disch_416	JUNCTION	6.9	18.47	12:01	126.14
Disch_419	JUNCTION	7.84	20.2	12:05	107.02
Disch_420	JUNCTION	11.68	14.55	12:01	193.4
Lift Station	JUNCTION	12.11	16.83	12:04	128.34
MH_07A	JUNCTION	19.05	30.17	12:08	36.43
I_08	JUNCTION	14.56	25.61	12:11	27.98
I_33	JUNCTION	7.69	8.44	11:58	196.1
I_37	JUNCTION	11.19	17.25	11:58	130.77
MH_42	JUNCTION	7.39	29.79	12:05	27.5
I_57	JUNCTION	12.17	28.59	12:06	91.27
MH_58	JUNCTION	10.01	24.81	12:05	101.82
I_67	JUNCTION	6.88	19.1	12:05	117.84
MH_403A	JUNCTION	8.95	29.45	12:06	59.65
MH_406A	JUNCTION	11.11	26.95	12:06	99.86
MH_55B	JUNCTION	9.34	23.19	12:05	101.82
MP201	JUNCTION	12.86	16.15	12:05	172.74
OWS	JUNCTION	0.01	0.01	0:53	1.37
I_66	JUNCTION	4.08	22.07	12:07	3.89
I_65	JUNCTION	3.71	22.48	12:09	2.63
MH_43	JUNCTION	7.82	30.7	11:57	32.27
MH_44	JUNCTION	6.48	29.77	12:06	19.21
MH_45	JUNCTION	6.14	29.79	12:05	12.12
I_68	JUNCTION	4.27	20.54	11:58	3.19
MH_55	JUNCTION	10.48	25.88	12:05	99.88
I_27	JUNCTION	10.02	15.89	12:04	32.55
To_Anacostia River	OUTFALL	4.01	4.63	12:00	196.77

Table A-5: 10-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Outfall 005	OUTFALL	0	0	0:00	2.71
Outfall 006	OUTFALL	0	0	0:00	11.42
Outfall 014	OUTFALL	0	0	0:00	8.6
Outfall 015	OUTFALL	0	0	0:00	14.07
Outfall 016	OUTFALL	0	0	0:00	12.39
Outfall 101	OUTFALL	0	0	0:00	27.09
Outfall 401	OUTFALL	0	0	0:00	6.65
Outfall NW	OUTFALL	0	0	0:00	5.61
WQ1	STORAGE	10.24	16.24	12:05	4.31
WQ2	STORAGE	8.3	14.3	12:05	13.34
WQ3	STORAGE	8.34	14.34	12:05	99.47

Table A-6: 15-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Disch_206	JUNCTION	9.95	11.76	12:02	186.58
Disch_403	JUNCTION	11.34	30.39	12:06	75.54
Disch_404	JUNCTION	9.65	30.71	12:06	64.32
Disch_405	JUNCTION	8.68	30.78	12:06	37.96
Disch_406	JUNCTION	12.91	29	12:06	100.57
Disch_407	JUNCTION	12.49	30.14	12:06	84.43
MH_55C	JUNCTION	9.92	22.62	12:06	107.71
Disch_413	JUNCTION	12.81	15.79	12:02	142.39
Disch_416	JUNCTION	7.13	18.7	12:02	134.01
Disch_419	JUNCTION	8.61	20.97	12:06	110.91
Disch_420	JUNCTION	11.85	14.72	12:06	195.49
Lift Station	JUNCTION	12.11	16.83	12:02	131.87
MH_07A	JUNCTION	21.38	32.5	12:08	40.6
I_08	JUNCTION	16.29	27.34	12:12	30.38
I_33	JUNCTION	7.78	8.53	12:02	204.68
I_37	JUNCTION	11.19	17.25	12:06	137.85
MH_42	JUNCTION	8.39	30.79	12:06	29.85
I_57	JUNCTION	13.26	29.68	12:06	89.89
MH_58	JUNCTION	10.96	25.76	12:05	105.34
I_67	JUNCTION	7.53	19.75	12:06	122.73
MH_403A	JUNCTION	10.02	30.52	12:06	64.34
MH_406A	JUNCTION	12.15	27.99	12:06	102.62
MH_55B	JUNCTION	10.2	24.05	12:06	105.32
MP201	JUNCTION	12.85	16.14	11:58	160.56
OWS	JUNCTION	0.01	0.01	0:57	1.37
I_66	JUNCTION	4.46	22.45	12:09	4.26
I_65	JUNCTION	3.99	22.76	12:11	2.89
MH_43	JUNCTION	7.94	30.82	12:06	37.91
MH_44	JUNCTION	7.52	30.81	12:07	30.35
MH_45	JUNCTION	7.14	30.79	12:06	15.99
I_68	JUNCTION	4.85	21.12	12:06	3.49
MH_55	JUNCTION	11.49	26.89	12:06	104
I_27	JUNCTION	10.08	15.95	12:00	36.8
To_Anacostia River	OUTFALL	4.06	4.68	12:02	204.93

Table A-6: 15-Year Return Period Storm Event Node Summary

Node	Type	Maximum Depth (feet)	Maximum HGL (feet)	Hour of Maximum Depth	Maximum Total Inflow (cfs)
Outfall 005	OUTFALL	0	0	0:00	3.02
Outfall 006	OUTFALL	0	0	0:00	12.68
Outfall 014	OUTFALL	0	0	0:00	9.7
Outfall 015	OUTFALL	0	0	0:00	15.78
Outfall 016	OUTFALL	0	0	0:00	13.66
Outfall 101	OUTFALL	0	0	0:00	30.65
Outfall 401	OUTFALL	0	0	0:00	7.34
Outfall NW	OUTFALL	0	0	0:00	6.33
WQ1	STORAGE	10.26	16.26	12:05	4.84
WQ2	STORAGE	8.91	14.91	12:02	12.5
WQ3	STORAGE	9.1	15.1	12:02	67.85

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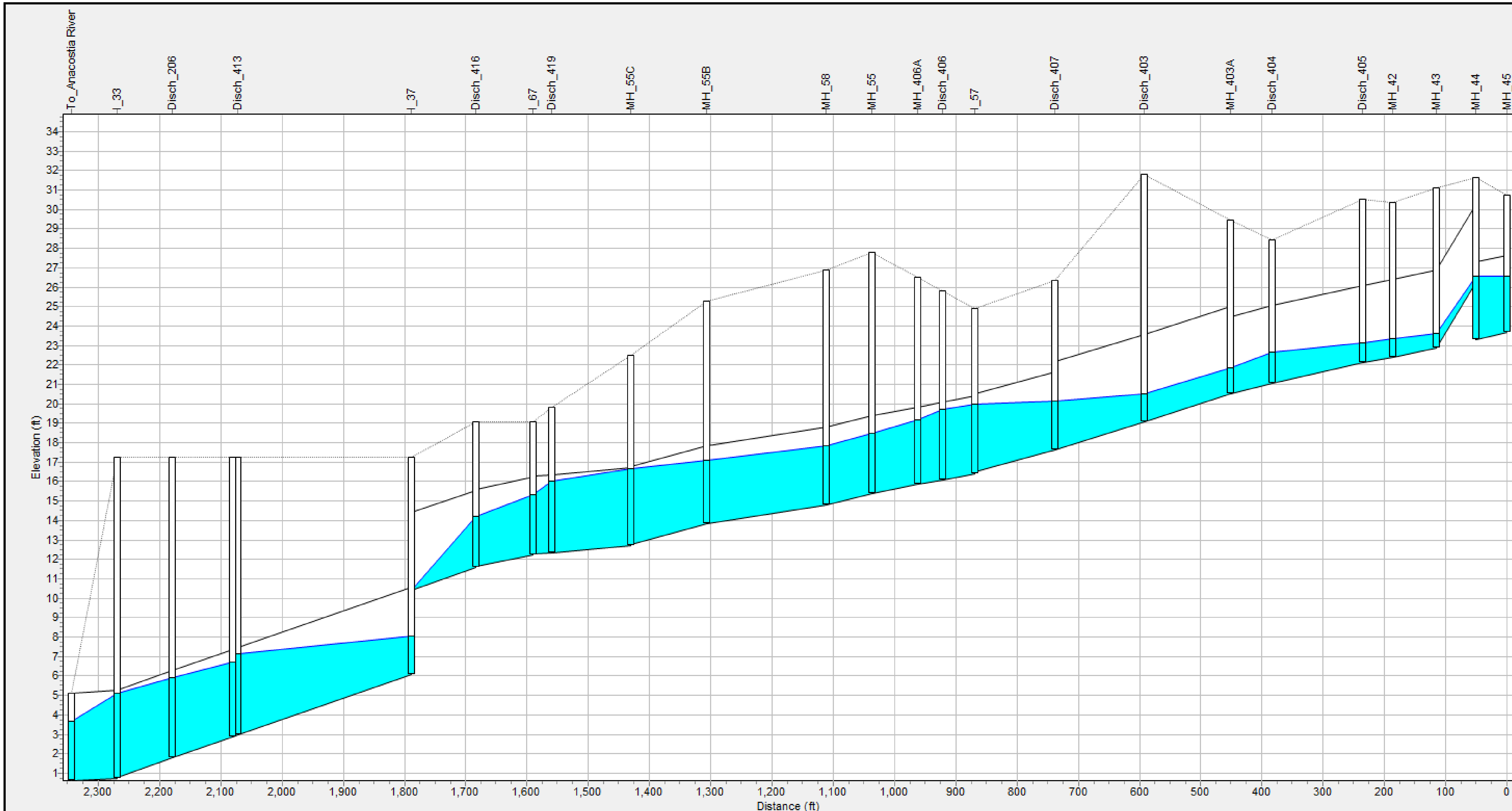
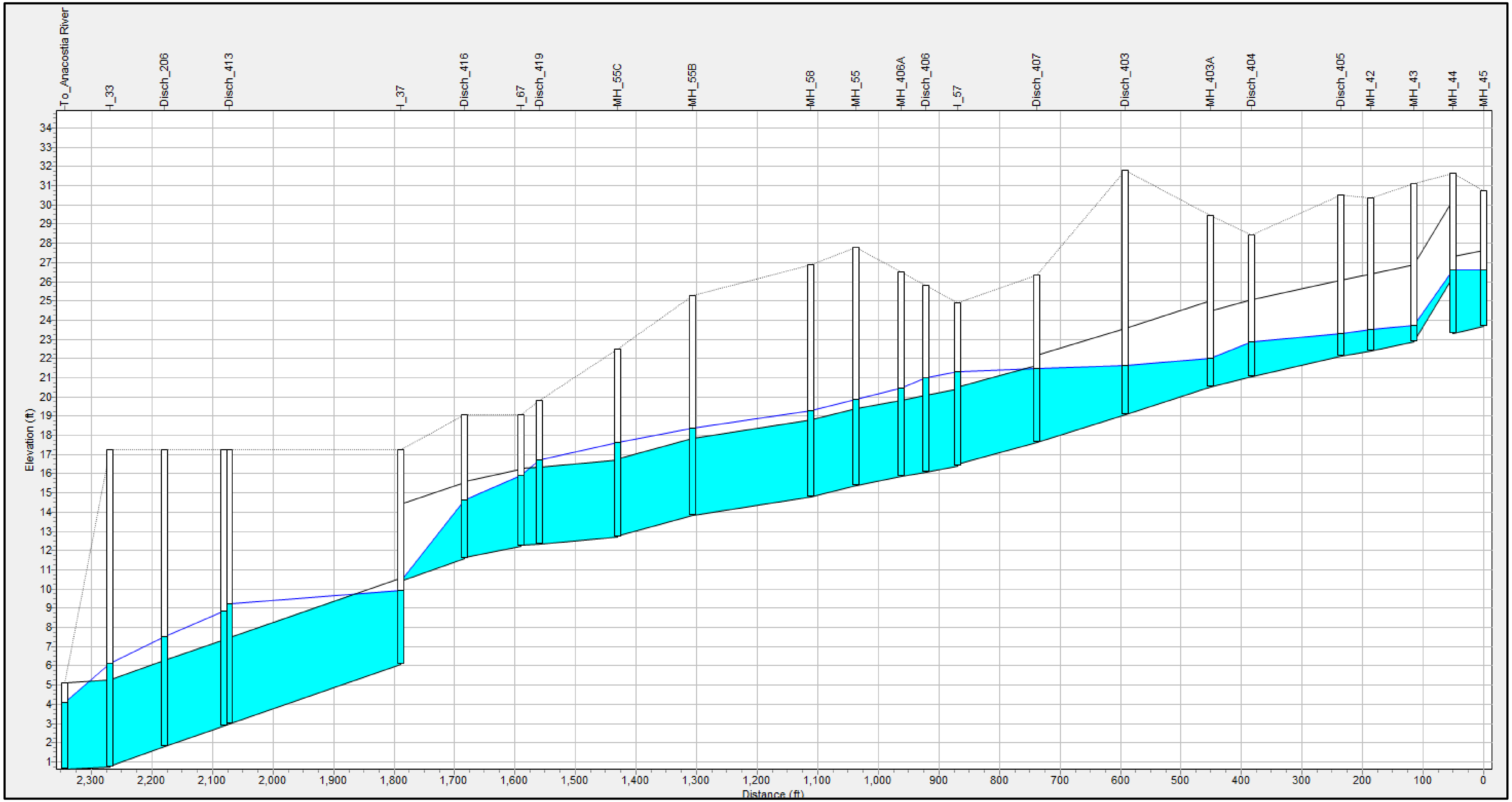
Attachment B

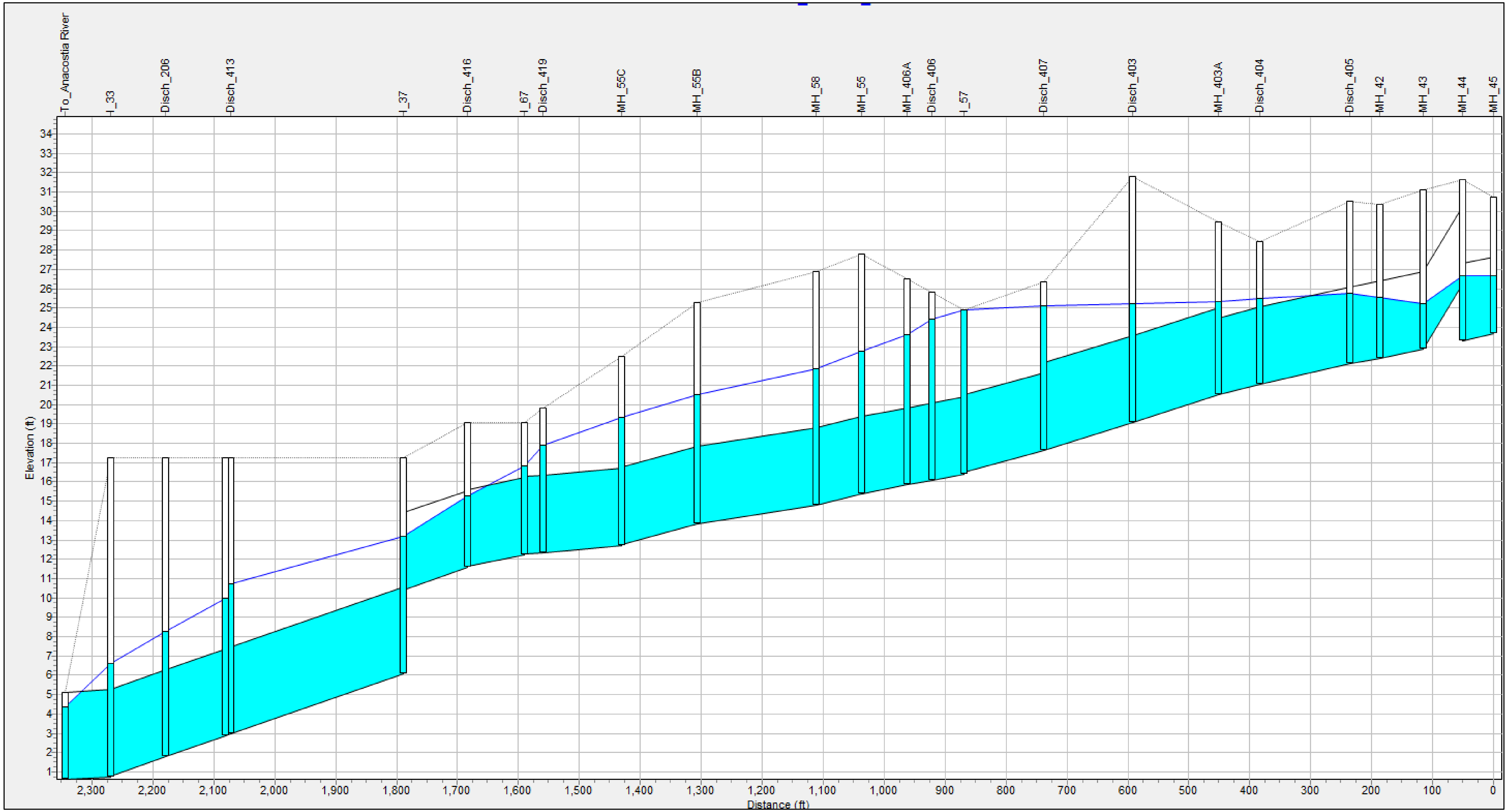
1-Year Return Period Maximum Flood Profile from MH_45 to Model Outfall:



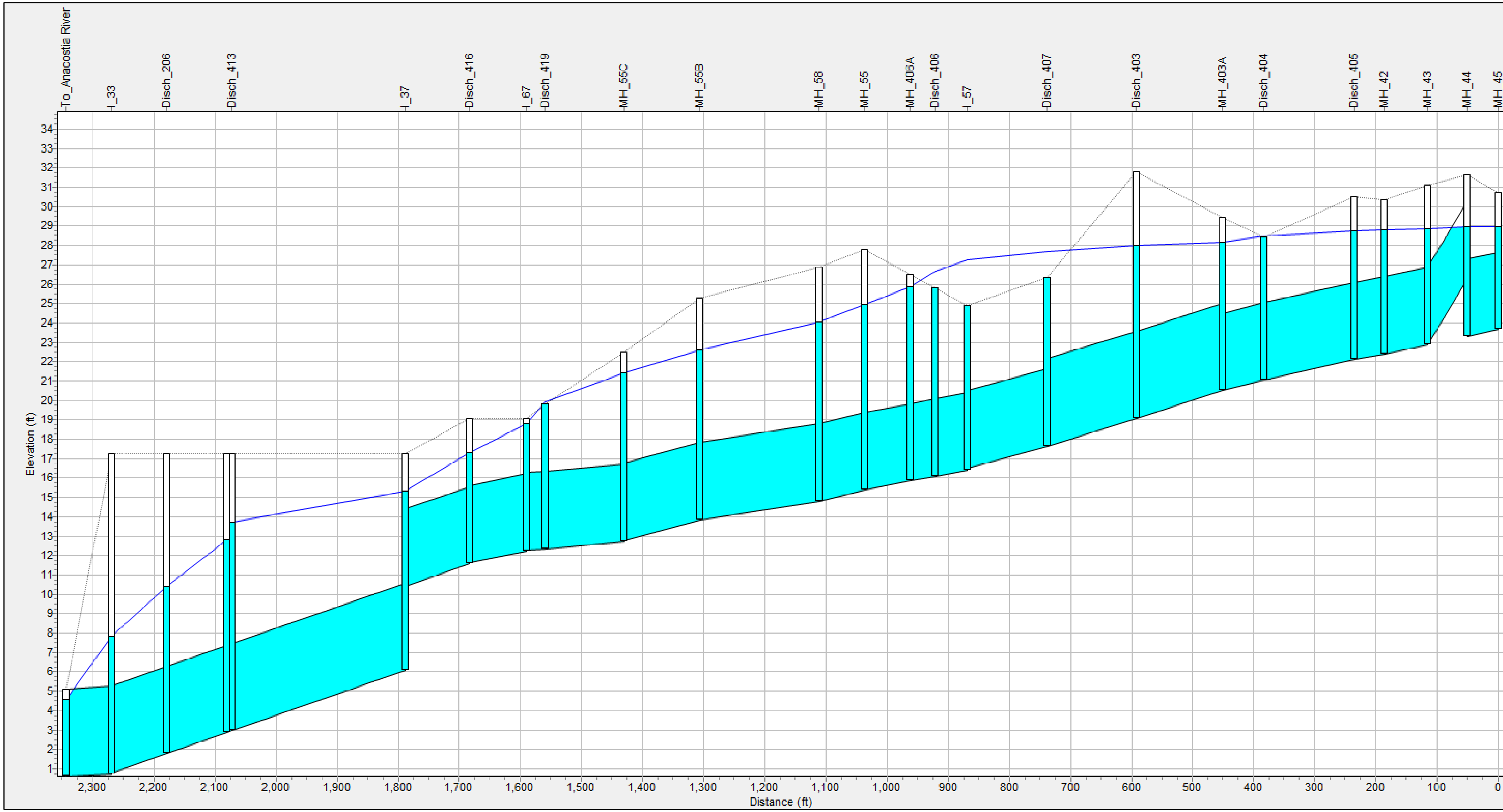
2-Year Return Period Maximum Flood Profile from MH_45 to Model Outfall:



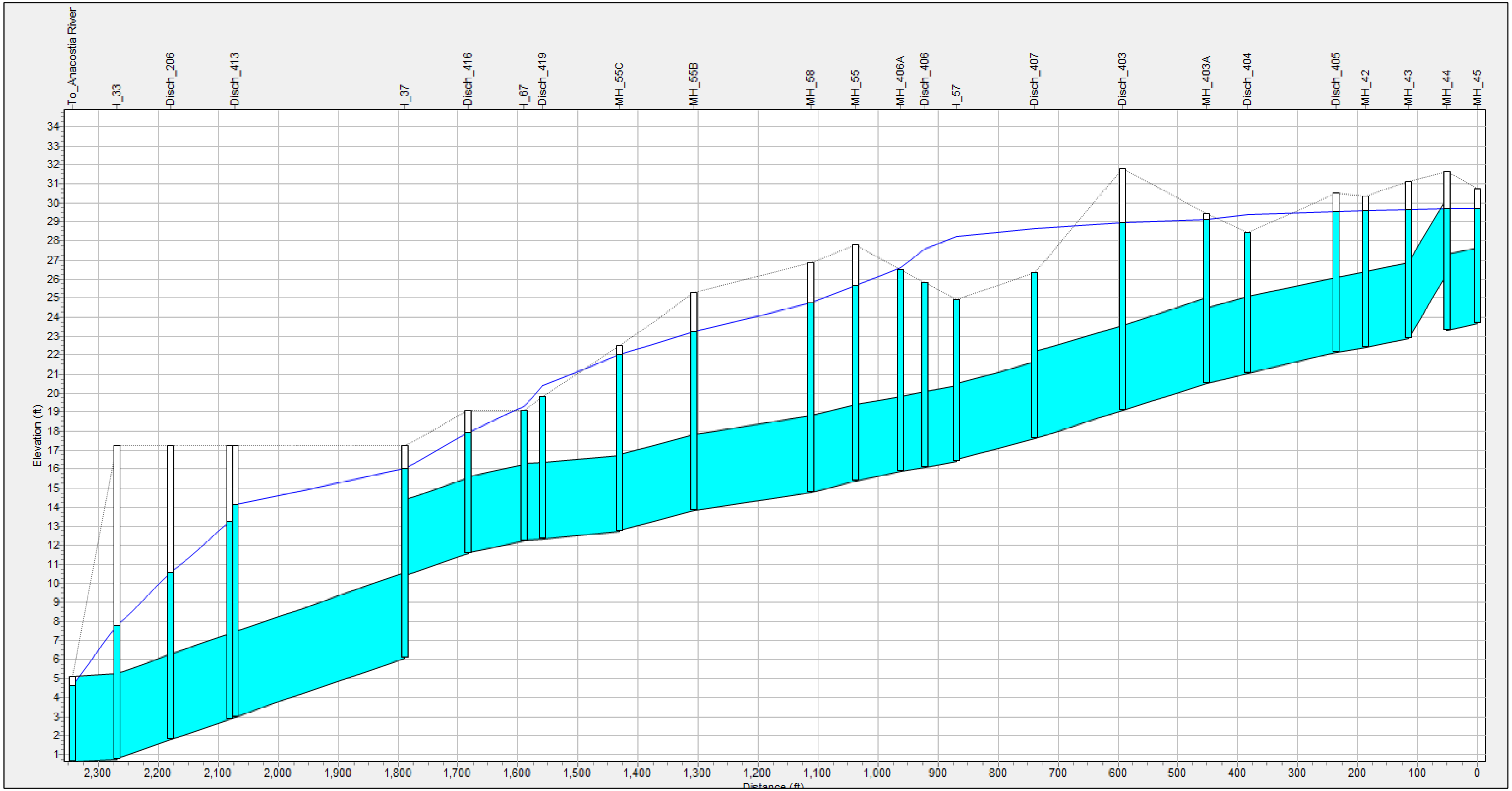
5-Year Return Period Maximum Flood Profile from MH_45 to Model Outfall:



10-Year Return Period Maximum Flood Profile from MH_45 to Model Outfall:



15-Year Return Period Maximum Flood Profile from MH_45 to Model Outfall:



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Attachment C

Attachment C – First Flush Volume Calculations

The first flush volume is calculated using the methodology described in the District Department of the Environment "Stormwater Management Guidebook" (July 2013) at focus design areas. The guidebook provides a methodology for calculating the stormwater retention volume based on precipitation, land cover (impervious, compacted, or natural), and drainage area. For this study the 85th percentile annual event (1.0 inch) is assumed to approximate the first flush volume. The treatment volume equation is:

$$SWRv = (P \times [(Rv_I \times \%I) + (Rv_C \times \%C) + (Rv_N \times \%N) \times SA] \times 7.48/12)$$

where:

- SWR*v* = volume required to be retained on site (gal)
- P = 85th percentile rain event for the District (1.0 inches)
- Rv_I = 0.95 (runoff coefficient for impervious cover)
- Rv_C = 0.25 (runoff coefficient for compacted cover)
- Rv_N = 0.00 (runoff coefficient for natural cover)
- %I = percent of site in impervious cover (decimal)
- %C = percent of site in compacted cover (decimal)
- %N = percent of site in natural cover (decimal)
- SA = surface area (ft^2)

The peak flows associated with the inch storm were calculated in EPA-SWMM by simulating 1 inch of rainfall using the Type II SCS 24-hour rainfall distribution. All other model parameters were the same as discussed in the Sections 3, 4, and 5 of the Hydrologic and Hydraulic Report.

Table C-1 provides the stormwater retention volume and flows for in-line focus design locations and at individual catch basins, respectively. Typically retaining the stormwater retention volume is required because of development or redevelopment at a site. For this study any proposed projects will be implemented with the intent of improving water quality for existing site conditions and not due development. As a result, the design volumes are flexible pending specific site considerations.

Table C-1: First flush volume (stormwater retention volume) at in-line focus design areas

Hot Spot	Location Description	Drainage Area (ft^2)	Percent Compacted Cover	Percent Impervious Area	Rainfall Depth (inch)	Stormwater Retention Volume (gal)	Peak Flow for 1-inch 24-hour storm event (cfs)
1	Building #54 (Sub-basin 17E)	36,200	8%	92%	1	20,200	1.11
1	Inlets 42-44, MH 43 (Sub-basin 17A	26,100	25%	75%	1	12,600	0.6
1	Inlets 42-44, MH 43 (Sub-basin 17B)	13,500	14%	86%	1	7,200	0.31
1	Inlets 42-44, MH 43 (Sub-basin 17C)	7,000	22%	78%	1	3,500	0.16
2	Inlets 65, 68 (Sub-basin 10B)	18,300	37%	63%	1	7,900	0.6
2	Inlets 65,68 (Sub-basins 31)	20,900	2%	98%	1	12,200	0.62
3	Building #35, Inlets 2, 3, 4, 5, 7 (Sub-basins 6B)	356,800	53%	47%	1	128,400	4.43
3	Inlet 10 (Sub-basins 6C)	8,700	19%	81%	1	4,400	0.21
4	Inlets 15, 17, 18, 27 (Sub-basin 2)	298,800	74%	26%	1	81,000	2.46

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Attachment D

Table D-1: Pollutant Load for 1-inch Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)
Subshed_01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_02	-	0.00	0.00	0.00	0.01	0.04	0.00	0.01	0.87	5.56	0.02	0.09	0.00	0.05	0.00	0.00	0.02	0.07	0.01	0.01	0.04	0.16	0.01	0.01	21.31	246.21
Subshed_03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6B	0.00	0.00	0.00	0.02	0.02	0.10	0.01	0.04	2.94	9.36	0.03	0.78	0.03	0.23	0.01	0.01	0.02	0.16	0.02	0.02	0.19	3.02	0.01	2.70	72.58	582.27
Subshed_6C	-	-	-	-	-	0.00	-	0.00	0.04	0.12	0.00	0.00	-	0.00	-	-	0.00	0.00	-	0.00	0.01	0.02	0.01	0.01	0.66	6.09
Subshed_07	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.36	0.36	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.07	0.07	0.01	0.01	35.69	35.69
Subshed_08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10B	-	-	-	-	0.01	0.01	0.00	0.00	0.04	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.02	0.02	1.99	1.99
Subshed_11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_12	-	-	-	-	0.01	0.02	0.00	0.00	0.53	0.92	0.00	0.00	0.03	0.07	0.00	0.00	0.01	0.01	0.00	0.00	0.11	0.20	0.03	0.04	10.49	11.99
Subshed_13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_16	-	-	-	-	0.00	0.00	0.00	0.00	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.03	0.03	2.70	2.70
Subshed_17A	-	0.00	-	-	0.01	0.02	0.00	0.01	0.37	0.91	0.01	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.18	0.01	0.02	7.21	40.86
Subshed_17B	-	-	-	-	0.00	0.01	0.00	0.00	0.13	0.82	0.00	0.01	0.00	0.01	-	0.00	0.00	0.00	0.00	0.00	0.02	0.13	0.00	0.01	4.48	32.27
Subshed_17C	-	-	-	-	0.00	0.00	-	-	0.02	0.06	0.00	0.00	-	0.00	-	-	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	1.61	2.58
Subshed_17D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_17E	-	-	-	-	0.00	0.01	0.00	0.01	0.01	0.03	0.01	0.01	-	0.00	-	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.02	0.06	0.73	1.71
Subshed_18																										

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_31	-	-	-	-	0.01	0.02	0.00	0.01	0.13	0.75	0.01	0.01	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.12	0.01	0.03	3.39	72.68
Subshed_32	-	-	-	-	0.00	0.00	0.00	0.00	0.09	0.09	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	-	-
Subshed_33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Link_01	0.01	0.01	0.01	0.03	0.13	0.35	0.04	0.10	8.11	26.14	0.15	1.36	0.13	0.59	0.02	0.04	0.09	0.38	0.07	0.08	0.96	5.67	0.20	4.21	291.55	1,474.97
Link_02	0.01	0.01	0.01	0.03	0.13	0.35	0.04	0.10	8.11	26.15	0.15	1.36	0.13	0.59	0.02	0.04	0.09	0.38	0.07	0.08	0.96	5.68	0.20	4.21	291.52	1,475.25
Link_03	0.01	0.01	0.01	0.03	0.13	0.35	0.04	0.10	8.11	26.13	0.15	1.36	0.13	0.59	0.02	0.04	0.09	0.38	0.07	0.08	0.96	5.67	0.20	4.20	291.56	1,474.62
Link_04	0.00	0.00	0.00	0.00	0.04	0.10	0.01	0.03	1.38	3.67	0.04	0.06	0.06	0.18	0.01	0.01	0.02	0.03	0.02	0.02	0.35	0.81	0.13	0.21	32.34	166.18
Link_06	0.00	0.00	0.00	0.00	0.04	0.10	0.01	0.03	1.38	3.68	0.04	0.06	0.06	0.18	0.01	0.01	0.02	0.03	0.02	0.02	0.36	0.81	0.14	0.21	32.38	166.41
Link_07	0.00	0.00	0.00	0.00	0.04	0.10	0.01	0.03	1.38	3.67	0.04	0.06	0.06	0.18	0.01	0.01	0.02	0.03	0.02	0.02	0.35	0.81	0.13	0.21	32.33	166.15

Table D-1: Pollutant Load for 1-inch Storm

Table D-1: Pollutant Load for 1-inch Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Link_08	0.00	0.00	0.00	0.00	0.03	0.08	0.01	0.02	0.85	2.75	0.04	0.06	0.04	0.11	0.01	0.01	0.01	0.02	0.01	0.02	0.24	0.61	0.10	0.17	21.85	154.20
Link_09	0.00	0.00	0.00	0.00	0.02	0.07	0.01	0.02	0.81	2.71	0.04	0.06	0.03	0.10	0.01	0.01	0.01	0.02	0.01	0.02	0.21	0.58	0.09	0.16	19.87	152.18
Link_10	0.00	0.00	0.00	0.00	0.02	0.05	0.01	0.01	0.68	1.96	0.03	0.05	0.01	0.04	0.01	0.01	0.01	0.01	0.01	0.01	0.17	0.46	0.08	0.13	16.47	79.61
Link_11	0.00	0.00	0.00	0.00	0.01	0.05	0.01	0.01	0.62	1.90	0.03	0.05	0.01	0.03	0.00	0.01	0.01	0.01	0.01	0.01	0.13	0.42	0.05	0.10	13.78	76.91
Link_12	0.00	0.00	0.00	0.00	0.01	0.05	0.01	0.01	0.62	1.90	0.03	0.05	0.01	0.03	0.00	0.01	0.01	0.01	0.01	0.01	0.13	0.42	0.05	0.10	13.78	76.92
Link_13	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	76.98
Link_14	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	77.00
Link_15	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	76.98
Link_17	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.78	76.94
Link_18	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	76.98
Link_19	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	76.98
Link_20	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	77.00
Link_21	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	76.98
Link_22	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	76.99
Link_23	0.01	0.01	0.01	0.03	0.09	0.25	0.03	0.08	6.73	22.47	0.11	1.30	0.06	0.41	0.02	0.03	0.07	0.35	0.05	0.07	0.61	4.87	0.06	3.99	259.14	1,308.64
Link_25	0.00	0.00	0.00	0.02	0.02	0.11	0.01	0.04	2.98	9.48	0.03	0.78	0.03	0.23	0.01	0.01	0.02	0.16	0.02	0.02	0.21	3.04	0.02	2.72	73.23	588.37
Link_26	0.00	0.00	0.00	0.02	0.02	0.11	0.01	0.04	2.97	9.47	0.03	0.78	0.03	0.23	0.01	0.01	0.02	0.16	0.02	0.02	0.21	3.03	0.02	2.71	73.14	587.58
Link_27	-	-	-	-	0.01	0.01	0.00	0.00	0.04	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.02	0.02	1.98	1.98
Link_28	-	-	-	-	0.01	0.01	0.00	0.00	0.04	0.04	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.02	0.02	1.98	1.98
Link_29	-	0.00	-	0.00	0.00	0.02	0.00	0.01	0.16	0.91	0.01	0.02	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.01	0.05	0.21	0.03	0.07	6.58	36.11
Link_30	-	-	-	-	0.00	0.01	0.00	0.01	0.03	0.08	0.01	0.01	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.02	0.06	2.09	3.83
Link_31	-	-	-	-	0.00	0.01	0.00	0.01	0.01	0.03	0.01	0.01	-	0.00	-	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.02	0.06	0.70	1.64
Link_32	-	-	-	-	0.01	0.02	0.00	0.01	0.13	0.75	0.01	0.01	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.12	0.01	0.03	3.39	72.72
Link_33	0.00	0.00	-	0.00	0.01	0.04	0.00	0.01	0.53	1.81	0.02	0.03	0.01	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.39	0.04	0.08	13.79	76.98

Table D-1: Pollutant Load for 1-inch Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Link_34	-	0.00	0.00	0.00	0.01	0.04	0.00	0.01	0.87	5.55	0.02	0.09	0.00	0.05	0.00	0.00	0.02	0.07	0.01	0.01	0.04	0.16	0.01	0.01	21.28	245.76
Link-06	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.32	0.32	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.06	0.06	0.01	0.01	31.82	31.82
OWS to MP2 01	0.00	0.01	0.00	0.03	0.05	0.25	0.02	0.08	6.60	25.05	0.07	1.54	0.06	0.48	0.01	0.02	0.06	0.40	0.04	0.06	0.43	5.70	0.04	4.91	162.53	1,413.00
Pump-02	0.00	0.00	0.00	0.01	0.02	0.11	0.01	0.03	2.84	10.95	0.03	0.65	0.02	0.21	0.01	0.01	0.03	0.17	0.02	0.02	0.18	2.39	0.02	2.05	69.76	611.78
WQ Orifice 1	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.33	0.33	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.07	0.07	0.01	0.01	32.74	32.74
WQ Orifice 2	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.32	0.32	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.06	0.06	0.01	0.01	31.84	31.84
WQ_Weir-01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WQ_Weir-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lift to MP201	-	0.00	0.00	0.01	0.01	0.04	0.00	0.01	1.02	4.15	0.01	0.22	0.01	0.07	0.00	0.00	0.01	0.06	0.01	0.01	0.07	0.80	0.01	0.67	24.99	225.10
To_Anacostia River	0.01	0.01	0.01	0.03	0.13	0.35	0.04	0.10	8.11	26.14	0.15	1.36	0.13	0.59	0.02	0.04	0.09	0.38	0.07	0.08	0.96	5.67	0.20	4.21	291.55	1,474.97
Outfall 005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall NW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-2: Pollutant Load for 1-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)
Subshed_01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_02	0.00	0.01	0.00	0.01	0.07	0.26	0.02	0.03	5.34	34.20	0.09	0.58	0.02	0.28	0.01	0.02	0.11	0.44	0.04	0.07	0.27	0.97	0.03	0.07	131.02	1,513.51
Subshed_03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6B	0.01	0.02	0.01	0.06	0.07	0.38	0.03	0.15	10.80	34.41	0.10	2.86	0.10	0.84	0.02	0.04	0.08	0.60	0.05	0.08	0.71	11.09	0.04	9.94	266.83	2,140.79
Subshed_6C	-	-	-	-	0.00	0.00	0.00	0.00	0.11	0.36	0.00	0.01	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.04	0.06	0.02	0.04	1.93	17.92
Subshed_07	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	1.08	1.08	0.04	0.04	0.01	0.01	0.00	0.00	0.02	0.02	0.02	0.02	0.22	0.22	0.03	0.03	107.47	107.47
Subshed_08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10B	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.01	0.12	0.12	0.01	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.08	0.08	0.05	0.05	5.64	5.64
Subshed_11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_12	-	-	-	-	0.03	0.06	0.01	0.01	1.47	2.57	0.00	0.00	0.08	0.19	0.01	0.01	0.01	0.02	0.01	0.01	0.32	0.55	0.09	0.12	29.28	33.46
Subshed_13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_16	-	-	-	-	0.00	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.11	0.11	0.08	0.08	7.43	7.43
Subshed_17A	0.00	0.00	-	0.00	0.02	0.07	0.00	0.02	1.05	2.55	0.02	0.03	0.01	0.04	0.00	0.00	0.01	0.01	0.01	0.01	0.15	0.51	0.02	0.05	20.30	115.01
Subshed_17B	-	0.00	-	-	0.01	0.04	0.00	0.00	0.36	2.29	0.01	0.02	0.01	0.04	0.00	0.00	0.00	0.01	0.00	0.00	0.05	0.36	0.01	0.03	12.49	89.92

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Subshed_17C	-	-	-	-	0.00	0.00	0.00	0.00	0.06	0.17	0.01	0.01	0.00	0.00	-	-	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	4.52	7.23
Subshed_17D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_17E	0.00	0.00	-	0.00	0.01	0.02	0.00	0.02	0.02	0.09	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.07	0.23	0.07	0.18	2.03	4.73
Subshed_18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_31	0.00	0.00	-	0.00	0.02	0.07	0.00	0.02	0.37	2.06	0.01	0.03	0.04	0.19	0.00	0.00	0.01	0.01	0.01	0.01	0.12	0.33	0.02	0.07	9.33	200.40
Subshed_32	-	-	-	-	0.01	0.01	0.00	0.00	0.25	0.25	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.10	0.10	0.04	0.04	-	-
Subshed_33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Link_01	0.02	0.03	0.02	0.09	0.34	1.05	0.11	0.29	23.43	85.96	0.41	3.98	0.34	1.75	0.07	0.10	0.28	1.22	0.18	0.24	2.50	15.87	0.53	11.64	730.42	4,608.35
Link_02	0.02	0.03	0.02	0.09	0.34	1.05	0.11	0.29	23.43	85.95	0.41	3.98	0.34	1.75	0.07	0.10	0.28	1.22	0.18	0.24	2.50	15.87	0.53	11.64	730.31	4,607.9

Table D-2: Pollutant Load for 1-Year Storm

Table D-2: Pollutant Load for 1-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
																										2
Link_03	0.02	0.03	0.02	0.09	0.34	1.05	0.11	0.29	23.43	85.93	0.41	3.98	0.34	1.75	0.07	0.10	0.28	1.22	0.18	0.24	2.50	15.87	0.53	11.63	730.25	4,606.73
Link_04	0.00	0.01	0.00	0.01	0.12	0.28	0.03	0.07	3.85	10.25	0.12	0.17	0.18	0.51	0.02	0.03	0.05	0.07	0.05	0.05	0.99	2.26	0.38	0.61	90.70	462.98
Link_06	0.00	0.01	0.00	0.01	0.12	0.28	0.03	0.07	3.87	10.27	0.12	0.17	0.18	0.51	0.02	0.03	0.05	0.07	0.05	0.05	1.00	2.27	0.38	0.61	90.95	464.09
Link_07	0.00	0.01	0.00	0.01	0.12	0.28	0.03	0.07	3.86	10.25	0.12	0.17	0.18	0.51	0.02	0.03	0.05	0.07	0.05	0.05	0.99	2.26	0.38	0.61	90.74	463.04
Link_08	0.00	0.01	0.00	0.01	0.09	0.23	0.03	0.06	2.38	7.69	0.12	0.17	0.10	0.32	0.02	0.02	0.04	0.05	0.04	0.05	0.67	1.71	0.29	0.49	61.50	429.79
Link_09	0.00	0.01	0.00	0.00	0.07	0.20	0.02	0.06	2.27	7.57	0.11	0.16	0.08	0.29	0.02	0.02	0.04	0.05	0.04	0.04	0.60	1.64	0.24	0.44	55.86	424.01
Link_10	0.00	0.01	0.00	0.00	0.04	0.14	0.02	0.04	1.90	5.51	0.09	0.13	0.03	0.10	0.01	0.02	0.03	0.04	0.03	0.04	0.48	1.31	0.22	0.37	46.55	224.03
Link_11	0.00	0.00	0.00	0.00	0.04	0.13	0.01	0.04	1.74	5.35	0.09	0.13	0.03	0.09	0.01	0.01	0.03	0.03	0.02	0.03	0.37	1.20	0.14	0.29	39.11	216.58
Link_12	0.00	0.00	0.00	0.00	0.04	0.13	0.01	0.04	1.74	5.34	0.09	0.13	0.03	0.09	0.01	0.01	0.03	0.03	0.02	0.03	0.37	1.20	0.14	0.29	39.09	216.46
Link_13	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.12	216.64
Link_14	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.13	216.68
Link_15	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.13	216.67
Link_17	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.12	216.60
Link_18	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.11	216.56
Link_19	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.10	216.54
Link_20	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.01	0.02	0.28	1.10	0.10	0.25	39.10	216.51
Link_21	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.10	216.54
Link_22	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.01	0.02	0.28	1.10	0.10	0.25	39.09	216.45
Link_23	0.01	0.03	0.01	0.08	0.22	0.76	0.07	0.21	19.64	75.98	0.29	3.82	0.16	1.25	0.04	0.07	0.23	1.15	0.14	0.19	1.52	13.65	0.15	11.06	641.27	4,159.21
Link_25	0.01	0.02	0.01	0.06	0.07	0.39	0.03	0.15	10.92	34.78	0.10	2.87	0.10	0.84	0.02	0.04	0.08	0.60	0.06	0.08	0.75	11.15	0.06	9.98	268.87	2,159.55
Link_26	0.01	0.02	0.01	0.06	0.07	0.39	0.03	0.15	10.91	34.74	0.10	2.86	0.10	0.84	0.02	0.04	0.08	0.60	0.06	0.08	0.75	11.14	0.06	9.97	268.53	2,156.84
Link_27	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.01	0.12	0.12	0.01	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.08	0.08	0.05	0.05	5.63	5.63

Table D-2: Pollutant Load for 1-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)
Link_28	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.01	0.12	0.12	0.01	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.08	0.08	0.05	0.05	5.64	5.64
Link_29	0.00	0.00	0.00	0.00	0.01	0.06	0.01	0.02	0.44	2.54	0.03	0.05	0.01	0.04	0.00	0.00	0.01	0.02	0.01	0.01	0.13	0.60	0.08	0.20	18.79	101.43
Link_30	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.02	0.08	0.25	0.02	0.03	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.08	0.23	0.07	0.18	6.30	11.51
Link_31	0.00	0.00	-	0.00	0.01	0.02	0.00	0.02	0.02	0.09	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.07	0.22	0.06	0.17	2.00	4.66
Link_32	0.00	0.00	-	0.00	0.02	0.07	0.00	0.02	0.37	2.06	0.01	0.03	0.04	0.19	0.00	0.00	0.01	0.01	0.01	0.01	0.12	0.33	0.02	0.07	9.34	200.45
Link_33	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.04	1.49	5.10	0.04	0.08	0.02	0.09	0.00	0.01	0.02	0.02	0.02	0.02	0.28	1.10	0.10	0.25	39.12	216.64
Link_34	0.00	0.01	0.00	0.01	0.07	0.25	0.02	0.03	5.24	33.59	0.09	0.57	0.02	0.28	0.01	0.02	0.10	0.43	0.04	0.07	0.26	0.95	0.03	0.06	128.69	1,486.56
Link-06	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	1.10	1.37	0.04	0.05	0.01	0.02	0.00	0.00	0.02	0.02	0.02	0.02	0.21	0.26	0.03	0.08	104.03	120.47
OWS to MP201	0.00	0.01	0.01	0.04	0.08	0.38	0.03	0.11	9.57	39.88	0.11	2.06	0.08	0.67	0.02	0.04	0.11	0.61	0.06	0.09	0.60	7.33	0.05	6.12	235.50	2,143.15
Pump-02	0.00	0.01	0.00	0.03	0.07	0.30	0.02	0.08	7.57	32.32	0.09	1.60	0.06	0.52	0.01	0.03	0.09	0.49	0.05	0.07	0.47	5.59	0.04	4.62	186.24	1,715.92
WQ Orifice 1	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	0.87	0.87	0.03	0.03	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.17	0.17	0.02	0.02	86.78	86.78
WQ Orifice 2	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	1.04	1.04	0.04	0.04	0.01	0.01	0.00	0.00	0.02	0.02	0.02	0.02	0.21	0.21	0.03	0.03	103.60	103.60
WQ_Weir-01	-	-	-	-	0.01	0.01	0.00	0.00	0.18	0.18	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	17.72	17.72
WQ_Weir-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lift to MP201	0.00	0.01	0.01	0.04	0.08	0.37	0.03	0.11	9.51	39.88	0.12	2.02	0.08	0.66	0.02	0.04	0.11	0.60	0.06	0.09	0.60	7.14	0.05	5.93	237.48	2,133.59
To_Anacostia River	0.02	0.03	0.02	0.09	0.34	1.05	0.11	0.29	23.43	85.96	0.41	3.98	0.34	1.75	0.07	0.10	0.28	1.22	0.18	0.24	2.50	15.87	0.53	11.64	730.42	4,608.35
Outfall 005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-2: Pollutant Load for 1-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Outfall 401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall NW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-3: Pollutant Load for 2-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Subshed_01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_02	0.00	0.01	0.00	0.02	0.09	0.34	0.02	0.04	7.05	45.15	0.12	0.76	0.03	0.38	0.02	0.03	0.14	0.58	0.06	0.09	0.35	1.28	0.04	0.09	172.99	1,998.35
Subshed_03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6B	0.01	0.02	0.01	0.08	0.09	0.48	0.04	0.18	13.54	43.14	0.13	3.59	0.13	1.06	0.02	0.05	0.10	0.75	0.07	0.10	0.89	13.90	0.05	12.46	334.61	2,684.54
Subshed_6C	-	-	-	-	0.00	0.00	0.00	0.00	0.14	0.44	0.01	0.01	0.00	0.00	-	0.00	0.00	0.01	0.00	0.00	0.05	0.07	0.02	0.05	2.37	21.94
Subshed_07	0.00	0.00	0.00	0.00	0.05	0.05	0.01	0.01	1.32	1.32	0.05	0.05	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.26	0.26	0.04	0.04	131.70	131.70
Subshed_08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10B	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	0.14	0.14	0.01	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.09	0.09	0.06	0.06	6.87	6.87
Subshed_11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_12	-	-	-	-	0.04	0.07	0.01	0.01	1.79	3.13	0.00	0.00	0.09	0.24	0.01	0.01	0.02	0.02	0.01	0.01	0.39	0.67	0.11	0.14	35.59	40.67
Subshed_13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_16	-	-	-	-	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.13	0.13	0.10	0.10	9.02	9.02
Subshed_17A	0.00	0.00	-	0.00	0.02	0.08	0.01	0.02	1.28	3.11	0.02	0.04	0.02	0.05	0.00	0.00	0.01	0.01	0.01	0.01	0.18	0.62	0.03	0.06	24.69	139.93
Subshed_17B	0.00	0.00	-	0.00	0.01	0.04	0.00	0.00	0.44	2.78	0.01	0.02	0.01	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.44	0.02	0.03	15.18	109.28
Subshed_17	-	-	-	-	0.00	0.00	0.00	0.00	0.08	0.21	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.01	5.50	8.80

Table D-3: Pollutant Load for 2-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
C																										
Subshed_17D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_17E	0.00	0.00	-	0.00	0.01	0.02	0.01	0.02	0.03	0.11	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.08	0.28	0.08	0.21	2.46	5.75
Subshed_18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_31	0.00	0.00	-	0.00	0.03	0.08	0.00	0.02	0.44	2.50	0.02	0.03	0.05	0.23	0.00	0.00	0.01	0.01	0.01	0.01	0.14	0.40	0.02	0.09	11.33	243.25
Subshed_32	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.30	0.30	0.06	0.06	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.12	0.12	0.05	0.05	-	-
Subshed_33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Link_01	0.02	0.04	0.02	0.10	0.41	1.25	0.12	0.34	27.80	102.76	0.49	4.69	0.41	2.08	0.08	0.12	0.33	1.45	0.22	0.29	2.97	18.69	0.64	13.62	859.25	5,483.97
Link_02	0.02	0.04	0.02	0.10	0.41	1.25	0.12	0.34	27.79	102.75	0.49	4.69	0.41	2.08	0.08	0.12	0.33	1.45	0.22	0.29	2.97	18.69	0.64	13.62	859.11	5,483.52
Link_03																										

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)	Median (lbs)	Max (lbs)
	0.02	0.04	0.02	0.10	0.41	1.25	0.12	0.34	27.78	102.72	0.49	4.69	0.41	2.08	0.08	0.12	0.33	1.45	0.22	0.29	2.97	18.68	0.64	13.61	858.88	5,481.38
Link_04	0.01	0.01	0.00	0.01	0.15	0.35	0.04	0.09	4.70	12.50	0.15	0.21	0.22	0.62	0.03	0.04	0.07	0.09	0.06	0.06	1.21	2.76	0.46	0.74	110.80	564.36
Link_06	0.01	0.01	0.00	0.01	0.15	0.35	0.04	0.09	4.70	12.50	0.15	0.21	0.22	0.62	0.03	0.04	0.07	0.09	0.06	0.06	1.21	2.76	0.46	0.74	110.83	564.37
Link_07	0.01	0.01	0.00	0.01	0.15	0.35	0.04	0.09	4.69	12.48	0.15	0.21	0.22	0.62	0.03	0.04	0.07	0.09	0.06	0.06	1.21	2.75	0.46	0.74	110.61	563.25
Link_08	0.01	0.01	0.00	0.01	0.11	0.27	0.03	0.08	2.90	9.35	0.15	0.21	0.12	0.38	0.02	0.03	0.05	0.07	0.05	0.06	0.82	2.08	0.35	0.59	75.08	522.83
Link_09	0.00	0.01	0.00	0.01	0.08	0.25	0.02	0.07	2.76	9.21	0.13	0.19	0.09	0.35	0.02	0.03	0.04	0.06	0.04	0.05	0.73	1.99	0.29	0.54	68.21	515.80
Link_10	0.00	0.01	0.00	0.00	0.05	0.17	0.02	0.05	2.32	6.72	0.12	0.16	0.04	0.12	0.02	0.02	0.04	0.05	0.04	0.04	0.59	1.59	0.27	0.45	56.90	272.97
Link_11	0.00	0.01	0.00	0.00	0.05	0.16	0.02	0.05	2.12	6.51	0.11	0.16	0.03	0.11	0.01	0.02	0.03	0.04	0.03	0.04	0.46	1.46	0.17	0.35	47.87	263.95
Link_12	0.00	0.01	0.00	0.00	0.05	0.16	0.02	0.05	2.12	6.51	0.11	0.16	0.03	0.11	0.01	0.02	0.03	0.04	0.03	0.04	0.46	1.46	0.17	0.35	47.83	263.73
Link_13	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.87	263.95
Link_14	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.88	264.01
Link_15	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.88	264.01
Link_17	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.87	263.91
Link_18	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.85	263.80
Link_19	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.84	263.77
Link_20	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.83	263.74
Link_21	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.84	263.77
Link_22	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.81	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.82	263.67
Link_23	0.01	0.03	0.02	0.10	0.26	0.91	0.09	0.25	23.25	90.91	0.34	4.50	0.19	1.48	0.05	0.09	0.27	1.37	0.16	0.23	1.78	16.02	0.18	12.94	752.35	4,952.23
Link_25	0.01	0.02	0.01	0.08	0.09	0.48	0.04	0.18	13.69	43.61	0.13	3.59	0.13	1.06	0.02	0.05	0.10	0.75	0.07	0.10	0.94	13.98	0.07	12.52	337.13	2,707.74
Link_26	0.01	0.02	0.01	0.08	0.09	0.48	0.04	0.18	13.68	43.59	0.13	3.59	0.13	1.06	0.02	0.05	0.10	0.75	0.07	0.10	0.94	13.98	0.07	12.51	337.00	2,706.71
Link_27	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	0.14	0.14	0.01	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.09	0.09	0.06	0.06	6.86	6.86
Link_28	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	0.14	0.14	0.01	0.01	0.03	0.03	0.00	0.00	0.01	0.01	0.01	0.01	0.09	0.09	0.06	0.06	6.87	6.87
Link_29																										

Table D-3: Pollutant Load for 2-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	0.00	0.00	0.00	0.00	0.02	0.07	0.01	0.02	0.54	3.10	0.03	0.06	0.01	0.05	0.00	0.01	0.01	0.02	0.01	0.02	0.16	0.73	0.10	0.24	23.13	123.73
Link_30	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.02	0.10	0.32	0.02	0.03	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.28	0.08	0.21	7.94	14.45
Link_31	0.00	0.00	-	0.00	0.01	0.02	0.01	0.02	0.03	0.12	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.08	0.27	0.08	0.21	2.80	6.26
Link_32	0.00	0.00	-	0.00	0.03	0.08	0.00	0.02	0.44	2.50	0.02	0.03	0.05	0.23	0.00	0.00	0.01	0.01	0.01	0.01	0.14	0.40	0.02	0.09	11.33	243.29
Link_33	0.00	0.01	0.00	0.00	0.04	0.15	0.01	0.05	1.82	6.21	0.05	0.10	0.03	0.11	0.01	0.01	0.02	0.03	0.02	0.03	0.34	1.34	0.13	0.30	47.87	263.95
Link_34	0.00	0.01	0.00	0.02	0.09	0.33	0.02	0.04	6.94	44.46	0.12	0.75	0.03	0.37	0.02	0.03	0.14	0.57	0.06	0.09	0.34	1.26	0.04	0.08	170.34	1,967.74
Link-06	0.00	0.00	0.00	0.00	0.05	0.06	0.01	0.02	1.60	2.67	0.05	0.10	0.02	0.04	0.01	0.01	0.02	0.04	0.02	0.02	0.28	0.45	0.04	0.18	137.22	199.88
OWS to MP2 01	0.01	0.01	0.01	0.05	0.09	0.40	0.03	0.12	10.30	43.03	0.12	2.22	0.08	0.72	0.02	0.04	0.11	0.66	0.06	0.09	0.64	7.85	0.06	6.55	253.38	2,309.28
Pump-02	0.00	0.01	0.01	0.04	0.07	0.34	0.03	0.09	8.54	36.58	0.10	1.80	0.07	0.59	0.02	0.03	0.10	0.55	0.05	0.08	0.53	6.29	0.05	5.19	210.20	1,939.19
WQ Orifice 1	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	0.99	0.99	0.04	0.04	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.20	0.20	0.03	0.03	99.40	99.40
WQ Orifice 2	0.00	0.00	0.00	0.00	0.05	0.05	0.01	0.01	1.28	1.28	0.05	0.05	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.26	0.26	0.04	0.04	127.83	127.87
WQ_Weir-01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.29	0.29	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.01	0.01	29.32	29.32
WQ_Weir-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lift to MP201	0.01	0.02	0.01	0.05	0.11	0.47	0.04	0.13	11.95	50.28	0.15	2.51	0.09	0.82	0.02	0.05	0.14	0.76	0.07	0.11	0.76	8.85	0.07	7.32	303.35	2,683.72
To_Anacostia River	0.02	0.04	0.02	0.10	0.41	1.25	0.12	0.34	27.80	102.76	0.49	4.69	0.41	2.08	0.08	0.12	0.33	1.45	0.22	0.29	2.97	18.69	0.64	13.62	859.25	5,483.97
Outfall 005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall NW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-3: Pollutant Load for 2-Year Storm

Table D-4: Pollutant Load for 5-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Subshed_01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_02	0.00	0.01	0.01	0.02	0.12	0.48	0.03	0.06	9.99	64.01	0.17	1.08	0.04	0.53	0.02	0.04	0.20	0.83	0.08	0.13	0.50	1.82	0.06	0.12	245.21	2,832.63
Subshed_03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6B	0.01	0.03	0.01	0.10	0.12	0.64	0.05	0.24	18.16	57.85	0.17	4.81	0.17	1.41	0.03	0.06	0.13	1.00	0.09	0.14	1.19	18.64	0.06	16.71	448.62	3,599.26
Subshed_6C	-	0.00	-	-	0.00	0.01	0.00	0.00	0.18	0.58	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.10	0.03	0.06	3.09	28.65
Subshed_07	0.00	0.00	0.00	0.00	0.06	0.06	0.02	0.02	1.72	1.72	0.06	0.06	0.02	0.02	0.01	0.01	0.03	0.03	0.03	0.03	0.34	0.34	0.05	0.05	172.13	172.13
Subshed_08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10B	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	0.18	0.18	0.02	0.02	0.04	0.04	0.00	0.00	0.01	0.01	0.01	0.01	0.12	0.12	0.07	0.07	8.93	8.93
Subshed_11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_12	0.00	0.00	0.00	0.00	0.05	0.09	0.01	0.02	2.32	4.05	0.01	0.01	0.12	0.30	0.01	0.01	0.02	0.03	0.01	0.01	0.50	0.87	0.14	0.19	46.11	52.70
Subshed_13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_16	-	-	-	-	0.00	0.00	0.00	0.00	0.26	0.26	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.17	0.17	0.13	0.13	11.67	11.67
Subshed_17A	0.00	0.00	0.00	0.00	0.03	0.11	0.01	0.03	1.66	4.03	0.03	0.05	0.02	0.07	0.00	0.01	0.01	0.01	0.01	0.01	0.24	0.80	0.04	0.08	32.03	181.48
Subshed_17B	0.00	0.00	-	0.00	0.01	0.06	0.00	0.00	0.57	3.60	0.01	0.03	0.01	0.06	0.00	0.00	0.01	0.01	0.01	0.01	0.08	0.57	0.02	0.04	19.67	141.55
Subshed_17	-	-	-	-	0.00	0.01	0.00	0.00	0.10	0.27	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.01	0.01	7.13	11.40

Table D-3: Pollutant Load for 2-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
C																										
Subshed_17D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_17E	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.03	0.03	0.14	0.02	0.04	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.02	0.11	0.36	0.10	0.28	3.18	7.44
Subshed_18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_31	0.00	0.00	-	0.00	0.04	0.10	0.01	0.02	0.57	3.23	0.02	0.04	0.07	0.30	0.00	0.01	0.01	0.02	0.01	0.01	0.19	0.52	0.03	0.12	14.66	314.66
Subshed_32	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.39	0.39	0.08	0.08	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.15	0.15	0.06	0.06	-	-
Subshed_33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Link_01	0.02	0.05	0.02	0.13	0.51	1.59	0.16	0.43	35.22	131.53	0.61	5.98	0.52	2.67	0.10	0.16	0.42	1.85	0.27	0.36	3.74	23.84	0.81	17.39	1,055.22	6,989.84
Link_02	0.02	0.05	0.02	0.13	0.51	1.59	0.16	0.43	35.21	131.52	0.61	5.98	0.52	2.67	0.10	0.16	0.42	1.85	0.27	0.36	3.73	23.84	0.81	17.39	1,055.07	6,989.32
Link_03																										

Table D-3: Pollutant Load for 2-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	0.02	0.05	0.02	0.13	0.51	1.59	0.16	0.43	35.20	131.47	0.61	5.98	0.52	2.67	0.10	0.16	0.42	1.85	0.27	0.36	3.73	23.83	0.81	17.37	1,054.70	6,986.12
Link_04	0.01	0.01	0.01	0.01	0.19	0.45	0.05	0.12	6.11	16.25	0.19	0.27	0.28	0.80	0.04	0.05	0.09	0.12	0.07	0.08	1.57	3.59	0.60	0.96	143.86	733.66
Link_06	0.01	0.01	0.01	0.01	0.19	0.45	0.05	0.12	6.10	16.22	0.19	0.27	0.28	0.80	0.04	0.05	0.09	0.11	0.07	0.08	1.57	3.58	0.60	0.96	143.59	732.21
Link_07	0.01	0.01	0.01	0.01	0.19	0.45	0.05	0.12	6.10	16.21	0.19	0.27	0.28	0.80	0.04	0.05	0.09	0.11	0.07	0.08	1.57	3.58	0.60	0.96	143.50	731.64
Link_08	0.01	0.01	0.00	0.01	0.14	0.36	0.04	0.10	3.78	12.16	0.19	0.27	0.16	0.50	0.03	0.04	0.06	0.09	0.06	0.07	1.07	2.71	0.46	0.77	97.42	679.09
Link_09	0.01	0.01	0.00	0.01	0.10	0.32	0.03	0.09	3.60	11.98	0.17	0.25	0.12	0.46	0.02	0.03	0.06	0.08	0.06	0.07	0.95	2.59	0.38	0.70	88.53	670.08
Link_10	0.00	0.01	0.00	0.01	0.07	0.22	0.03	0.07	3.02	8.74	0.15	0.21	0.05	0.16	0.02	0.03	0.05	0.06	0.05	0.06	0.76	2.07	0.35	0.58	73.86	355.62
Link_11	0.00	0.01	0.00	0.01	0.06	0.21	0.02	0.06	2.76	8.48	0.15	0.20	0.04	0.15	0.01	0.02	0.04	0.05	0.04	0.05	0.59	1.90	0.23	0.46	62.19	343.95
Link_12	0.00	0.01	0.00	0.01	0.06	0.21	0.02	0.06	2.76	8.47	0.15	0.20	0.04	0.15	0.01	0.02	0.04	0.05	0.04	0.05	0.59	1.90	0.23	0.45	62.09	343.38
Link_13	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.37	8.09	0.07	0.13	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.17	0.39	62.15	343.73
Link_14	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.37	8.09	0.07	0.13	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.76	0.17	0.39	62.18	343.88
Link_15	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.37	8.09	0.07	0.13	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.17	0.39	62.18	343.87
Link_17	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.37	8.08	0.07	0.13	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.17	0.39	62.13	343.62
Link_18	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.36	8.06	0.07	0.13	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.17	0.39	61.98	342.76
Link_19	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.36	8.05	0.07	0.12	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.16	0.39	61.86	342.16
Link_20	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.36	8.05	0.07	0.12	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.16	0.39	61.88	342.23
Link_21	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.36	8.03	0.07	0.12	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.74	0.16	0.39	61.73	341.43
Link_22	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.37	8.07	0.07	0.13	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.17	0.39	62.01	342.95
Link_23	0.02	0.04	0.02	0.12	0.32	1.15	0.11	0.32	29.29	116.11	0.42	5.74	0.24	1.88	0.06	0.11	0.34	1.75	0.20	0.28	2.18	20.35	0.22	16.49	916.57	6,297.64
Link_25	0.01	0.03	0.01	0.10	0.12	0.65	0.05	0.25	18.35	58.45	0.18	4.82	0.17	1.42	0.03	0.07	0.13	1.01	0.09	0.14	1.26	18.74	0.09	16.78	451.95	3,629.80
Link_26	0.01	0.03	0.01	0.10	0.12	0.65	0.05	0.25	18.35	58.44	0.18	4.82	0.17	1.42	0.03	0.07	0.13	1.01	0.09	0.14	1.26	18.74	0.09	16.78	451.83	3,628.87
Link_27	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	0.18	0.18	0.02	0.02	0.04	0.04	0.00	0.00	0.01	0.01	0.01	0.01	0.12	0.12	0.07	0.07	8.90	8.90
Link_28	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	0.18	0.18	0.02	0.02	0.04	0.04	0.00	0.00	0.01	0.01	0.01	0.01	0.12	0.12	0.07	0.07	8.91	8.91
Link_29																										

Table D-3: Pollutant Load for 2-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	0.00	0.00	0.00	0.00	0.02	0.09	0.01	0.03	0.75	4.14	0.04	0.07	0.01	0.07	0.00	0.01	0.01	0.03	0.01	0.02	0.21	0.97	0.13	0.32	30.83	166.21
Link_30	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.03	0.13	0.40	0.03	0.04	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.02	0.13	0.37	0.11	0.28	10.05	18.37
Link_31	0.00	0.00	0.00	0.00	0.01	0.03	0.01	0.03	0.03	0.14	0.02	0.04	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.02	0.11	0.35	0.10	0.27	3.16	7.37
Link_32	0.00	0.00	-	0.00	0.04	0.10	0.01	0.02	0.57	3.23	0.02	0.04	0.07	0.30	0.00	0.01	0.01	0.02	0.01	0.01	0.19	0.52	0.03	0.12	14.66	314.70
Link_33	0.00	0.01	0.00	0.00	0.05	0.20	0.02	0.06	2.37	8.09	0.07	0.13	0.03	0.14	0.01	0.01	0.02	0.04	0.02	0.03	0.44	1.75	0.17	0.39	62.16	343.75
Link_34	0.00	0.01	0.01	0.02	0.12	0.48	0.03	0.06	9.88	63.27	0.17	1.07	0.04	0.53	0.02	0.04	0.19	0.82	0.08	0.12	0.49	1.80	0.06	0.12	242.39	2,800.08
Link-06	0.00	0.00	0.00	0.01	0.07	0.10	0.02	0.02	2.58	5.54	0.08	0.20	0.03	0.07	0.01	0.01	0.04	0.08	0.03	0.03	0.41	0.79	0.05	0.37	201.72	366.91
OWS to MP201	0.01	0.02	0.01	0.05	0.10	0.45	0.04	0.13	11.41	47.85	0.14	2.45	0.09	0.80	0.02	0.04	0.13	0.73	0.07	0.10	0.71	8.66	0.06	7.22	280.81	2,563.53
Pump-02	0.00	0.01	0.01	0.04	0.09	0.39	0.03	0.11	9.89	42.43	0.12	2.07	0.08	0.68	0.02	0.04	0.11	0.64	0.06	0.09	0.61	7.25	0.06	5.98	243.21	2,246.54
WQ Orifice 1	0.00	0.00	0.00	0.00	0.04	0.04	0.01	0.01	1.19	1.19	0.04	0.04	0.01	0.01	0.00	0.00	0.02	0.02	0.02	0.02	0.24	0.24	0.03	0.03	118.80	118.80
WQ Orifice 2	0.00	0.00	0.00	0.00	0.06	0.06	0.02	0.02	1.72	1.78	0.06	0.06	0.02	0.02	0.01	0.01	0.03	0.03	0.02	0.03	0.34	0.35	0.05	0.05	171.04	174.39
WQ_Weir-01	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.50	0.50	0.02	0.02	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.10	0.01	0.01	50.35	50.35
WQ_Weir-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lift to MP201	0.01	0.02	0.01	0.08	0.16	0.70	0.06	0.19	17.62	75.40	0.22	3.65	0.14	1.21	0.03	0.07	0.20	1.13	0.11	0.16	1.11	12.74	0.10	10.46	445.89	3,991.39
To_Anacostia River	0.02	0.05	0.02	0.13	0.51	1.59	0.16	0.43	35.22	131.53	0.61	5.98	0.52	2.67	0.10	0.16	0.42	1.85	0.27	0.36	3.74	23.84	0.81	17.39	1,055.22	6,989.84
Outfall 005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall NW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-5: Pollutant Load for 10-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Subshed_01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_02	0.00	0.01	0.01	0.03	0.16	0.61	0.04	0.08	12.64	80.96	0.22	1.37	0.06	0.67	0.03	0.06	0.25	1.05	0.10	0.16	0.63	2.30	0.08	0.15	310.16	3,583.01
Subshed_03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6B	0.01	0.03	0.01	0.13	0.15	0.79	0.06	0.30	22.24	70.84	0.21	5.89	0.21	1.73	0.04	0.08	0.16	1.23	0.11	0.17	1.46	22.83	0.08	20.46	549.38	4,407.63
Subshed_6C	0.00	0.00	-	0.00	0.00	0.01	0.00	0.00	0.22	0.70	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.08	0.11	0.04	0.07	3.73	34.56
Subshed_07	0.00	0.00	0.00	0.00	0.07	0.07	0.02	0.02	2.08	2.08	0.07	0.07	0.03	0.03	0.01	0.01	0.03	0.03	0.03	0.03	0.42	0.42	0.06	0.06	207.65	207.65
Subshed_08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10B	0.00	0.00	0.00	0.00	0.04	0.04	0.02	0.02	0.22	0.22	0.02	0.02	0.05	0.05	0.00	0.00	0.01	0.01	0.01	0.01	0.14	0.14	0.09	0.09	10.73	10.73
Subshed_11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_12	0.00	0.00	0.00	0.00	0.06	0.11	0.01	0.02	2.79	4.87	0.01	0.01	0.15	0.37	0.01	0.01	0.03	0.03	0.01	0.01	0.60	1.05	0.17	0.22	55.34	63.25
Subshed_13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_16	-	-	-	-	0.01	0.01	0.01	0.01	0.31	0.31	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.20	0.20	0.15	0.15	14.00	14.00
Subshed_17A	0.00	0.00	0.00	0.00	0.03	0.13	0.01	0.03	1.99	4.84	0.03	0.06	0.03	0.08	0.00	0.01	0.01	0.01	0.01	0.01	0.28	0.96	0.05	0.09	38.46	217.96
Subshed_17B	0.00	0.00	0.00	0.00	0.01	0.07	0.00	0.01	0.68	4.32	0.01	0.03	0.01	0.07	0.00	0.00	0.01	0.01	0.01	0.01	0.10	0.69	0.02	0.05	23.60	169.89
Subshed_17	-	-	-	-	0.00	0.01	0.00	0.00	0.12	0.33	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	8.56	13.69

Table D-3: Pollutant Load for 2-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
C																										
Subshed_17 D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_17 E	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.03	0.04	0.17	0.03	0.05	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.02	0.13	0.43	0.12	0.33	3.82	8.92
Subshed_18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21 A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21 B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_31	0.00	0.00	0.00	0.00	0.05	0.12	0.01	0.03	0.69	3.88	0.03	0.05	0.08	0.36	0.00	0.01	0.01	0.02	0.01	0.01	0.22	0.62	0.03	0.14	17.58	377.34
Subshed_32	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.47	0.47	0.09	0.09	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.18	0.18	0.07	0.07	-	-
Subshed_33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Link_01	0.03	0.06	0.03	0.16	0.61	1.94	0.19	0.53	43.07	162.97	0.74	7.35	0.63	3.27	0.12	0.19	0.52	2.30	0.33	0.44	4.49	29.11	0.97	21.26	1,270.74	8,627.48
Link_02	0.03	0.06	0.03	0.16	0.61	1.94	0.19	0.53	43.07	162.97	0.74	7.35	0.63	3.27	0.12	0.19	0.52	2.30	0.33	0.44	4.49	29.11	0.97	21.26	1,270.62	8,627.16
Link_03																										

Table D-3: Pollutant Load for 2-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	0.03	0.06	0.03	0.16	0.61	1.94	0.19	0.53	43.05	162.91	0.74	7.35	0.63	3.27	0.12	0.19	0.52	2.30	0.33	0.44	4.49	29.09	0.97	21.24	1,270.23	8,623.47
Link_04	0.01	0.01	0.01	0.01	0.23	0.54	0.06	0.14	7.32	19.49	0.23	0.33	0.34	0.96	0.05	0.06	0.10	0.14	0.09	0.10	1.88	4.30	0.72	1.15	172.68	879.29
Link_06	0.01	0.01	0.01	0.01	0.23	0.54	0.06	0.14	7.31	19.48	0.23	0.33	0.34	0.96	0.05	0.06	0.10	0.14	0.09	0.10	1.88	4.30	0.72	1.15	172.57	878.83
Link_07	0.01	0.01	0.01	0.01	0.23	0.54	0.06	0.14	7.31	19.47	0.23	0.33	0.34	0.96	0.05	0.06	0.10	0.14	0.09	0.10	1.88	4.30	0.72	1.15	172.57	878.50
Link_08	0.01	0.01	0.01	0.01	0.17	0.43	0.05	0.12	4.53	14.61	0.23	0.32	0.19	0.60	0.03	0.04	0.08	0.10	0.08	0.09	1.28	3.25	0.55	0.93	117.24	815.33
Link_09	0.01	0.01	0.00	0.01	0.12	0.38	0.04	0.11	4.31	14.39	0.21	0.30	0.14	0.55	0.03	0.04	0.07	0.09	0.07	0.08	1.14	3.11	0.46	0.84	106.55	804.55
Link_10	0.01	0.01	0.00	0.01	0.08	0.26	0.03	0.08	3.62	10.51	0.18	0.25	0.06	0.19	0.03	0.03	0.06	0.07	0.06	0.07	0.91	2.49	0.42	0.70	88.95	427.37
Link_11	0.01	0.01	0.00	0.01	0.07	0.26	0.03	0.07	3.31	10.20	0.17	0.24	0.05	0.18	0.02	0.02	0.05	0.06	0.05	0.06	0.71	2.28	0.27	0.55	74.96	413.38
Link_12	0.01	0.01	0.00	0.01	0.07	0.26	0.03	0.07	3.31	10.19	0.17	0.24	0.05	0.18	0.02	0.02	0.05	0.06	0.05	0.06	0.71	2.28	0.27	0.54	74.84	412.77
Link_13	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.84	9.73	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.92	413.17
Link_14	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.84	9.73	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.95	413.32
Link_15	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.84	9.73	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.95	413.36
Link_17	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.84	9.72	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.89	413.03
Link_18	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.83	9.70	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.73	412.21
Link_19	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.83	9.69	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.09	0.20	0.47	74.59	411.48
Link_20	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.83	9.69	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.61	411.55
Link_21	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.83	9.70	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.71	412.18
Link_22	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.85	9.76	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.11	0.20	0.47	75.16	414.51
Link_23	0.02	0.05	0.02	0.15	0.39	1.41	0.13	0.39	36.00	144.60	0.51	7.06	0.29	2.32	0.07	0.14	0.42	2.17	0.24	0.35	2.63	24.94	0.26	20.19	1,105.37	7,803.07
Link_25	0.01	0.03	0.01	0.13	0.15	0.79	0.07	0.30	22.47	71.57	0.22	5.90	0.21	1.74	0.04	0.08	0.16	1.24	0.11	0.17	1.54	22.95	0.11	20.55	553.37	4,444.31
Link_26	0.01	0.03	0.01	0.13	0.15	0.79	0.07	0.30	22.48	71.59	0.22	5.90	0.21	1.74	0.04	0.08	0.16	1.24	0.11	0.17	1.54	22.96	0.11	20.55	553.58	4,446.01
Link_27	0.00	0.00	0.00	0.00	0.04	0.04	0.02	0.02	0.22	0.22	0.02	0.02	0.05	0.05	0.00	0.00	0.01	0.01	0.01	0.01	0.14	0.14	0.09	0.09	10.71	10.71
Link_28	0.00	0.00	0.00	0.00	0.04	0.04	0.02	0.02	0.22	0.22	0.02	0.02	0.05	0.05	0.00	0.00	0.01	0.01	0.01	0.01	0.14	0.14	0.09	0.09	10.71	10.71
Link_29																										

Table D-3: Pollutant Load for 2-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	0.00	0.00	0.00	0.00	0.03	0.11	0.01	0.04	0.91	5.05	0.05	0.09	0.01	0.09	0.00	0.01	0.02	0.03	0.02	0.03	0.26	1.18	0.16	0.39	37.72	202.41
Link_30	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.03	0.18	0.62	0.04	0.05	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.02	0.16	0.47	0.13	0.34	13.20	27.58
Link_31	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.03	0.05	0.20	0.03	0.05	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.02	0.13	0.43	0.12	0.33	4.38	9.91
Link_32	0.00	0.00	0.00	0.00	0.05	0.12	0.01	0.03	0.69	3.88	0.03	0.05	0.08	0.36	0.00	0.01	0.01	0.02	0.01	0.01	0.22	0.62	0.03	0.14	17.58	377.39
Link_33	0.00	0.01	0.00	0.01	0.06	0.24	0.02	0.07	2.84	9.73	0.08	0.15	0.04	0.17	0.01	0.02	0.03	0.05	0.03	0.04	0.53	2.10	0.20	0.47	74.92	413.20
Link_34	0.00	0.01	0.01	0.03	0.16	0.60	0.04	0.08	12.52	80.19	0.22	1.36	0.06	0.67	0.03	0.05	0.25	1.04	0.10	0.16	0.62	2.28	0.08	0.15	307.22	3,548.99
Link-06	0.01	0.01	0.01	0.01	0.10	0.14	0.03	0.03	3.76	9.20	0.11	0.32	0.04	0.12	0.01	0.01	0.05	0.13	0.04	0.05	0.56	1.22	0.07	0.61	274.18	574.64
OWS to MP201	0.01	0.02	0.01	0.06	0.10	0.48	0.04	0.14	12.21	51.34	0.15	2.61	0.10	0.85	0.02	0.05	0.14	0.78	0.07	0.11	0.76	9.24	0.07	7.69	300.62	2,747.38
Pump-02	0.01	0.01	0.01	0.05	0.09	0.43	0.03	0.12	10.84	46.59	0.13	2.27	0.08	0.75	0.02	0.04	0.12	0.70	0.07	0.10	0.67	7.92	0.06	6.53	266.63	2,464.70
WQ Orifice 1	0.00	0.00	0.00	0.00	0.05	0.05	0.01	0.01	1.34	1.34	0.05	0.05	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.27	0.27	0.04	0.04	134.29	134.29
WQ Orifice 2	0.00	0.00	0.00	0.00	0.07	0.08	0.02	0.02	2.15	2.29	0.08	0.08	0.03	0.03	0.01	0.01	0.03	0.03	0.03	0.03	0.42	0.44	0.06	0.07	211.96	219.54
WQ_Weir-01	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	0.70	0.70	0.03	0.03	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.14	0.14	0.02	0.02	70.37	70.37
WQ_Weir-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lift to MP201	0.01	0.03	0.01	0.11	0.22	0.97	0.08	0.26	24.38	105.35	0.31	4.98	0.19	1.66	0.05	0.09	0.29	1.57	0.15	0.23	1.54	17.29	0.14	14.11	621.37	5,547.90
To_Anacostia River	0.03	0.06	0.03	0.16	0.61	1.94	0.19	0.53	43.07	162.97	0.74	7.35	0.63	3.27	0.12	0.19	0.52	2.30	0.33	0.44	4.49	29.11	0.97	21.26	1,270.74	8,627.48
Outfall 005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall NW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-6: Pollutant Load for 15-Year Storm

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
Subshed_01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_02	0.01	0.02	0.01	0.03	0.18	0.68	0.05	0.09	14.20	90.96	0.25	1.54	0.06	0.76	0.03	0.06	0.28	1.17	0.12	0.18	0.70	2.58	0.09	0.17	348.46	4,025.38
Subshed_03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_6B	0.01	0.04	0.01	0.14	0.16	0.87	0.07	0.33	24.62	78.43	0.23	6.52	0.24	1.92	0.04	0.09	0.17	1.36	0.12	0.18	1.62	25.27	0.09	22.66	608.23	4,879.77
Subshed_6C	0.00	0.00	-	0.00	0.00	0.01	0.00	0.00	0.24	0.77	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.08	0.13	0.04	0.08	4.10	38.01
Subshed_07	0.00	0.00	0.00	0.00	0.08	0.08	0.02	0.02	2.28	2.28	0.08	0.08	0.03	0.03	0.01	0.01	0.03	0.03	0.03	0.03	0.46	0.46	0.06	0.06	228.33	228.33
Subshed_08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_10B	0.00	0.00	0.00	0.00	0.05	0.05	0.02	0.02	0.24	0.24	0.03	0.03	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.16	0.16	0.10	0.10	11.78	11.78
Subshed_11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_12	0.00	0.00	0.00	0.00	0.07	0.12	0.01	0.02	3.06	5.34	0.01	0.01	0.16	0.40	0.01	0.01	0.03	0.04	0.01	0.01	0.66	1.15	0.19	0.25	60.72	69.40
Subshed_13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_16	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.34	0.34	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.22	0.22	0.17	0.17	15.35	15.35
Subshed_17A	0.00	0.00	0.00	0.00	0.04	0.14	0.01	0.04	2.18	5.31	0.04	0.07	0.03	0.09	0.00	0.01	0.01	0.01	0.01	0.01	0.31	1.06	0.05	0.10	42.21	239.20
Subshed_17B	0.00	0.00	0.00	0.00	0.01	0.08	0.00	0.01	0.75	4.74	0.02	0.04	0.01	0.08	0.00	0.00	0.01	0.01	0.01	0.01	0.11	0.75	0.03	0.05	25.90	186.38
Subshed_17	-	-	-	-	0.01	0.01	0.00	0.00	0.13	0.36	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.02	9.39	15.02

Table D-3: Pollutant Load for 2-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
C																										
Subshed_17D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_17E	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.03	0.04	0.19	0.03	0.05	0.00	0.01	0.00	0.01	0.01	0.02	0.01	0.02	0.14	0.47	0.14	0.36	4.19	9.79
Subshed_18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_21B	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subshed_31	0.00	0.00	0.00	0.00	0.05	0.14	0.01	0.03	0.75	4.25	0.03	0.06	0.09	0.40	0.00	0.01	0.01	0.02	0.01	0.01	0.24	0.68	0.04	0.15	19.28	413.84
Subshed_32	0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.51	0.51	0.10	0.10	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.20	0.20	0.08	0.08	-	-
Subshed_33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Link_01	0.03	0.07	0.03	0.18	0.67	2.17	0.21	0.59	48.07	183.70	0.82	8.22	0.69	3.64	0.13	0.21	0.58	2.59	0.37	0.49	4.95	32.39	1.07	23.66	1,402.80	9,694.93
Link_02	0.03	0.07	0.03	0.18	0.67	2.17	0.21	0.59	48.06	183.67	0.82	8.22	0.69	3.64	0.13	0.21	0.58	2.59	0.37	0.49	4.95	32.38	1.07	23.66	1,402.55	9,693.50
Link_03																										

Table D-3: Pollutant Load for 2-Year Storm																										
Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	0.03	0.07	0.03	0.18	0.67	2.17	0.21	0.59	48.04	183.60	0.82	8.21	0.69	3.64	0.13	0.21	0.58	2.59	0.37	0.49	4.95	32.36	1.07	23.64	1,402.12	9,689.47
Link_04	0.01	0.01	0.01	0.01	0.25	0.59	0.07	0.15	8.04	21.42	0.26	0.36	0.37	1.06	0.05	0.06	0.11	0.15	0.10	0.11	2.06	4.72	0.79	1.26	189.71	966.30
Link_06	0.01	0.01	0.01	0.01	0.25	0.59	0.07	0.15	8.05	21.42	0.26	0.36	0.37	1.06	0.05	0.06	0.11	0.15	0.10	0.11	2.07	4.72	0.79	1.26	189.69	966.28
Link_07	0.01	0.01	0.01	0.01	0.25	0.59	0.07	0.15	8.04	21.41	0.26	0.36	0.37	1.06	0.05	0.06	0.11	0.15	0.10	0.11	2.07	4.72	0.79	1.26	189.66	965.47
Link_08	0.01	0.01	0.01	0.01	0.18	0.47	0.06	0.13	4.99	16.07	0.25	0.35	0.21	0.66	0.04	0.05	0.08	0.11	0.08	0.10	1.41	3.57	0.60	1.02	128.95	896.26
Link_09	0.01	0.01	0.01	0.01	0.14	0.42	0.04	0.12	4.75	15.83	0.23	0.33	0.16	0.60	0.03	0.04	0.07	0.10	0.07	0.09	1.25	3.42	0.50	0.92	117.20	884.43
Link_10	0.01	0.01	0.00	0.01	0.09	0.29	0.03	0.09	3.99	11.58	0.20	0.27	0.07	0.21	0.03	0.04	0.06	0.08	0.06	0.08	1.01	2.74	0.47	0.77	97.91	470.97
Link_11	0.01	0.01	0.00	0.01	0.08	0.28	0.03	0.08	3.65	11.24	0.19	0.27	0.06	0.20	0.02	0.03	0.05	0.07	0.05	0.07	0.78	2.52	0.30	0.60	82.56	455.62
Link_12	0.01	0.01	0.00	0.01	0.08	0.28	0.03	0.08	3.65	11.22	0.19	0.27	0.06	0.20	0.02	0.03	0.05	0.07	0.05	0.07	0.78	2.51	0.30	0.60	82.43	454.96
Link_13	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.14	10.72	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.04	0.59	2.32	0.22	0.52	82.52	455.39
Link_14	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.14	10.72	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.05	0.59	2.32	0.22	0.52	82.55	455.57
Link_15	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.14	10.72	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.05	0.59	2.32	0.22	0.52	82.56	455.62
Link_17	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.13	10.72	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.04	0.59	2.32	0.22	0.52	82.50	455.31
Link_18	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.13	10.70	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.04	0.59	2.31	0.22	0.52	82.33	454.48
Link_19	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.13	10.68	0.09	0.16	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.04	0.58	2.31	0.22	0.52	82.18	453.73
Link_20	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.12	10.68	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.04	0.58	2.31	0.22	0.52	82.21	453.75
Link_21	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.13	10.70	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.04	0.59	2.31	0.22	0.52	82.38	454.81
Link_22	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.15	10.77	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.05	0.59	2.33	0.22	0.52	82.90	457.52
Link_23	0.02	0.05	0.03	0.17	0.43	1.59	0.14	0.44	40.41	163.96	0.57	7.92	0.33	2.61	0.08	0.15	0.47	2.46	0.27	0.39	2.92	27.86	0.29	22.52	1,223.72	8,811.10
Link_25	0.01	0.04	0.01	0.14	0.17	0.88	0.07	0.33	24.87	79.23	0.24	6.53	0.24	1.92	0.04	0.09	0.18	1.37	0.13	0.19	1.70	25.41	0.13	22.75	612.62	4,920.16
Link_26	0.01	0.04	0.01	0.14	0.17	0.88	0.07	0.34	24.89	79.28	0.24	6.54	0.24	1.93	0.04	0.09	0.18	1.37	0.13	0.19	1.70	25.43	0.13	22.76	613.06	4,923.65
Link_27	0.00	0.00	0.00	0.00	0.05	0.05	0.02	0.02	0.24	0.24	0.03	0.03	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.16	0.16	0.10	0.10	11.78	11.78
Link_28	0.00	0.00	0.00	0.00	0.05	0.05	0.02	0.02	0.24	0.24	0.02	0.02	0.05	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.16	0.16	0.10	0.10	11.76	11.76
Link_29																										

Storm Element	Total Cadmium		Dissolved Cadmium		Total Copper		Dissolved Copper		Total Iron		Dissolved Iron		Total Lead		Dissolved Lead		Total Nickel		Dissolved Nickle		Total Zinc		Dissolved Zinc		TSS	
	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max	Median	Max
	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)	(lbs)
	0.00	0.01	0.00	0.00	0.03	0.13	0.02	0.04	1.01	5.56	0.06	0.10	0.02	0.09	0.01	0.01	0.02	0.04	0.02	0.03	0.29	1.30	0.17	0.43	41.52	223.07
Link_30	0.00	0.00	0.00	0.00	0.02	0.05	0.01	0.04	0.21	0.71	0.04	0.06	0.01	0.01	0.00	0.01	0.01	0.02	0.01	0.02	0.17	0.52	0.14	0.37	14.66	31.43
Link_31	0.00	0.00	0.00	0.00	0.01	0.04	0.01	0.03	0.05	0.21	0.03	0.05	0.00	0.01	0.00	0.01	0.01	0.02	0.01	0.02	0.14	0.47	0.13	0.36	4.65	10.61
Link_32	0.00	0.00	0.00	0.00	0.05	0.14	0.01	0.03	0.75	4.25	0.03	0.06	0.09	0.40	0.00	0.01	0.01	0.02	0.01	0.01	0.24	0.68	0.04	0.15	19.28	413.81
Link_33	0.00	0.01	0.00	0.01	0.06	0.26	0.02	0.08	3.14	10.72	0.09	0.17	0.04	0.18	0.01	0.02	0.03	0.05	0.03	0.04	0.59	2.32	0.22	0.52	82.52	455.42
Link_34	0.01	0.02	0.01	0.03	0.18	0.68	0.05	0.09	14.09	90.28	0.24	1.53	0.06	0.75	0.03	0.06	0.28	1.17	0.12	0.18	0.70	2.56	0.09	0.17	345.86	3,995.41
Link-06	0.01	0.01	0.01	0.01	0.10	0.15	0.03	0.04	3.99	10.07	0.11	0.35	0.04	0.13	0.01	0.02	0.06	0.14	0.05	0.05	0.59	1.29	0.08	0.65	285.86	619.96
OWS to MP201	0.01	0.02	0.01	0.06	0.11	0.50	0.04	0.14	12.66	53.23	0.15	2.71	0.10	0.88	0.02	0.05	0.14	0.81	0.08	0.12	0.79	9.57	0.07	7.96	311.47	2,847.55
Pump-02	0.01	0.02	0.01	0.05	0.10	0.45	0.03	0.12	11.25	48.37	0.14	2.35	0.09	0.78	0.02	0.04	0.13	0.73	0.07	0.10	0.70	8.22	0.06	6.77	276.70	2,558.59
WQ Orifice 1	0.00	0.00	0.00	0.00	0.05	0.05	0.01	0.01	1.43	1.43	0.05	0.05	0.02	0.02	0.01	0.01	0.02	0.02	0.02	0.02	0.29	0.29	0.04	0.04	142.82	142.82
WQ Orifice 2	0.00	0.00	0.00	0.00	0.08	0.08	0.02	0.02	2.33	2.43	0.08	0.09	0.03	0.03	0.01	0.01	0.03	0.04	0.03	0.03	0.46	0.47	0.06	0.07	230.68	236.33
WQ_Weir-01	0.00	0.00	0.00	0.00	0.03	0.03	0.01	0.01	0.83	0.83	0.03	0.03	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.17	0.17	0.02	0.02	82.52	82.52
WQ_Weir-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lift to MP201	0.01	0.04	0.02	0.12	0.24	1.06	0.08	0.29	26.48	113.95	0.33	5.44	0.21	1.80	0.05	0.10	0.31	1.71	0.17	0.25	1.67	18.93	0.15	15.49	673.45	6,014.51
To_Anacostia River	0.03	0.07	0.03	0.18	0.67	2.17	0.21	0.59	48.07	183.70	0.82	8.22	0.69	3.64	0.13	0.21	0.58	2.59	0.37	0.49	4.95	32.39	1.07	23.66	1,402.80	9,694.93
Outfall 005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 101	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall 401	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Outfall NW	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table D-3: Pollutant Load for 2-Year Storm

Appendix B
Civil / Site Design Package and Specifications

PLOTTED: 2/15/2017 9:08 AM

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0001-COVER SHEET.dwg

BENNING ROAD FACILITY
3400 BENNING ROAD NE, WASHINGTON, DC 20019
STORMWATER MEASURES

COVER SHEET

SHEET INDEX

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

	DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

PROJECT OVERVIEW

POTOMAC ELECTRIC POWER CO. (PEPCO) IS PLANNING TO INSTALL AND MAINTAIN SEVERAL NEW WATER QUALITY TREATMENT BEST MANAGEMENT PRACTICES (BMPS) AT THEIR BENNING SERVICE CENTER LOCATED AT 3400 BENNING ROAD NE IN WASHINGTON, DC AS A RESULT OF AN ENVIRONMENTAL CONSENT DECREE ISSUED BY THE US ENVIRONMENTAL PROTECTION AGENCY (EPA). PEPCO IS SEEKING A BUILDING/CONSTRUCTION PERMIT FROM THE DISTRICT'S DEPARTMENT OF CONSUMER AND REGULATORY AFFAIRS (DCRA) AND AN EROSION AND SEDIMENT CONTROL (ESC) PERMIT FROM THE DISTRICT'S DEPARTMENT OF ENERGY & ENVIRONMENT (DOEE) TO CONSTRUCT THE NEW WATER QUALITY TREATMENT BMPS AND THE ASSOCIATED NEW STORM SEWER PIPING AND STRUCTURES DESCRIBED HEREIN. THE PROPOSED BMPS WILL REDUCE CONTAMINATION AND POLLUTANT LOADS IN SURFACE RUNOFF WATER WHICH IS CURRENTLY COLLECTED ON-SITE IN A PRIVATE, UNDERGROUND, SEPARATE STORM SEWER SYSTEM. STORMWATER RUNOFF LEAVES THE SITE THROUGH A SEPARATE STORM SEWER OUTFALL TO THE NORTH WHERE IT DISCHARGES DIRECTLY INTO THE ANACOSTIA RIVER.

THIS PROJECT IS CLASSIFIED AS EXEMPT FROM THE REQUIREMENTS OF SECTION 520 (STORMWATER MANAGEMENT: PERFORMANCE REQUIREMENTS FOR MAJOR LAND-DISTURBING ACTIVITY) OF THE DC MUNICIPAL REGULATIONS (DCMR) FOR TWO REASONS, AS FOLLOWS, PER DCMR SECTION 517 (STORMWATER MANAGEMENT: EXEMPTIONS):

1. SECTION 517.2(E): THE PROJECT IS BEING CONDUCTED FOR THE SOLE PURPOSE TO INSTALL BMPS IN COMPLIANCE WITH A COURT-APPROVED CONSENT DECREE OR IN COMPLIANCE WITH A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT; AND/OR
2. SECTION 517.3: THE PROJECT IS A LAND-DISTURBING ACTIVITY THAT CONSISTS SOLELY OF CUTTING A TRENCH FOR UTILITY WORK AND DOES NOT INVOLVE THE RECONSTRUCTION OF A DC DEPARTMENT OF TRANSPORTATION (DDOT) ROADWAY.

THE PROPOSED WATER QUALITY BMPS INCLUDE MEDIA FILTERS (E.G., CONTECH® STORMFILTER®), MEMBRANE FILTERS (E.G., CONTECH® JELLYFISH®), OR A COMBINATION OF THE TWO. THE MEDIA FILTERS (E.G., CONTECH® STORMFILTER®) WILL BE RECHARGEABLE, SELF-CLEANING CARTRIDGES THAT TRAP PARTICULATES AND ABSORB DISSOLVED METALS. THE MEMBRANE FILTERS (E.G., CONTECH® JELLYFISH®) WILL BE HIGH FLOW PRETREATMENT AND MEMBRANE FILTRATION TO REMOVE FLOATABLES, TRASH, OIL, DEBRIS, TOTAL SUSPENDED SOLIDS (TSS), FINE SILT-SIZED PARTICLES, AND A HIGH PERCENTAGE OF PARTICULATE-BOUND POLLUTANTS, INCLUDING METALS. EACH BMP OR BMP COMBINATION HAS BEEN DESIGNED TO REDUCE METAL CONCENTRATIONS IN COMPLIANCE WITH THE REQUIREMENTS OF THE CONSENT DECREE WITH THE EPA.

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

COVER SHEET

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: NTS	
						C0001	SHEET OF 28	REV. NEW

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C0002 SHEET OF 28	REV. NEW

STANDARD ABBREVIATIONS

ABBREVIATION	DESCRIPTION
BLDG.	BUILDING
BM	MONUMENT (BENCHMARK)
BMP	BEST MANAGEMENT PRACTICE
BW	BOTTOM OF WALL
CC	CONCRETE BARRIER
CI	CAST IRON
CLF	CHAIN LINK FENCE
CMP	CORRUGATED METAL PIPE
CN	CURVE NUMBER
CONC.	CONCRETE
C&G	CURB AND GUTTER
CW	COLD WATER
C/O	CLEAN OUT
DHCW	DOMESTIC HOT AND COLD WATER PIPE
DIP	DUCTILE IRON PIPE
DP	DETENTION PIPE
ELE	ELEVATION
ELEC	ELECTRICAL
EJB	ELECTRICAL JUNCTION BOX
E.P.	EDGE OF PAVEMENT
EX.	EXISTING
FF	FINISHED FLOOR
FFE	FINISHED FLOOR ELEVATION
FG	FINISH GRADE
FTG	FITTING
FPS	FEET PER SECOND
FS	FLOW SPLITTER
GP	GUARD POST
GR	GREEN ROOF
GV	GAS VALVE
HDPE	HIGH DENSITY POLYETHYLENE PIPE
HERCP	HORIZONTAL ELLIPTICAL REINFORCED CONCRETE PIPE
HGL	HYDRAULIC GRADE LINE
HS-1	HOTSPOT
HVAC	HEATING, VENTILATION AND AIR CONDITIONING
HW	HEADWALL
HYDR	FIRE HYDRANT
INV.	INVERT
INV. EL	INVERT ELEVATION
INV. IN	INVERT IN
INV. OUT	INVERT OUT
JF-3	JELLYFISH
LEN	LENGTH
LF	LINEAR FEET
LOD	LIMITS OF DISTURBANCE
MDSHA	MARYLAND STATE HIGHWAY ADMINISTRATION
MH	MANHOLE
MH-XXX	ELECTRIC MANHOLE
MH-XX-XXX	ELECTRIC MANHOLE
NSA-XX	NSA IDENTIFYING MONUMENT
PE	POLYETHYLENE
PIV	POST INDICATOR VALVE
PVC	PLASTIC PIPE
PROP.	PROPOSED
RCP	REINFORCED CONCRETE PIPE
RD-I	ROOF DRAIN
S	SLOPE
SAN MH / SSMH	SANITARY MANHOLE
SB	SOIL BORING
SF	SILT FENCE
SF-1	STORM FILTER
SSF	SUPER SILT FENCE
STA.	STATION
STL	STEEL
STMH	STEAM MANHOLE
SUB	CONTROL POINT
SWM	STORM WATER MANAGEMENT
T-COMM	TELECOMMUNICATIONS LINE
TB	TOF OF BUILDING
TG	TOP OF GRADE
TW	TOP OF WALL
TRAV	TRAVERSE CONTROL POINT
TYP.	TYPICAL
USCS	UNIFIED SOILS CLASSIFICATION SYSTEM
W	WIDTH OF OUTLET PROTECTION
W/	WITH
Wa	WATER
WV	WATER VALVE

EXISTING LEGEND

SYMBOL	DESCRIPTION
	MONITORING WELL
	TREE
	BUSH
	GRATE INLET
	GRATE INLET ROUND
	STORM MANHOLE
	DRAIN
	SINGLE POST SIGN
	GAS VALVE
	LIGHT POLE
	TRAFFIC SIGNAL POLE
	POWER POLE
	ELECTRIC OUTLET
	ELECTRIC MANHOLE
	ELECTRIC BOX
110.19	GROUND SHOT
110.19TW	TOP OF WALL ELEVATION
	COMUNICATION MANHOLE
	UNKNOWN UTILITY MANHOLE
	SANITARY SEWER MANHOLE
	WATER VALVE
	FIRE HYDRANT
	WATER MANHOLE
	BOLLARD
	TRAVERSE
	BENCH MARK
	CURB AND GUTTER
OHE	OVERHEAD ELECTRIC LINE
W	UNDERGROUND WATERLINE PAINT
	PROPERTY LINE
CLF	CHAIN LINK FENCE
	BUILDING OVERHANG
	GATE
24" RCP	STORM DRAIN PIPE
	BUILDING
	WALL

DEMOLITION LEGEND

SYMBOL	DESCRIPTION
	DEMOLISH / REMOVE EX. PIPE
	DEMOLISH EXISTING CURB AND GUTTER
	DEMOLISH OF ASPHALT PAVEMENT
	DEMOLISH OF EXISTING CONCRETE PAVEMENT
	DEMOLISH EXISTING BOLLARDS

PROPOSED LEGEND

SYMBOL	DESCRIPTION
	PROPOSED COMPACTED COVER
	PROPOSED CONCRETE PAVEMENT
	PROPOSED ASPHALT SURFACE (REPLACED)
	JELLYFISH GRATE INLET
FS-1	FLOW-SPLITTER
MH-1	STORM DRAIN MANHOLE
	STORM DRAIN PIPE
	HOTSPOT DELINEATION
LOD	LIMITS OF DISTURBANCE
19	PROPOSED CONTOUR
18.95	PROPOSED SPOT SHOT
	PROPOSED DOWNSPOUT TREATMENT DEVICE
JF-1	PROPOSED JELLYFISH MANHOLE
143	PROPOSED STRUCTURE NUMBERS
	PROPOSED STORM FILTER

ESC LEGEND

SYMBOL	DESCRIPTION
LOD	LIMITS OF DISTURBANCE
SBD	STRAW BALE DIKE (SBD)
SF	SILT FENCE (SF)
	INLET PROTECTION (IP)

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3400 BENNING ROAD NE
STORMWATER MEASURES

ABBREVIATIONS AND LEGENDS

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP / DATE: 01/27/17	ENGR.:SJN / SCALE:NTS	CLASS
SJN						C0002 SHEET OF 28		REV. NEW

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0002-C003-ABBREVIATIONS AND LEGENDS.dwg

EXISTING STORM STRUCTURE DATA:

J01 MANHOLE
TOP=19.05'
INV OUT=16.35'

J02 MANHOLE
TOP=20.26'
INV IN=17.06'
INV OUT=16.46' (BLOCKED)

J03 INLET
TOP=21.25'
INV IN=16.00'
INV OUT=15.85'

J04 INLET
TOP=18.69'
INV IN(A)=12.38
INV IN(B)=12.29'
INV OUT=11.99'

J05 GRATE
TOP=19.11'
INV IN=12.88'
INV OUT=12.56

J06 INLET
TOP=18.95'
INV IN=14.85'
INV OUT=14.75'

J07 INLET
TOP=17.56'
INV IN(A)=13.46'
INV IN(B)=14.86'
INV OUT=13.76'

M07A MANHOLE
TOP=20.76'
INV IN=11.27'
INV OUT=11.12'

J08 GRATE
TOP=18.40'
INV IN(A)=11.15'
INV IN(B)=11.45'
INV IN(C)=17.10'
INV OUT=11.05'

J09 INLET
TOP=18.19'
INV OUT=16.80'

J16 GRATE
TOP=16.68'
INV OUT=11.48'

M18 MANHOLE
TOP=15.53'
INV (A)IN=8.18'
INV (B)IN=7.63'
INV OUT=7.53'

J17 INLET
TOP=15.59'
INV IN(A)=10.59'
INV IN(B)=7.70'
INV IN(C)=7.39'
INV OUT=7.29'

J18 INLET
TOP=14.36'
INV IN(A)=12.19'
INV IN(B)=12.09'
INV OUT=11.81'

J18A INLET
TOP=14.10'
INV OUT=12.15'

J19 INLET
TOP=20.74'
INV IN(A)=16.14'
INV IN(B)=15.54'
INV IN(C)=18.64'
INV IN(D)=18.74'
INV OUT=15.04'

J26 INLET
TOP=16.86'
INV IN(A)=14.60'
INV IN(B)=14.56'
INV OUT=13.41'

J27 MANHOLE
TOP=15.87'
INV IN(A)=6.47'
INV IN(B)=6.22'
INV OUT=5.87'

J28 INLET
TOP=16.14'
INV IN=12.59'
INV OUT=11.66'

M30 GRATE INLET
TOP=16.38'
INV IN=11.33'
INV OUT=10.48'

J31 INLET
TOP=16.49'
INV OUT=12.79'

M32 MANHOLE
TOP=16.76'
INV IN=12.41'
INV OUT=12.16'

J33 INLET
TOP=17.23
INV IN=0.80'
INV OUT=0.75'

J34 INLET
TOP=15.71
INV IN=13.76'
INV OUT=13.41'

J35 MANHOLE
TOP=16.45'
INV IN(A)=15.20'
INV IN(B)=14.80'
INV OUT=14.35'

J37 INLET
TOP=17.25'
INV (A)IN=10.41'
INV (B)IN=10.74'
INV OUT=6.06'

M38A MANHOLE
TOP=27.95'
INV IN(A)=23.20'
INV IN(B)=24.50'
INV OUT=23.20'

J38 CURB INLET
TOP=27.40'
INV OUT=24.80'

J39 CURB INLET
TOP=27.34'
INV OUT=23.29'

J40 CURB INLET
TOP=28.65'
INV OUT=23.45'

M41 MANHOLE
TOP=29.63'
INV IN=25.73'
INV OUT=25.48'

J42 INLET
TOP=30.20'
INV OUT=25.65'

M43 MANHOLE
TOP=31.01'
INV (A)IN=23.21'
INV (B)IN=24.81'
INV OUT=23.01'

J43 INLET
TOP=30.02'
INV OUT=25.52'

J44 INLET
TOP=30.18'
INV OUT=24.73'

M45 MANHOLE
TOP=30.75'
INV IN(A)=23.9'
IN IN(B)=25.75'
INV OUT=23.65'

J45 INLET
TOP=30.22'
INV OUT=24.52'

J46 INLET
TOP=30.33'
INV OUT=24.73'

M46 MANHOLE
TOP=30.60'
INV IN=25.1'
INV OUT=25.05'

J47 INLET
TOP=31.06'
INV OUT=26.16'

M48B MANHOLE
TOP=30.25'
INV IN(A)=23.73'
INV IN(B)=25.1'
INV OUT=23.47'

M48A MANHOLE
TOP=30.95'
INV IN=24.75'
INV OUT=24.50'

M48 MANHOLE
TOP=30.80'
INV IN(A)=25.35'
INV IN(B)=25.90'
INV OUT=25.45'

J48 INLET
TOP=29.94'
INV OUT=25.79'

M49 MANHOLE
TOP=30.77'
INV IN(A)=26.77'
INV IN(B)=26.27'
INV IN(C)=26.57'
INV OUT=26.29'

T49 TRENCH DRAIN
TOP=30.52'
INV IN=28.78'
INV OUT=28.77'

M51A MANHOLE
TOP=27.49'
INV IN=22.09'
INV OUT=21.99'

M51B MANHOLE
TOP=27.73'
INV IN=21.93'
INV OUT=21.73'

J51 INLET
TOP=25.97'
INV IN=23.92'
INV OUT=23.77'

M51C MANHOLE
TOP=27.49'
INV IN=21.04'
INV OUT=19.59'

M52 MANHOLE
TOP=27.07'
INV IN(A)=25.79'
INV IN(B)=25.39'
INV OUT=24.22'

M52A MANHOLE
TOP=28.31'
INV IN=26.36'
INV OUT=26.11'

J53 INLET
TOP=32.49'
INV OUT=29.39'

T53 TRENCH DRAIN
TOP=32.20'
INV OUT=30.67'

J54 CURB INLET
TOP=32.16'
INV OUT=27.01'

M55B MANHOLE
TOP=25.26'
INV IN=13.90'
INV OUT=13.85'

M55A MANHOLE
TOP=27.23'
INV IN=20.06'
INV IN=15.05'
INV OUT=15.00'

M55 MANHOLE
TOP=27.77'
INV IN=15.45'
INV OUT=15.40'

M55C MANHOLE
TOP=22.49'
INV (A)IN=15.65'
INV (B)IN=12.75'
INV OUT=12.70'

J56 INLET
TOP=24.60'
INV OUT=20.70'

M56 MANHOLE
TOP=24.80'
INV IN(A)=19.35'
INV IN(B)=16.85'
INV OUT=16.80'

J57 MANHOLE
TOP=24.90'
INV (A)IN=16.62'
INV (B)IN=16.50'
INV OUT=16.42'

J58 INLET
TOP=26.60'
INV OUT=18.01' 8"RCP

J60 INLET
TOP=28.04'
INV IN=24.84'
INV OUT=20.84'

M60A MANHOLE
TOP=27.22'
INV IN(A)=16.67'
INV IN(B)=23.77'
INV OUT=16.62'

J61 CURB INLET
TOP=27.95'
INV OUT=22.15'

J62 CURB INLET
TOP=31.16'
INV IN(A)=23.68'
INV IN(B)=28.96'
INV OUT=23.06'

M63 MANHOLE
TOP=32.27'
INV IN(A)=27.82'
INV IN(B)=27.87'
INV OUT=25.87'

J63 INLET
TOP=32.11'
INV IN=29.76'
INV OUT=28.76'

J64 INLET
TOP=33.27'
INV OUT=29.87'

J65 INLET
TOP=21.40'
INV OUT "a"=19.77'
INV OUT "b"=19.77'

J66 INLET
TOP=21.49'
INV "a" IN=18.49'
INV "b" IN=18.59'
INV OUT=17.99'

J67 INLET
TOP=19.10'
INV (A)IN=12.28'
INV (B)IN=15.09'
INV OUT=12.22'

J68 INLET
TOP=20.77'
INV OUT=16.27'

M69A MANHOLE
TOP=18.57'
INV IN(A)=14.22'
INV IN(B)=14.22'
INV IN(C)=13.83'
INV OUT=13.77'

J69 INLET
TOP=18.02'
INV OUT=14.98'

J70 INLET
TOP=17.93'
INV OUT=14.53'

J71 INLET
TOP=20.94'
INV IN(A)=14.54'
INV IN(B)=16.49'
INV OUT=14.39'

M71 MANHOLE
TOP=22.65'
INV IN=14.4'
INV OUT=14.35'

M71A MANHOLE
TOP=21.70'
INV IN=14.40'
INV OUT=14.30'

M71B MANHOLE
TOP=21.98'
INV IN(A)=16.13'
INV IN(B)=13.98'
INV OUT=13.85'

J72 CURB INLET
TOP=20.42'
INV IN=17.72'
INV OUT=15.37'

M73 MANHOLE
TOP=24.84'
INV IN(A)=17.56'
INV IN(B)=18.89'
INV OUT=17.39'

J74 INLET
TOP=24.42'
INV IN=20.14'
INV OUT=19.87'

J75 INLET
TOP=22.59'
INV OUT=18.54'

M75A MANHOLE
TOP=22.69'
INV IN(A)=17.09'
INV IN(B)=16.24'
INV OUT=16.04'

J76 INLET
TOP=22.77'
INV OUT=18.87'

M77 MANHOLE
TOP=23.31'
INV IN(A)=18.26'
INV IN(B)=19.12'
INV OUT=17.76

J77 INLET
TOP=22.44'
INV OUT=19.44'

J97 MANHOLE
TOP=25.14'
INV IN=20.09'
INV OUT=18.54'

J98 INLET
TOP=21.03'
INV OUT=17.73'

J100 INLET
TOP=28.30'
INV OUT=23.00'

J101 INLET
TOP=32.21'
INV OUT=28.31'

M101 MANHOLE
TOP=32.48'
INV IN(A)=29.18'
INV IN(B)=28.43'
INV OUT=27.68'

J104 CURB INLET
TOP=25.61'
INV OUT=21.51'

T108 TRENCH
TOP=18.93'
INV IN=15.68'
INV OUT=15.23'

M108 MANHOLE
TOP=18.89'
INV IN(A)=15.20'
INV IN(B)=15.10'
INV OUT=12.40'

J108 INLET
TOP=18.83'
INV OUT=16.13'

M207 MANHOLE
TOP=19.59'
INV OUT=17.59'

CT-1 MANHOLE
TOP=28.26'
INV IN(A)=23.86'
INV IN(B)=22.86'
INV OUT=22.36'

CT-2 MANHOLE
TOP=28.29'
INV OUT=22.89'

T102 TRENCH DRAIN
TOP=33.37'
INV OUT=31.62'

T103 TRENCH DRAIN
TOP=33.46'
INV OUT=31.71'

403A MANHOLE
TOP=29.44'
INV IN=20.65'
INV OUT=20.50'

403 MANHOLE
TOP=31.79'
INV IN=25.54'
INV IN=19.15'
INV OUT=19.05'

404 MANHOLE
TOP=28.42'
INV (A)IN=24.03'
INV (B)IN=22.50'
INV (C)IN=21.06'
INV OUT=21.06'

405 MANHOLE
TOP=30.48'
INV (A)IN=22.88'
INV (B)IN=21.98'
INV OUT=21.93'

416 MANHOLE
TOP=19.08'
INV (A)IN=11.69'
INV (B)IN=11.62'
INV OUT=11.57'

WQS-1 MANHOLE
TOP=32.10'
INV IN=28.45'
INV OUT=28.42'

WQS-2 MANHOLE
TOP=32.09'
INV IN=28.44'
INV OUT=26.54'

WQS-3 MANHOLE
TOP=32.15'
INV IN=28.35'
INV OUT=24.15'

WQS2-1 MANHOLE
TOP=17.12'
INV IN=9.02'
INV OUT=7.77'

WQS2-2 MANHOLE
TOP=17.10'
INV IN=9.30'
INV OUT=7.75'

WQS2-3 MANHOLE
TOP=17.14'
INV IN=8.94'
INV OUT=5.49'

1 GRATE INLET
TOP=16.18'
INV OUT=14.00'

2 GRATE INLET
TOP=16.45'
INV OUT=14.63'

4 GRATE INLET
TOP=16.05'
INV OUT=14.07'

5 GRATE INLET
TOP=13.39'
INV IN=11.22'
INV OUT=11.15'

6 GRATE INLET
TOP=13.80'
INV OUT=11.22'

10 GRATE INLET (ROUND)
TOP=18.43'
FULL OF WATER

11 GRATE INLET (ROUND)
TOP=17.36'
INV IN 'a'=14.21'
INV IN 'b'=14.21'

12 GRATE INLET (ROUND)
TOP=16.47'
INV IN=12.87'

13 GRATE INLET ROUND
TOP=15.82'
INV IN=11.52'
INV OUT=11.27'

14 GRATE INLET
TOP=14.90'
INV IN=10.45'
INV OUT=10.00'

15 GRATE INLET (ROUND)
TOP=15.97'
INV IN 'a'=9.97'
INV IN 'b'=13.97'
INV IN 'c'=10.57'
INV IN 'd'=12.27'
INV OUT=8.27'

20 GRATE INLET
TOP=16.27'
INV IN=11.67'
INV OUT=11.57'

21 GRATE INLET (ROUND)
TOP=17.07'
INV OUT=14.07'

24 GRATE INLET
TOP=15.14'
INV OUT=13.34'

J29 GRATE INLET (ROUND)
TOP=15.82'
INV IN(A)=13.30'
INV IN(B)=7.80'
INV IN(C)=5.32'
INV OUT=3.29'

36 GRATE INLET
TOP=14.14'
INV CL=-6.66+/-

39 GRATE INLET
TOP=13.30'
INV OUT=11.05'

40 GRATE INLET
TOP=13.40'
INV OUT=11.20'

82 GRATE INLET
TOP=19.84'
INV CL OF STRUCTURE=14.94'

83 GRATE INLET
TOP=19.77'
INV CL OF STRUCTURE=14.67'

85 GRATE INLET
TOP=14.59'
INV IN=11.93'
INV OUT=11.88'

86 GRATE INLET
TOP=14.07'
INV (A)=11.06
INV (B)=10.42
INV OUT=-5.98+/-

87 GRATE INLET
TOP=13.55'
INV OUT=10.65'

88 GRATE INLET
TOP=13.62'
INV OUT=11.10'

89 GRATE INLET
TOP=13.60'
INV OUT=12.60'

90 GRATE INLET (ROUND)
TOP=13.73'
INV=12.53' (TO ELBOW)

91 GRATE INLET (ROUND)
TOP=13.56'
INV CL STRUCTURE=-3.54

92 GRATE INLET
TOP=12.56'
INV CL=-5.29'+/-

93 INTAKE/OUTAKE VAULT
TOP=11.64'
INV CL=2.64'+/-

94 INTAKE/OUTAKE VAULT
TOP=10.66'
INV CL=2.48'+/-

95 INTAKE/OUTAKE VAULT
TOP=11.00'
INV CL=2.35'+/-

96 GRATE INLET
TOP=5.52'
INV IN=1.82'

TRAVERSE DATA:

NO	NORTHING	EASTING	ELEV	DESCRIPTION
100	448979.0344	1323991.8206	15.93	MAG-NAIL
101	449056.4621	1324299.5078	16.24	MAG-NAIL
102	449069.6245	1324675.3016	17.18	REBAR AND CAP
103	449277.5801	1324670.7517	16.31	REBAR AND CAP
104	449238.1789	1324334.4499	16.97	MAG-NAIL
105	449274.9773	1323986.1116	17.02	MAG-NAIL
106	449188.6338	1323770.0377	14.53	MAG-NAIL
107	448942.8120	1323699.0142	15.52	MAG-NAIL
108	448716.9618	1323668.6786	14.30	REBAR AND CAP
109	448445.7218	1323648.5840	13.81	MAG-NAIL
110	448099.8743	1323741.1863	13.79	REBAR AND CAP
111	448090.6014	1323986.5759	18.84	REBAR AND CAP
112	448298.3931	1323998.0402	19.62	MAG-NAIL
113	448628.1753	1324029.0248	18.07	MAG-NAIL
114	448877.1197	1324069.8375	17.99	REBAR AND CAP
115	448040.1017	1324315.7506	23.81	MAG-NAIL
116	448173.2025	1324618.8406	31.71	REBAR AND CAP
117	448190.5431	1324945.6041	36.28	REBAR AND CAP
118	448198.5168	1325463.9901	30.56	REBAR AND CAP
119	447852.3375	1325431.2069	35.13	REBAR AND CAP
120	447773.5111	1325726.3107	33.22	MAG-NAIL
121	448221.1553	1325798.2405	28.37	REBAR AND CAP
122	448721.3461	1325370.5246	24.84	MAG-NAIL
123	448766.2682	1324845.1489	20.60	REBAR AND CAP
124	448755.6745	1324583.4232	19.96	MAG-NAIL
125	449022.6834	1324555.6820	18.69	REBAR AND CAP

UTILITY INFORMATION:

UTILITY COMPANY	STATUS
VERIZON 13101 COLUMBIA PIKE FDC-1 SILVER SPRING, MD 20904	NO INFORMATION RECEIVED AS OF NOVEMBER 15, 2013.
PEPCO 701 9th STREET, N.W. WASHINGTON, DC 20068	NO ELECTRIC PLANS PROVIDED DRAINAGE AREA MAP SHEET 1 MAP # ID1457-2
WASHINGTON GAS 6801 INDUSTRIAL ROAD SPRINGFIELD, VA 22151	NO INFORMATION RECEIVED AS OF NOVEMBER 15, 2013.
DC WATER 5000 OVERLOOK AVENUE, S.W. WASHINGTON, DC 20032	COMPOSITE OF DC - DPW PLANS I-K 3-4 N.E L-M 3-4 N.E

BENCH MARK DATA:

NO	ELEV	DESCRIPTION
107	15.52	MAG NAIL IN ASPHALT
112	19.62	MAG NAIL IN ASPHALT

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

	DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

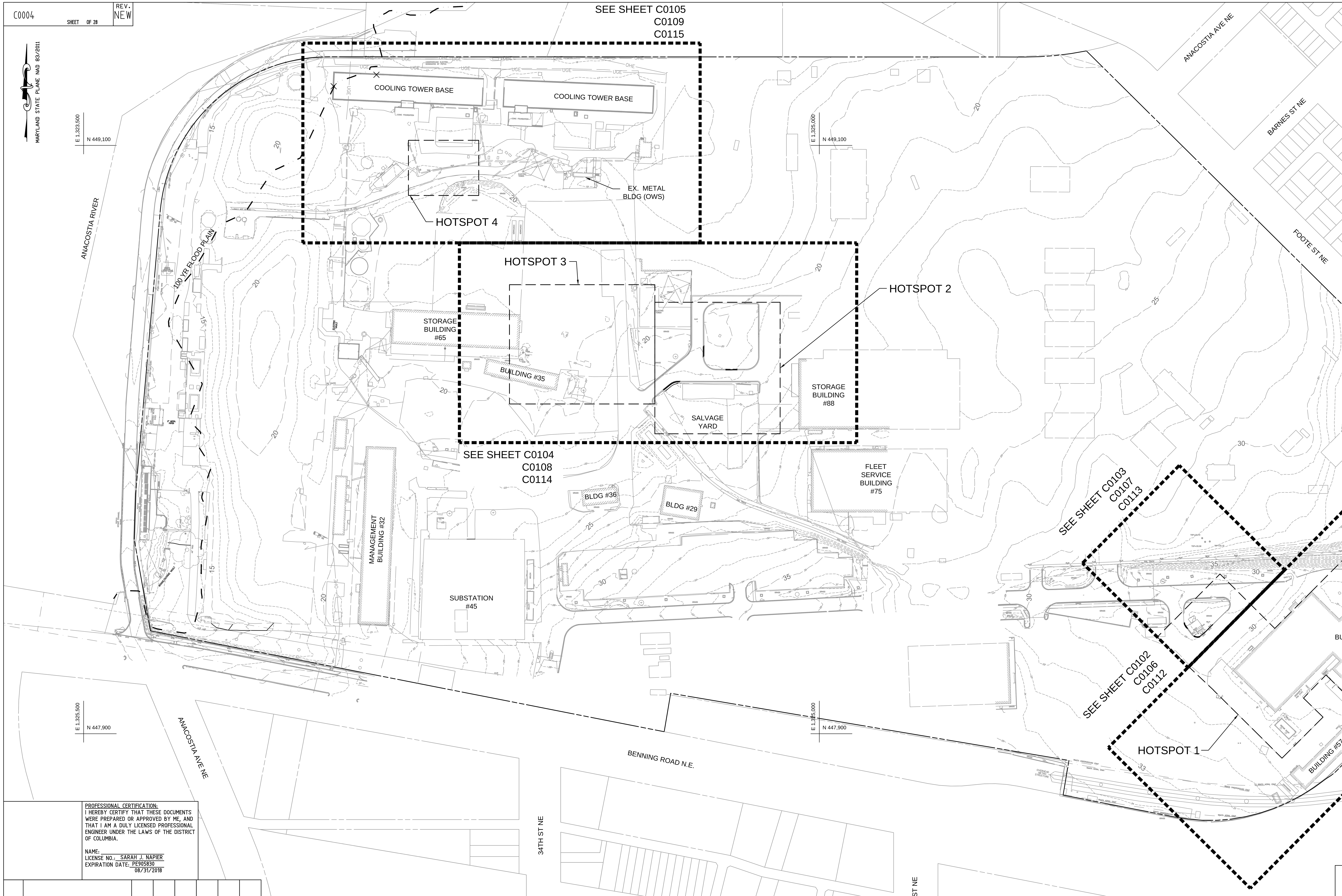
EXISTING CONDITIONS DATA

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=80'	
						C0003 SHEET OF 28		REV. NEW

PLOTTED: 2/15/2017 10:10 AM

C0004 SHEET OF 28	REV. NEW



GENERAL NOTES

1. HORIZONTAL DATUM: MARYLAND STATE PLANE NAD 83/2011
2. VERTICAL DATUM: DISTRICT OF COLUMBIA DEPARTMENT OF PUBLIC WORKS
3. PROPERTY LINES AND EASEMENT LINES SHOWN HEREON ARE BASED ON A COMPILATION OF FIELD EVIDENCE, RECORD INFORMATION, AND DRAWINGS PROVIDED BY OTHERS. THEIR LOCATION IS APPROXIMATE FOR GRAPHICAL PURPOSES ONLY. NO BOUNDARY SURVEY WAS PERFORMED.
4. THE UNDERGROUND UTILITIES INDICATED HEREON ARE DERIVED FROM A COMBINATION OF PLANS SUPPLIED BY VARIOUS UTILITY COMPANIES AND QUALITY LEVEL "B" UTILITY DESIGNATION. THE LOCATION OF THESE UTILITIES SHOULD BE CONSIDERED APPROXIMATE AND OTHER UTILITIES MAY EXIST WHICH HAVE NO RECORD DATA OR ARE UNDETECTABLE WITH CONVENTIONAL METHODS. NO GUARANTEE OR WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF UTILITY INFORMATION PROVIDED HEREON. UTILITIES LABELED (DATR) ARE SHOWN BASED UPON "DATA ACCORDING TO RECORDS". NOTE: UTILITIES LOCATED BY SUBSURFACE UTILITY ENGINEERING METHODS ARE LABELED "SUE" HEREON
5. CONTOUR INTERVAL IS ONE (1) FOOT.
6. STORM DRAIN INLET NUMBERS SHOWN IN CIRCLES ARE TAKEN FROM THE AMEC DRAINAGE AREA MAP PROVIDED FOR THE SITE, INLET NUMBERS SHOWN IN HEXAGONS ARE TAKEN FROM THE PREVIOUS AMT TOPOGRAPHIC SURVEY FOR THE AREA.
7. STORM INVERT INFORMATION FOR STRUCTURES THAT ARE INACCESSIBLE DUE TO EXISTING INLET PROTECTION ARE TAKEN FROM PREVIOUS SURVEYS
8. STORM DRAIN CONNECTIONS ARE BASED ON FIELD OBSERVATION AND EXHIBITS PROVIDED BY AECOM. NO CONSTRUCTION PLANS, LIMITED AS-BUILT PLANS, OR UTILITY LOCATION INFORMATION WAS PROVIDED TO AMT.
9. NAVD88=DCDPW-0.08' (+/-)
10. SOME INFORMATION FOR THE MAIN STORM DRAIN OUTFALL WAS TAKEN FROM A PLAN PREPARED BY MERESTONE CONSULTANTS INC, DATED APRIL 7, 2015, AND PROVIDED TO AMT BY AECOM.

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD
REVISIONS						

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM

8000 VIRGINIA MANOR ROAD
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BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

OVERALL EXISTING CONDITIONS PLAN

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=80'	
						C0004 SHEET OF 28		REV. NEW

PLOTTED: 2/15/2017 10:11 AM

C0101 SHEET OF 28 | REV. NEW

Drainage Areas	Area (Acre)	Area (Sqft)	% Imperviou	Impervius Area (Sqft)	Cover (Sqft)	Discharg e Strc. No	Hotspot No.	Outfall No.
01	3.93	171190.80	15.50	26534.57				101
02	6.86	298821.60	26.36	78769.37	1070	I27	4	013
03	1.63	71002.80	10.93	7760.61				101
04	1.11	48351.60	14.18	6856.26				013
05	2.04	88862.40	73.39	65216.12				016
06A	1.28	55756.80	62.07	34608.25		I09		
06B	8.19	356756.40	46.81	166997.67		I07/I08	3	013
06C	0.20	8712.00	80.75	7034.94	4535	I108		
07	1.42	61855.20	15.33	9482.40				013
08	1.84	80150.40	61.82	49548.98				
09	2.23	97138.80	64.12	62285.40				006
10A	0.76	33105.60	27.72	9176.87		I66	2	013
10B	0.42	18295.20	63.30	11580.86	2320	I65		
11	0.72	31363.20	41.43	12993.77				013
12	2.27	99086.93	83.60	82836.68				013
13	0.06	2474.08	0.00	0.00				
14	5.34	232610.40	76.20	177249.12				013
15	3.35	145903.83	98.40	143569.37				
16	1.71	74320.77	98.05	72871.51				
17A	0.60	26136.00	74.87	19568.02		I42		
17B	0.31	13503.60	85.68	11569.88		I43		
17C	0.16	6969.60	77.84	5425.14		I44	1	013
17D	0.49	21344.40	75.86	16191.86		I45		
17E	0.83	36154.80	92.10	33298.57	720	I46/I47		
18	1.47	64033.20	91.55	58622.39				
19	0.91	39513.15	94.50	37339.92				
20	6.69	291416.40	23.18	67550.32				013
21	3.01	131115.60	66.61	87336.10				
22	2.17	94382.02	77.62	73259.32				
23	2.44	106470.44	32.50	34602.89				014
24	2.52	109771.20	77.23	84776.30				013
25	0.60	26093.22	50.68	13224.05				005
26	1.13	49268.28	72.16	35551.99				401
27	4.35	189581.74	14.79	28039.14				015
28	1.45	63096.36	68.98	43523.87				
29	0.34	14810.40	24.04	3560.42				
30	1.04	45302.40	39.40	17849.15				013
31	0.48	20908.80	97.90	20469.72		I68	2	013
32	0.85	37046.69	100.00	37046.69				
33	0.23	9851.62	0.19	18.72				013

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.
NAME:
LICENSE NO.: SARAH J. NAPIER
EXPIRATION DATE: PE905830 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900
12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

EXISTING DRAINAGE AREA MAP

POTOMAC ELECTRIC POWER CO.

CHKD | APPD | APPD | APPD | APPD | APPD | DR BY: EP | ENGR.: SJN | CLASS
DATE: 01/27/17 | SCALE: 1"=80'
C0101 SHEET OF 28 | REV. NEW

FILE: \\URSgermantown.us.aecom.com\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0101-EXISTING DRAINAGE AREA MAP.dwg

PLOTTED: 2/15/2017 9:09 AM

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0102-C0103-EXISTING CONDITIONS AND DEMOLITION PLAN 1 OF 4.dwg

C0102 SHEET OF 28 REV. NEW

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

GENERAL NOTES:

1. LOCATE AND VERIFY ALL ABOVEGROUND AND UNDERGROUND UTILITIES.
2. TAKE ALL NECESSARY PRECAUTIONS TO ASSURE THAT NO DAMAGE OCCURS TO EXISTING UTILITIES AND ADJACENT BUILDINGS. RETAINING WALLS AND THEIR FOUNDATIONS MAY BE AFFECTED BY WORK ACTIVITIES BUT ARE TO REMAIN IN PLACE. ANY DAMAGE RESULTING FROM THE CONTRACTOR'S OPERATION SHALL BE REPAIRED AT NO EXPENSE TO THE OWNER.
3. CONTACT ANY PERTINENT UTILITY COMPANIES AND MISS UTILITY AT LEAST 48 HOURS PRIOR TO COMMENCING EXCAVATION.
4. CONTRACTOR IS RESPONSIBLE FOR LOCATING ANY AND ALL EXISTING SUBSURFACE OBSTRUCTIONS, INCLUDING BUT NOT LIMITED TO EXISTING BEDROCK OR SUBSURFACE STRUCTURES, PRIOR TO INITIATING EXCAVATION ACTIVITIES.
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DEMOLITION NOTES:

1. DEMOLISH AND REMOVE PORTION OF THE EXISTING STORM DRAIN PIPE.
2. DEMOLISH AND REMOVE EXISTING STORM DRAIN GRATE INLET.

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD
REVISIONS						

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EXISTING CONDITIONS AND
DEMOLITION PLAN 1 OF 4

POTOMAC ELECTRIC POWER CO.

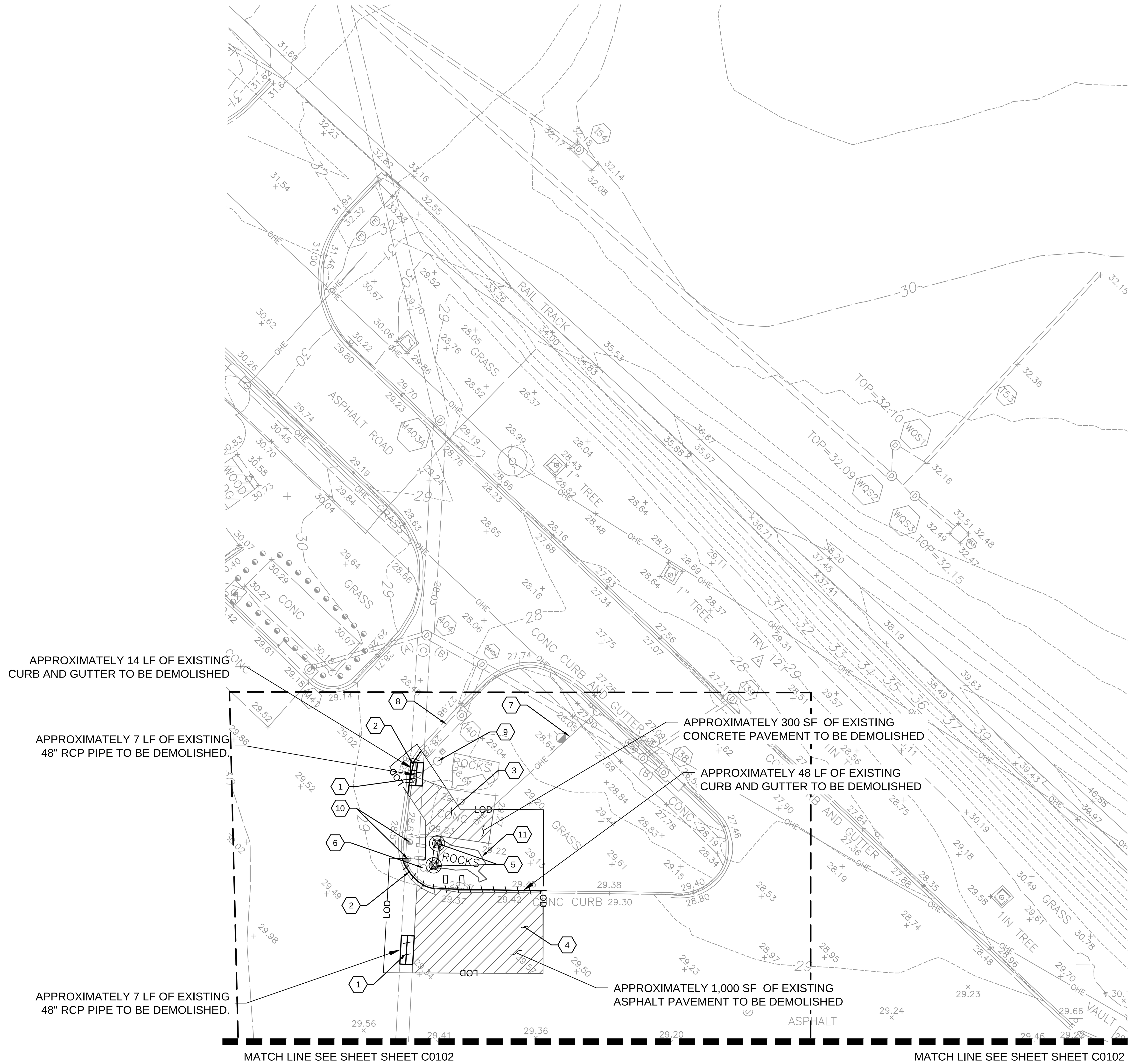
CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0102	SHEET OF 28	REV. NEW

PLOTTED: 2/15/2017 9:09 AM

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0102-C0103-EXISTING CONDITIONS AND DEMOLITION PLAN 1 OF 4.dwg

C0103 SHEET OF 28 REV. NEW

MARYLAND STATE PLANE NAD 83/2011



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DEMOLITION NOTES:

1. DEMOLISH AND REMOVE PORTION OF THE EXISTING STORM DRAIN PIPE.
2. DEMOLISH AND REMOVE PORTION OF THE EXISTING CURB AND GUTTER.
3. DEMOLISH AND REMOVE PORTION OF THE EXISTING CONCRETE PAVEMENT.
4. DEMOLISH AND REMOVE PORTION OF THE EXISTING ASPHALT PAVEMENT.
5. DEMOLISH EXISTING BOLLARDS.
6. EXISTING POWER POLE TO REMAIN AND BE PROTECTED THROUGHOUT THE DURATION OF THE CONSTRUCTION ACTIVITY.
7. EXISTING OVERHEAD POWER CABLE TO REMAIN AND BE PROTECTED THROUGHOUT THE DURATION OF THE CONSTRUCTION ACTIVITY.
8. EXISTING CURB INLET TO REMAIN AND BE PROTECTED THROUGHOUT THE DURATION OF THE CONSTRUCTION ACTIVITY.
9. EXISTING LIGHT POLE TO REMAIN , AND BE PROTECTED THROUGHOUT THE DURATION OF THE CONSTRUCTION ACTIVITY.
10. EXISTING BOLLARDS TO REMAIN, AND BE PROTECTED THROUGHOUT THE DURATION OF THE CONSTRUCTION ACTIVITY.
11. DEMOLISH AND REMOVE EXISTING RIPRAP.

PROFESSIONAL CERTIFICATION:
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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM

8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

0' 20' 40' 60'
SCALE: 1" = 20'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EXISTING CONDITIONS AND
DEMOLITION PLAN 2 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	

C0103 SHEET OF 28 REV. NEW

PLOTTED: 2/15/2017 9:10 AM

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
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12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
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DEMOLITION NOTES:

1. DEMOLISH AND REMOVE PORTION OF THE EXISTING STORM DRAIN PIPE.
2. DEMOLISH AND REMOVE EXISTING STORM DRAIN GRATE INLET.
3. SAFELY CAP WITH BRICK AND MORTAR AND ABANDON EXISTING STORM DRAIN PIPE.
4. DEMOLISH AND REMOVE PORTION OF THE FENCE ALONG WITH POSTS.
5. DEMOLISH AND REMOVE PORTION OF EXISTING SECTION OF CURB AND GUTTER.
6. DEMOLISH AND REMOVE PORTION OF THE EXISTING ASPHALT PAVEMENT.
7. CLEAR THE AREA FOR CONSTRUCTION ACTIVITY.

SCALE: 1" = 20'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EXISTING CONDITIONS AND
DEMOLITION PLAN 3 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	

C0104 SHEET OF 28 REV. NEW

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0104-EXISTING CONDITIONS AND DEMOLITION PLAN 3 OF 4.dwg

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

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DEMOLITION NOTES:

1. DEMOLISH AND REMOVE PORTION OF THE EXISTING STORM DRAIN PIPE.
2. SAWCUT AND REMOVE EXISTING ASPHALT PAVEMENT.
3. CLEAR THE AREA FOR CONSTRUCTION ACTIVITY.

SCALE: 1" = 20'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EXISTING CONDITIONS AND DEMOLITION PLAN 4 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0105	SHEET OF 28	REV. NEW

PROFESSIONAL CERTIFICATION:
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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

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SITE NOTES:

1. PROPOSED DOWNSPOUT TREATMENT DEVICES FOR EACH EXISTING ROOF DRAIN.
2. PROPOSED 48" MANHOLE WITH FLOW-SPLITTER DEVICE.
3. PROPOSED 96" MANHOLE WITH JELLY FISH TREATMENT DEVICE.
4. PROPOSED 12" HDPE PIPE FROM JF-1 TO EX. M45.
5. PROPOSED GRATE INLET WITH JELLY FISH TREATMENT DEVICE.
6. PROPOSED 10" HDPE.

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD
REVISIONS						

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

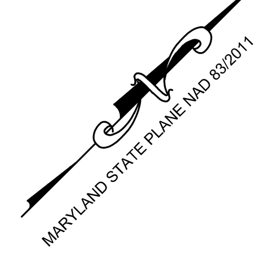
BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

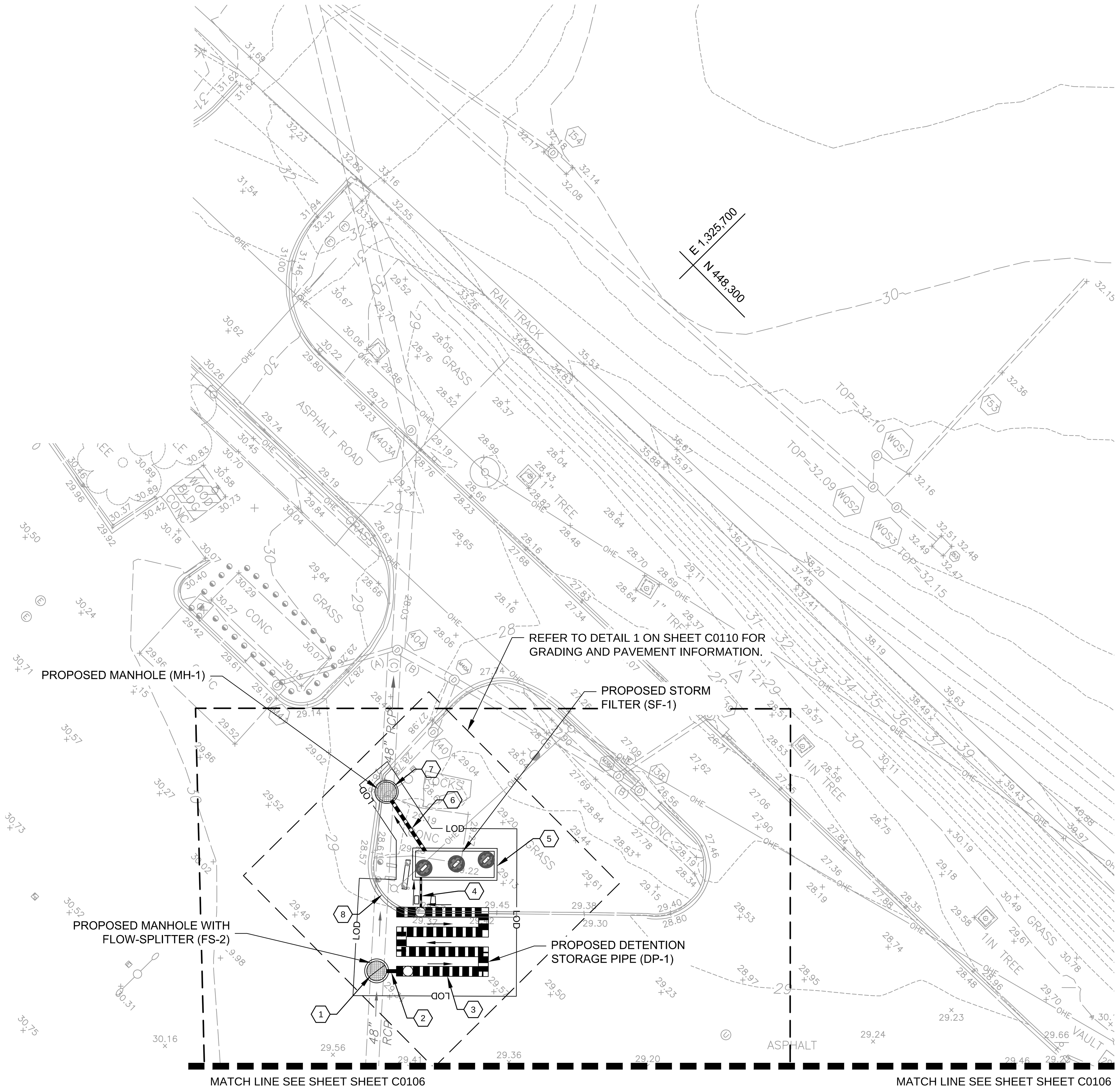
STORM DRAIN AND STORMWATER MANAGEMENT PLAN 1 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0106 SHEET OF 28		REV. NEW

C0107 SHEET OF 28 REV. NEW





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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
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SITE NOTES:

1. PROPOSED 72" MANHOLE WITH FLOW SPLITTER DEVICE.
2. PROPOSED 12" HDPE LOW FLOW PIPE TO PROPOSED UNDERGROUND PIPE DETENTION SYSTEM (DP-1).
3. PROPOSED UNDERGROUND 36" HDPE DETENTION SYSTEM (DP-1).
4. PROPOSED 6" HDPE PIPE FROM UNDERGROUND DETENTION SYSTEM TO UNDERGROUND WATER QUALITY STRUCTURE.
5. PROPOSED UNDERGROUND WATER QUALITY TREATMENT STORM FILTER DEVICE.
6. PROPOSED 12" HDPE TO PROPOSED MANHOLE MH-1
7. PROPOSED 72" MANHOLE.

0' 20' 40' 60'
SCALE: 1" = 20'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
STORM DRAIN AND STORMWATER MANAGEMENT PLAN 2 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0107	SHEET OF 28	REV. NEW

PLOTTED: 2/15/2017 9:11 AM

C0108 SHEET OF 28 REV. NEW

PROFESSIONAL CERTIFICATION:
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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

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SITE AND GRADING NOTES:

1. PROPOSED GRATED INLET WITH JELLYFISH TREATMENT DEVICE.
2. PROPOSED CATCH BASIN WITH JELLYFISH TREATMENT DEVICE.
3. PROPOSED 8" HDPE.
4. PROPOSED 10" HDPE.
5. PROPOSED 12" HDPE.
6. PROPOSED 12" RCP.
7. PROPOSED 15" RCP.
8. PROPOSED 30" RCP.
9. PROPOSED 48"Ø MANHOLE WITH FLOW-SPLITTER DEVICE.
10. PROPOSED 48 Ø" MANHOLE.
11. PROPOSED 60 Ø" MANHOLE WITH FLOW-SPLITTER DEVICE.
12. PROPOSED 60"Ø MANHOLE.
13. PROPOSED UNDERGROUND WATER QUALITY TREATMENT STORM FILTER DEVICE.
14. PROPOSED 96"Ø MANHOLE WITH JELLYFISH TREATMENT DEVICE.
15. PROPOSED 120" Ø MANHOLE WITH JELLYFISH TREATMENT DEVICE.

0' 20' 40' 60'
SCALE: 1" = 20'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
STORM DRAIN AND STORMWATER
MANAGEMENT PLAN 3 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	

C0108 SHEET OF 28 REV. NEW

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\SWT for Benning\Drawings\Working\C-SHEET\C0108-STORM DRAIN AND STORMWATER MANAGEMENT PLAN 3 OF 4.dwg

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

GENERAL NOTES:

1. LOCATE AND VERIFY ALL ABOVEGROUND AND UNDERGROUND UTILITIES.
2. TAKE ALL NECESSARY PRECAUTIONS TO ASSURE THAT NO DAMAGE OCCURS TO EXISTING UTILITIES AND ADJACENT BUILDINGS. RETAINING WALLS AND THEIR FOUNDATIONS MAY BE AFFECTED BY WORK ACTIVITIES BUT ARE TO REMAIN IN PLACE. ANY DAMAGE RESULTING FROM THE CONTRACTOR'S OPERATION SHALL BE REPAIRED AT NO EXPENSE TO THE OWNER.
3. CONTACT ANY PERTINENT UTILITY COMPANIES AND MISS UTILITY AT LEAST 48 HOURS PRIOR TO COMMENCING EXCAVATION.
4. CONTRACTOR IS RESPONSIBLE FOR LOCATING ANY AND ALL EXISTING SUBSURFACE OBSTRUCTIONS, INCLUDING BUT NOT LIMITED TO EXISTING BEDROCK OR SUBSURFACE STRUCTURES, PRIOR TO INITIATING EXCAVATION ACTIVITIES.
5. CONTRACTOR IS RESPONSIBLE FOR REMOVING ANY BELOW GRADE OBSTRUCTION THAT WILL IMPACT CONSTRUCTION OF THE PROPOSED FOUNDATIONS. CONTRACTOR TO STOP WORK AND NOTIFY PEPCO AND GEOTECHNICAL ENGINEER IF REMOVAL OF SUBSURFACE OBSTRUCTIONS WILL IMPACT NATIVE SOILS ON WHICH THAT FOUNDATIONS WERE DESIGNED TO BE CONSTRUCTED.

SITE NOTES:

1. PROPOSED 48"Ø MANHOLE WITH FLOW SPLITTER DEVICE.
2. PROPOSED 10" HDPE.
3. PROPOSED 72"Ø MANHOLE WITH JELLYFISH TREATMENT DEVICE.
4. PROPOSED 12" HDPE.
5. PROPOSED UNDERGROUND WATER QUALITY TREATMENT STORM FILTER DEVICE.
6. PROPOSED 48"Ø MANHOLE.

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

0' 20' 40' 60'
SCALE: 1" = 20'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
STORM DRAIN AND STORMWATER MANAGEMENT PLAN 4 OF 4

POTOMAC ELECTRIC POWER CO.

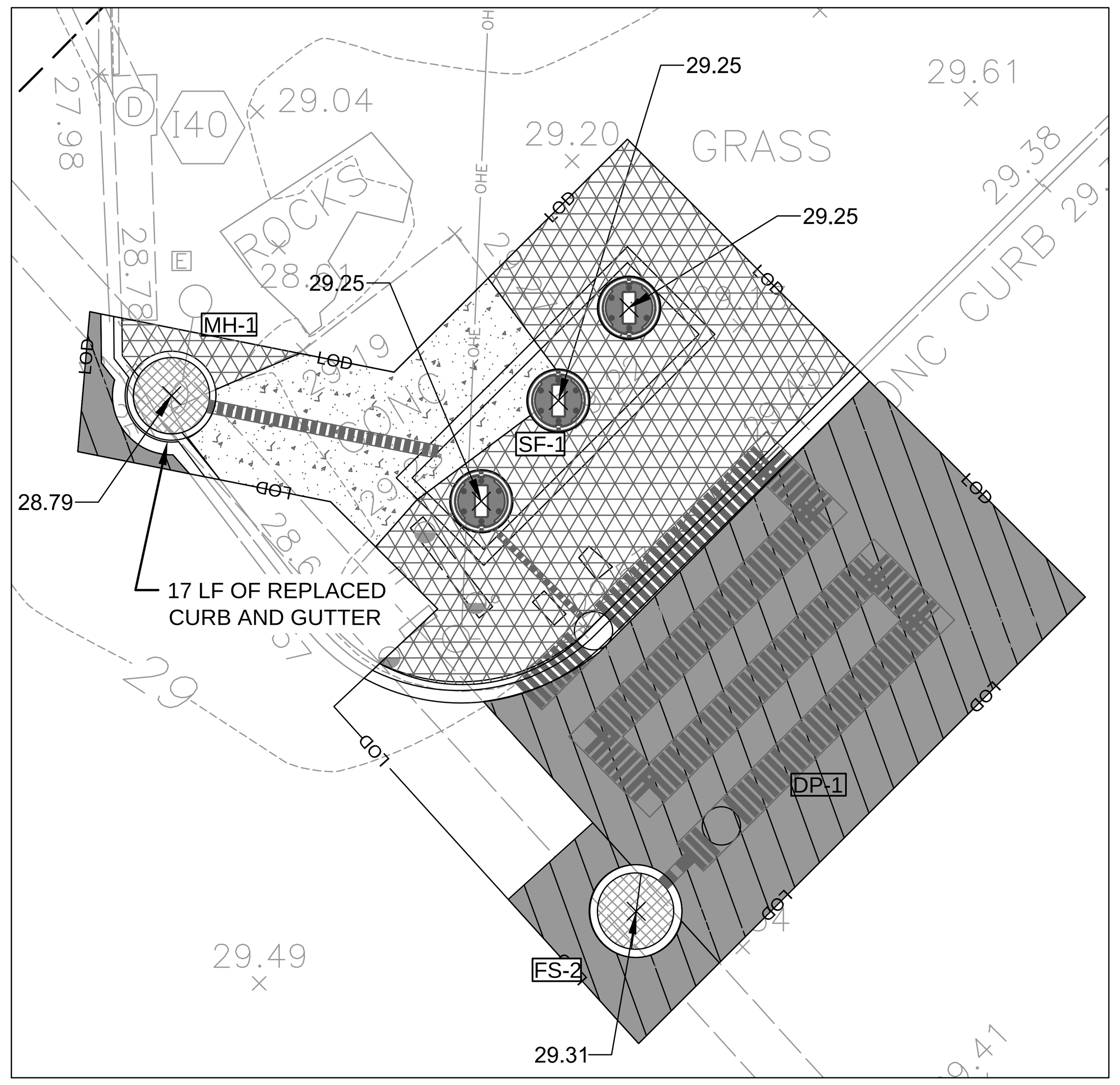
CHKD | APPD | APPD | APPD | APPD | APPD | DR BY: EP | ENGR.: SJN | CLASS
DATE: 01/27/17 | SCALE: 1"=20'
C0109 SHEET OF 28 REV. NEW

C0110 SHEET OF 28 | REV. NEW

LEGEND:

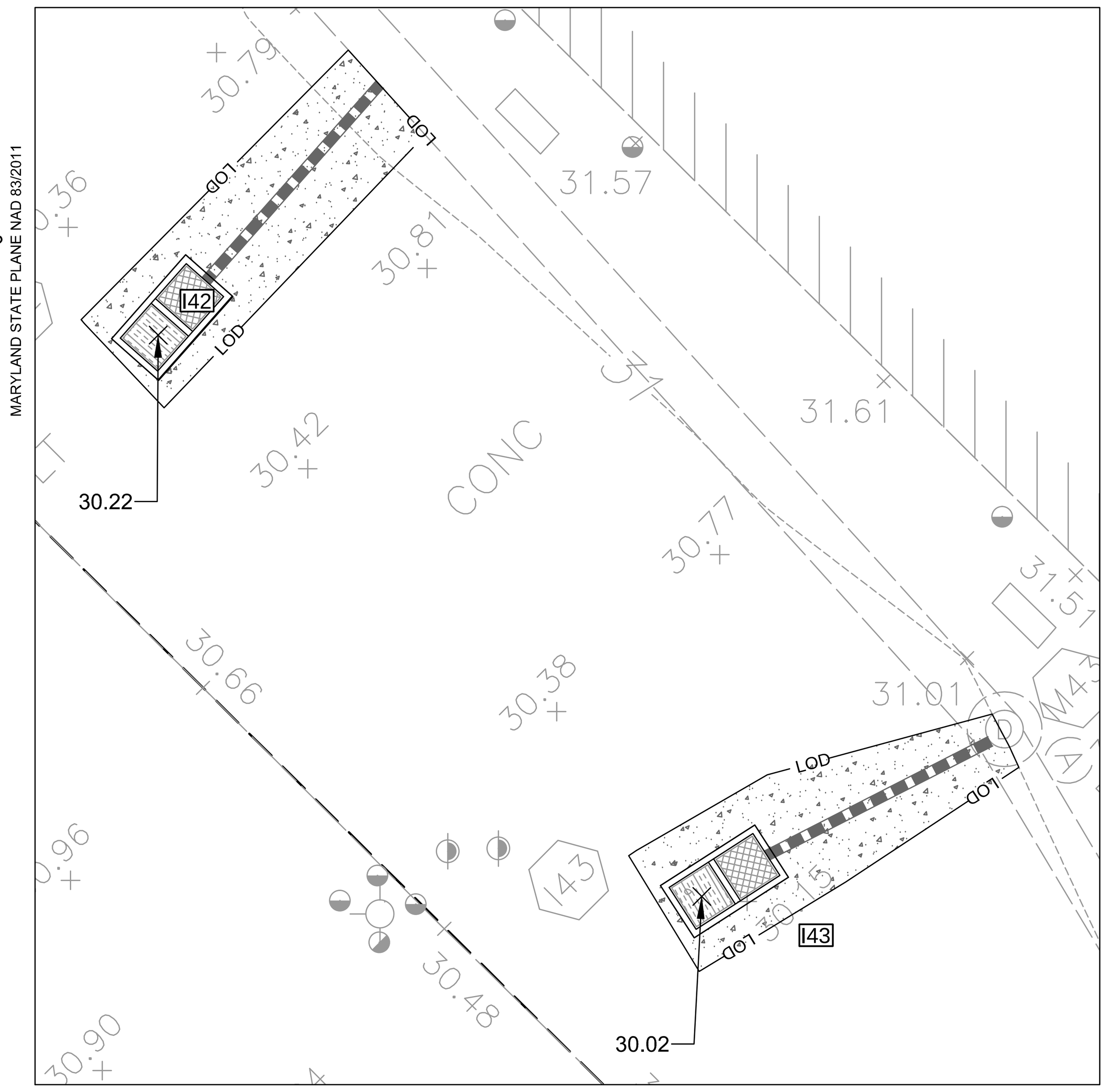
- RESTORED COMPACTED COVER
- RESTORED CONCRETE PAVEMENT OR TOP OF BMP STORM FILTER
- RESTORED ASPHALT PAVEMENT
- RESTORED CONCRETE CURB AND GUTTER
- RESTORED FENCE

MARYLAND STATE PLANE NAD 83/2011



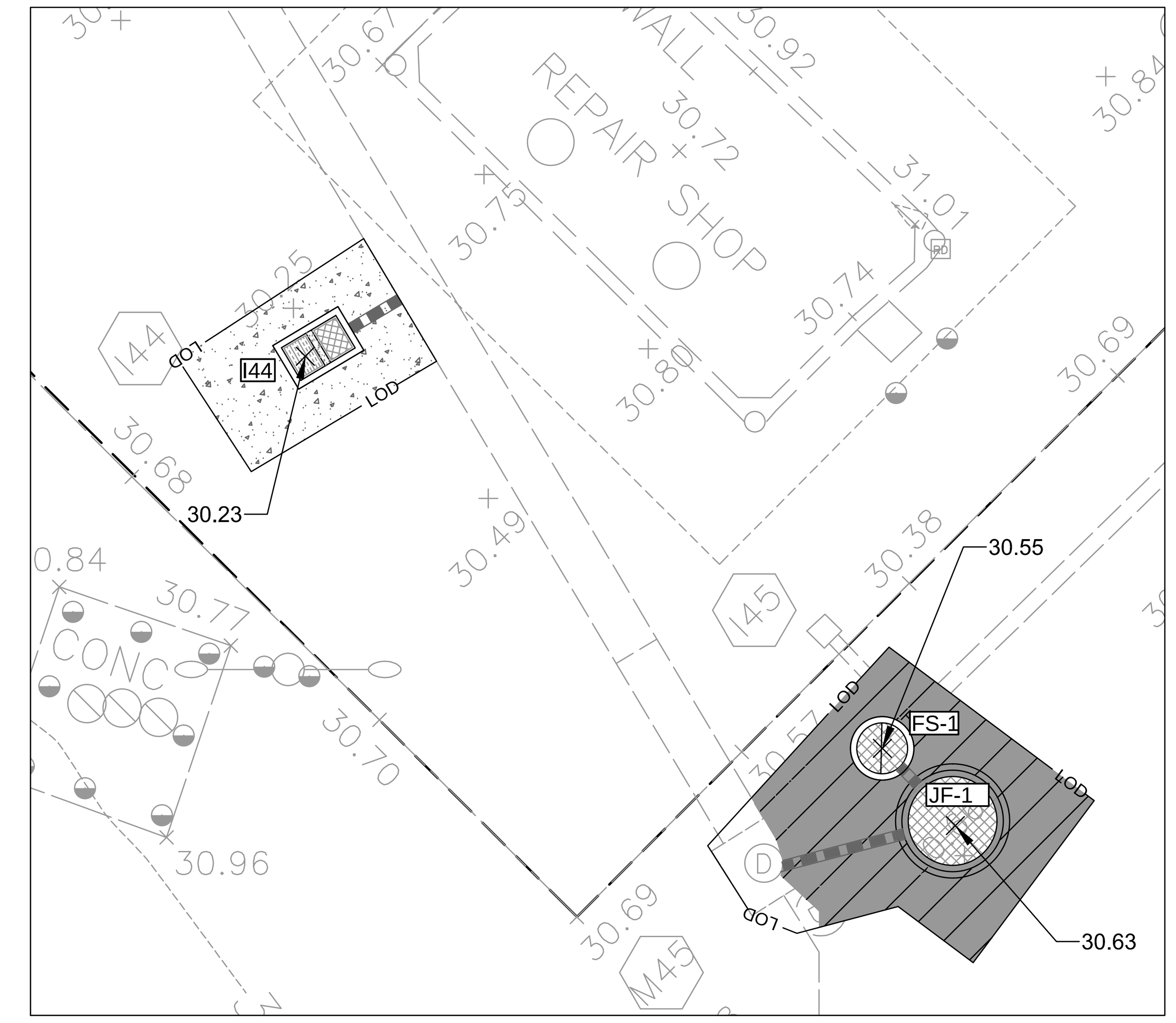
1 HOTSPOT - 1
SCALE: 1" = 10'

MARYLAND STATE PLANE NAD 83/2011



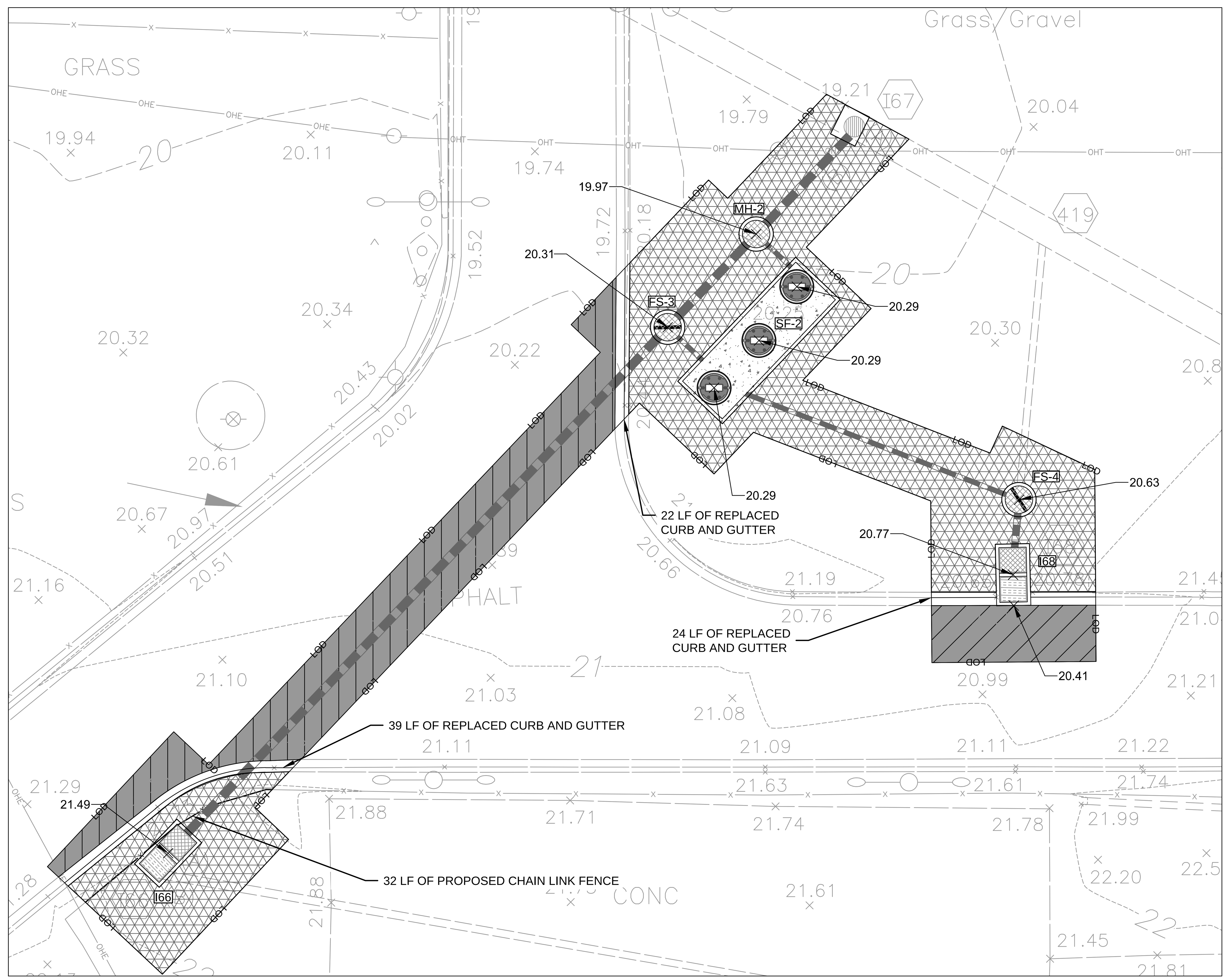
2 HOTSPOT - 1 (I-42 AND I-43)
SCALE: 1" = 10'

MARYLAND STATE PLANE NAD 83/2011



3 HOTSPOT - 1 (I-44 AND M45A)
SCALE: 1" = 10'

MARYLAND STATE PLANE NAD 83/2011



4 HOTSPOT - 2
SCALE: 1" = 10'

GENERAL NOTES:

1. LOCATE AND VERIFY ALL ABOVEGROUND AND UNDERGROUND UTILITIES.
2. TAKE ALL NECESSARY PRECAUTIONS TO ASSURE THAT NO DAMAGE OCCURS TO EXISTING UTILITIES AND ADJACENT BUILDINGS. RETAINING WALLS AND THEIR FOUNDATIONS MAY BE AFFECTED BY WORK ACTIVITIES BUT ARE TO REMAIN IN PLACE. ANY DAMAGE RESULTING FROM THE CONTRACTOR'S OPERATION SHALL BE REPAIRED AT NO EXPENSE TO THE OWNER.
3. CONTACT ANY PERTINENT UTILITY COMPANIES AND MISS UTILITY AT LEAST 48 HOURS PRIOR TO COMMENCING EXCAVATION.
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PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

0' 10' 20' 30'
SCALE: 1" = 10'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

GRADING AND PAVING PLAN 1 OF 2

POTOMAC ELECTRIC POWER CO.

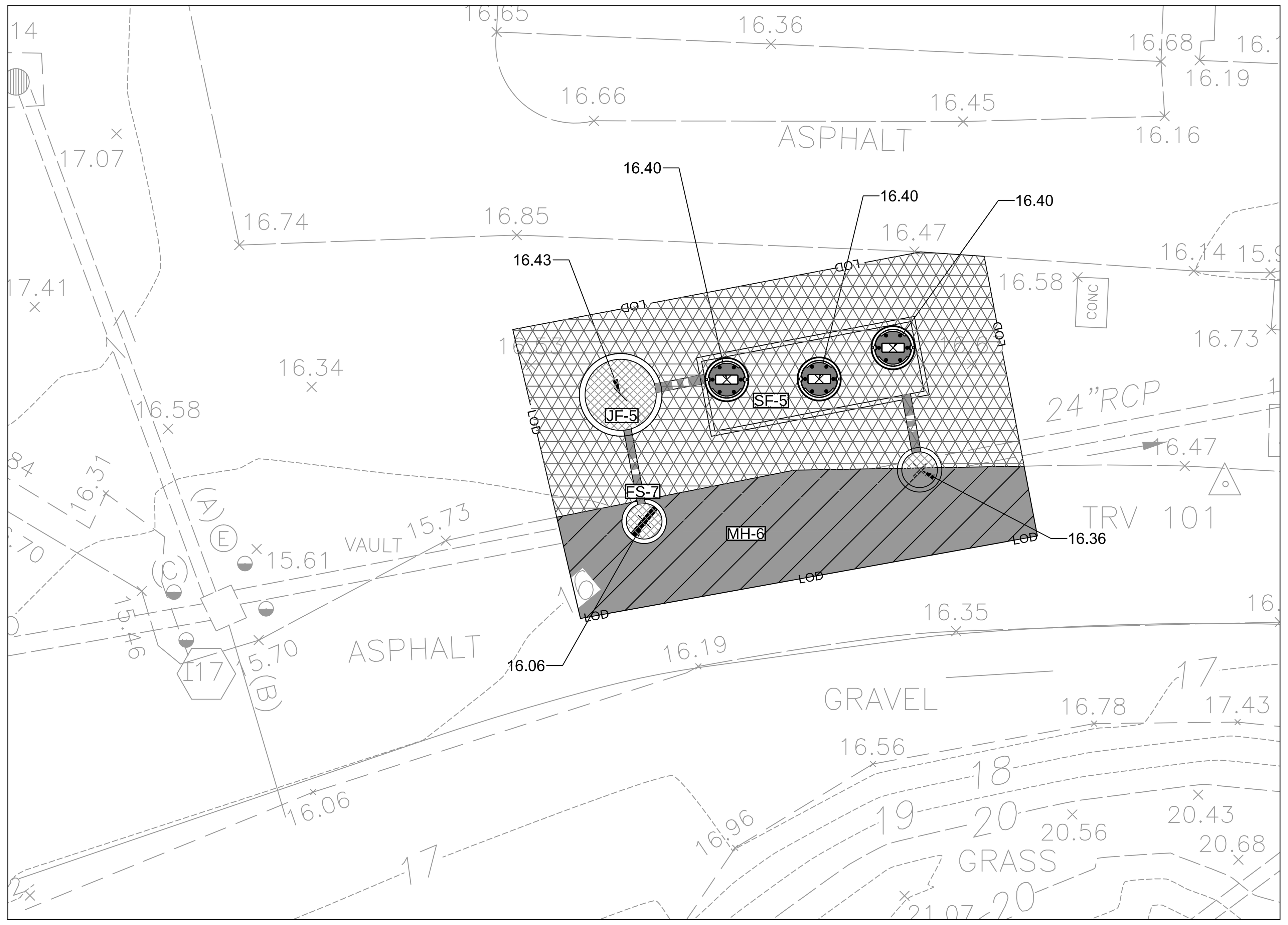
CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=10'	
						C0110	SHEET OF 28	REV. NEW

PLOTTED: 2/15/2017 9:12 AM

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0110-GRADING AND PAVING PLAN 1 OF 2.dwg

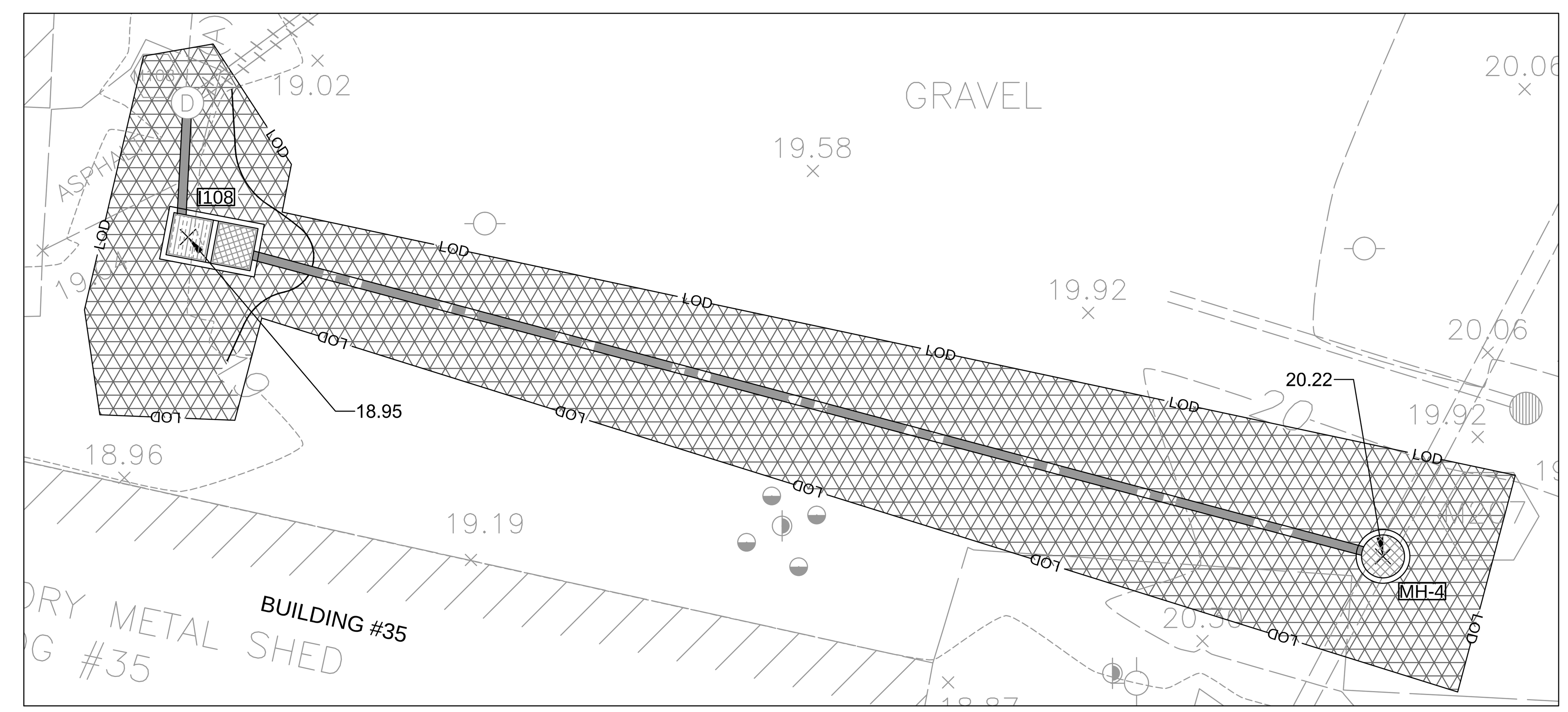
PLOTTED: 2/15/2017 10:12 AM

C0111 SHEET OF 28	REV. NEW



3 HOTSPOT - 4
SCALE: 1" = 10'

1 HOTSPOTS - 3
SCALE: 1" = 10'



2 HOTSPOT - 3
SCALE: 1" = 10'

LEGEND:

- RESTORED COMPACTED COVER
- RESTORED CONCRETE PAVEMENT OR TOP OF BMP STORM FILTER
- RESTORED ASPHALT PAVEMENT
- RESTORED CONCRETE CURB AND GUTTER
- RESTORED FENCE

GENERAL NOTES:

1. LOCATE AND VERIFY ALL ABOVEGROUND AND UNDERGROUND UTILITIES.
2. TAKE ALL NECESSARY PRECAUTIONS TO ASSURE THAT NO DAMAGE OCCURS TO EXISTING UTILITIES AND ADJACENT BUILDINGS. RETAINING WALLS AND THEIR FOUNDATIONS MAY BE AFFECTED BY WORK ACTIVITIES BUT ARE TO REMAIN IN PLACE. ANY DAMAGE RESULTING FROM THE CONTRACTOR'S OPERATION SHALL BE REPAIRED AT NO EXPENSE TO THE OWNER.
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NAME:
LICENSE NO.: SARAH J. NAPIER
EXPIRATION DATE: PE905830
08/31/2018

	DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

0' 10' 20' 30'
SCALE: 1" = 10'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

GRADING AND PAVING PLAN 2 OF 2

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=10'	
						C0111 SHEET OF 28		REV. NEW

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0111-GRADING AND PAVING PLAN 2 OF 2.dwg

PLOTTED: 2/15/2017 9:13 AM

PROJECT SITE INFORMATION:

PROPERTY ADDRESS: 3400 BENNING ROAD NE, WASHINGTON, DC 20019

SSL: PAR 01690114

PROPERTY OWNER:

FARIBA MAHVI, PEPCO HOLDINGS, INC.; 701 9TH STREET NW, WASHINGTON, DC 20001; OFFICE: (202) 331-6641; CELL: (202) 345-7647

CONTRACTOR:

(TBD AND SUBMITTED TO DCRA INSPECTION AND COMPLIANCE DIVISION)

DESIGNER OF RECORD:

SARAH J. NAPIER, PE; AECOM; 12420 MILESTONE CENTER DRIVE, SUITE 150, GERMANTOWN, MD 20876; OFFICE: (301) 820-3198; CELL: (301) 502-2657

SOIL TYPE: URBAN LAND (Ub)

PERMANENT STABILIZATION:

REPLACE EXISTING ASPHALT AND CONCRETE PAVEMENT IN LINE AND GRADE; REPLACE EXISTING COMPACTED COVER IN LINE AND GRADE AND USE DC/DOEE APPROVED SEED MIX

ENVIRONMENT:

NO WILDLIFE HABITAT OR WATER AREAS; ADJACENT TO ANACOSTIA RIVER; 100-YEAR FLOODPLAIN LOCATED AT WEST LIMIT OF PROPERTY OUTSIDE OF LIMITS OF DISTURBANCE (LOD)

GENERAL NOTES:

1. SCHEDULE PRE-CONSTRUCTION MEETING WITH DEPARTMENT OF ENERGY AND ENVIRONMENT (DDOE) EROSION AND SEDIMENT CONTROL (ESC) INSPECTOR 3-DAYS PRIOR TO BREAKING GROUND.
2. STABILIZED CONSTRUCTION ENTRANCES WILL NOT BE REQUIRED BECAUSE CONSTRUCTION AREAS AND VEHICLES WILL BE SWEPT CLEAN DAILY USING BRUSHES AND BROOMS TO REMOVE DEBRIS. NO TRACT VEHICLES SHALL BE PERMITTED ON EXPOSED SURFACES OR EXCAVATED SOIL AREAS. DUST WILL BE CONTROLLED ON-SITE USING STABILIZATION METHODS, FENCING, AND IRRIGATION IN COMBINATION WITH SWEEPING THE SITE, AS NEEDED.
3. EXISTING INLETS AND CATCH BASINS LOCATED AT THE FACILITY TYPICALLY HAVE FILTER BAG INLET PROTECTION (FBIP) CURRENTLY, SEMI-PERMANENTLY INSTALLED AND MAINTAINED BY ON-SITE COMPANY CONTRACTED BY PEPCO. PROVIDE AT GRADE INLET PROTECTION (AGIP) OR CURB INLET PROTECTION (CIP) (WITHOUT DISTURBING THE FBIP) ON ALL STORM DRAIN INLETS AND CATCH BASINS LOCATED IMMEDIATELY DOWNSTREAM FROM TRENCHES AND EXCAVATIONS ASSOCIATED WITH THIS PROJECT (EVEN IF LOCATED OUTSIDE OF THE LIMITS OF DISTURBANCE (LODs) OR OUTSIDE THE LIMITS OF THE PLAN VIEW CONTAINED HEREIN) IF NOT ALREADY INSTALLED AND IN USE.
4. SILT FENCE (SF) AND STRAW BALE DIKES (SBDs) PROVIDED FOR PERIMETER CONTROL SHALL BE INSPECTED DAILY FOR INTEGRITY. DOCUMENTATION OF INSPECTION IS REQUIRED. REMOVE ACCUMULATIONS OF SEDIMENT DAILY. PROVIDE SF IN PERVIOUS SURFACE AREAS AND SBDs ON IMPERVIOUS SURFACES. DO NOT USE SF IN PAVEMENT UNLESS APPROVED BY ESC INSPECTOR AT SITE.
5. PERFORM GROUNDWATER TESTING AS NEEDED AND IN ACCORDANCE WITH APPLICABLE DC WATER AND SEWER (DC WATER) AND DOEE REQUIREMENTS AND PERMITS. USE DOEE APPROVED DEWATERING AND FILTERING PRACTICES (WITH APPROVAL FROM THE DOEE INSPECTOR) TO DISCHARGE FILTERED STORMWATER RUNOFF AND GROUNDWATER WHICH HAS BEEN REMOVED FROM EXCAVATIONS INTO THE DC STORM DRAIN SYSTEM AND/OR WATERWAYS REGULATED BY DOEE. SIZE AND LOCATE SUMP PITS, PUMPS, SUCTION AND DISCHARGE HOSES, FILTER BAGS, AND/OR SEDIMENT TANKS, ETC. AS NECESSARY. HAUL WATER OFF-SITE AND DISPOSE OF IN DOEE APPROVED LOCATION IF NOT PERMITTED BY INSPECTOR TO DISCHARGE FILTERED WATER ON-SITE.

DESIGN NOTES/LEGEND:

1	LIMITS OF DISTURBANCE	LOD
2	STRAW BALE DIKE (SBD)	SBD
3	SILT FENCE (SF)	SF
4	INLET PROTECTION (IP)	
5	SUMP PIT (BY CONTRACTOR)	
6	PORTABLE SEDIMENT TANK (BY CONTRACTOR)	
7	PUMPED WATER FILTER BAG (BY CONTRACTOR)	

SITE DESCRIPTION:

LIMITS OF DISTURBANCE (LOD) = 3,720 SF OR 0.09 AC.

VOLUME OF CUT = 44,550 CF

VOLUME OF FILL = 38,610 CF

0' 20' 40' 60'
SCALE: 1" = 20'

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

	DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

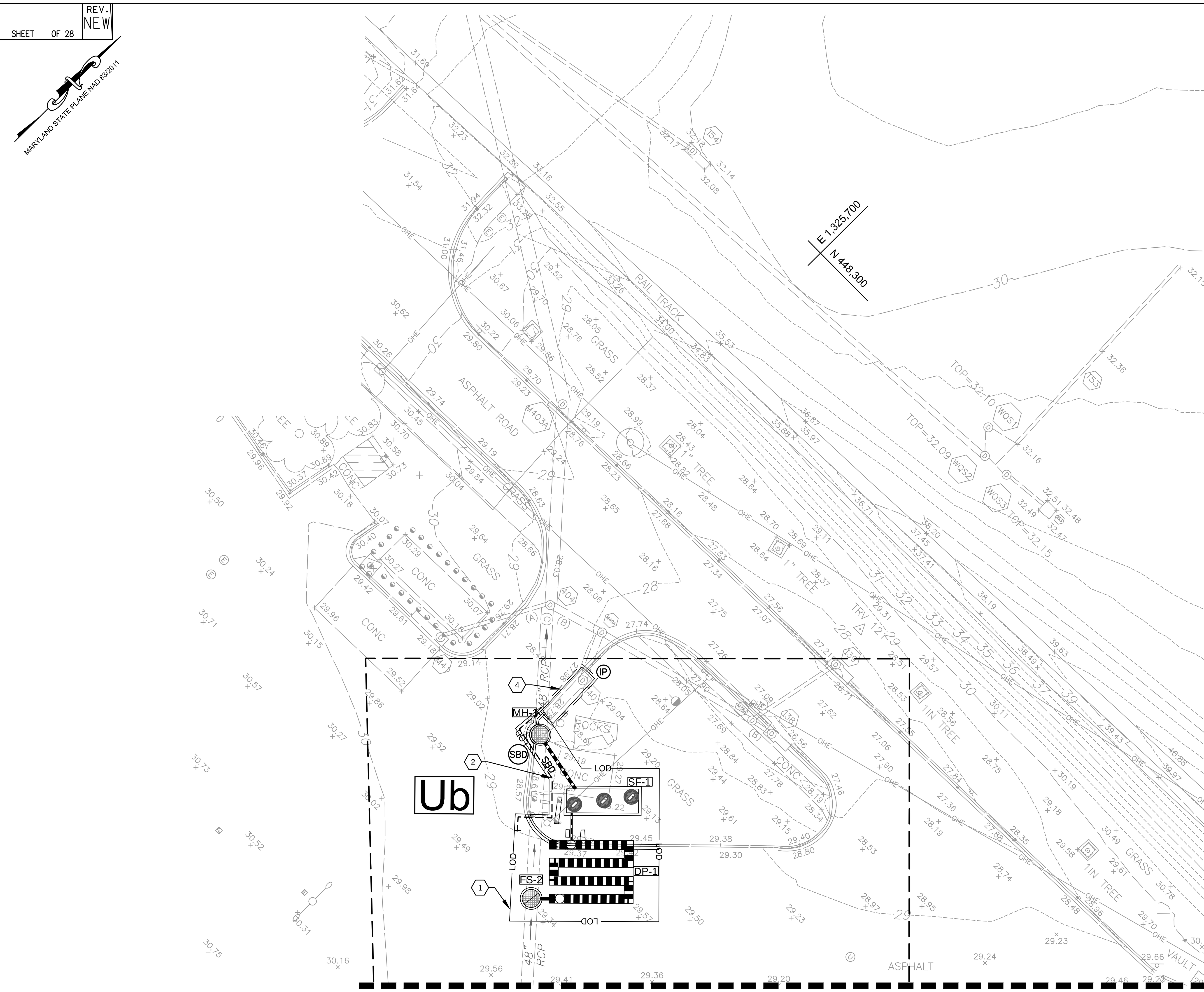
BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EROSION AND SEDIMENT CONTROL PLAN 1 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0112	SHEET OF 28	REV. NEW

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0112-C013-EROSION AND SEDIMENT CONTROL PLAN 1 OF 4.dwg

C0113 SHEET OF 28 REV. NEW



MATCH LINE SEE SHEET SHEET C0112

MATCH LINE SEE SHEET SHEET C0112

PROJECT SITE INFORMATION:

PROPERTY ADDRESS: 3400 BENNING ROAD NE, WASHINGTON, DC 20019

SSL: PAR 01690114

PROPERTY OWNER:

FARIBA MAHVI, PEPCO HOLDINGS, INC.; 701 9TH STREET NW, WASHINGTON, DC 20001; OFFICE: (202) 331-6641; CELL: (202) 345-7647

CONTRACTOR:

(TBD AND SUBMITTED TO DCRA INSPECTION AND COMPLIANCE DIVISION)

DESIGNER OF RECORD:

SARAH J. NAPIER, PE; AECOM; 12420 MILESTONE CENTER DRIVE, SUITE 150, GERMANTOWN, MD 20876; OFFICE: (301) 820-3198; CELL: (301) 502-2657

SOIL TYPE: URBAN LAND (Ub)

PERMANENT STABILIZATION:

REPLACE EXISTING ASPHALT AND CONCRETE PAVEMENT IN LINE AND GRADE; REPLACE EXISTING COMPACTED COVER IN LINE AND GRADE AND USE DC/DOEE APPROVED SEED MIX

ENVIRONMENT:

NO WILDLIFE HABITAT OR WATER AREAS; ADJACENT TO ANACOSTIA RIVER; 100-YEAR FLOODPLAIN LOCATED AT WEST LIMIT OF PROPERTY OUTSIDE OF LIMITS OF DISTURBANCE (LOD)

PROFESSIONAL CERTIFICATION:
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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM

8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

GENERAL NOTES:

1. SCHEDULE PRE-CONSTRUCTION MEETING WITH DEPARTMENT OF ENERGY AND ENVIRONMENT (DDOE) EROSION AND SEDIMENT CONTROL (ESC) INSPECTOR 3-DAYS PRIOR TO BREAKING GROUND.
2. STABILIZED CONSTRUCTION ENTRANCES WILL NOT BE REQUIRED BECAUSE CONSTRUCTION AREAS AND VEHICLES WILL BE SWEPT CLEAN DAILY USING BRUSHES AND BROOMS TO REMOVE DEBRIS. NO TRACT VEHICLES SHALL BE PERMITTED ON EXPOSED SURFACES OR EXCAVATED SOIL AREAS. DUST WILL BE CONTROLLED ON-SITE USING STABILIZATION METHODS, FENCING, AND IRRIGATION IN COMBINATION WITH SWEEPING THE SITE, AS NEEDED.
3. EXISTING INLETS AND CATCH BASINS LOCATED AT THE FACILITY TYPICALLY HAVE FILTER BAG INLET PROTECTION (FBIP) CURRENTLY, SEMI-PERMANENTLY INSTALLED AND MAINTAINED BY ON-SITE COMPANY CONTRACTED BY PEPCO. PROVIDE AT GRADE INLET PROTECTION (AGIP) OR CURB INLET PROTECTION (CIP) (WITHOUT DISTURBING THE FBIP) ON ALL STORM DRAIN INLETS AND CATCH BASINS LOCATED IMMEDIATELY DOWNSTREAM FROM TRENCHES AND EXCAVATIONS ASSOCIATED WITH THIS PROJECT (EVEN IF LOCATED OUTSIDE OF THE LIMITS OF DISTURBANCE (LODs) OR OUTSIDE THE LIMITS OF THE PLAN VIEW CONTAINED HEREIN) IF NOT ALREADY INSTALLED AND IN USE.
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DESIGN NOTES/LEGEND:

1. LIMITS OF DISTURBANCE — LOD —
2. STRAW BALE DIKE (SBD) — — SBD — —
3. SILT FENCE (SF) — SF —
4. INLET PROTECTION (IP)
5. SUMP PIT (BY CONTRACTOR)
6. PORTABLE SEDIMENT TANK (BY CONTRACTOR)
7. PUMPED WATER FILTER BAG (BY CONTRACTOR)

SITE DESCRIPTION:

LIMITS OF DISTURBANCE (LOD) = 3,720 SF OR 0.09 AC.

VOLUME OF CUT = 44,550 CF

VOLUME OF FILL = 38,610 CF

0' 20' 40' 60'
SCALE: 1" = 20'

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EROSION AND SEDIMENT
CONTROL PLAN 2 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0113	SHEET OF 28	REV. NEW

PLOTTED: 2/15/2017 9:13 AM

C0114	REV. NEW
SHEET OF 28	

PROJECT SITE INFORMATION:

PROPERTY ADDRESS: 3400 BENNING ROAD NE, WASHINGTON, DC 20019

SSL: PAR 01690114

PROPERTY OWNER:

FARIBA MAHVI, PEPCO HOLDINGS, INC.; 701 9TH STREET NW, WASHINGTON, DC 20001; OFFICE: (202) 331-6641; CELL: (202) 345-7647

CONTRACTOR:

(TBD AND SUBMITTED TO DCRA INSPECTION AND COMPLIANCE DIVISION)

DESIGNER OF RECORD:

SARAH J. NAPIER, PE; AECOM; 12420 MILESTONE CENTER DRIVE, SUITE 150, GERMANTOWN, MD 20876; OFFICE: (301) 820-3198; CELL: (301) 502-2657

SOIL TYPE: URBAN LAND (Ub)

PERMANENT STABILIZATION:

REPLACE EXISTING ASPHALT AND CONCRETE PAVEMENT IN LINE AND GRADE; REPLACE EXISTING COMPACTED COVER IN LINE AND GRADE AND USE DC/DOEE APPROVED SEED MIX

ENVIRONMENT:

NO WILDLIFE HABITAT OR WATER AREAS; ADJACENT TO ANACOSTIA RIVER; 100-YEAR FLOODPLAIN LOCATED AT WEST LIMIT OF PROPERTY OUTSIDE OF LIMITS OF DISTURBANCE (LOD)

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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

GENERAL NOTES:

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2. STABILIZED CONSTRUCTION ENTRANCES WILL NOT BE REQUIRED BECAUSE CONSTRUCTION AREAS AND VEHICLES WILL BE SWEPT CLEAN DAILY USING BRUSHES AND BROOMS TO REMOVE DEBRIS. NO TRACT VEHICLES SHALL BE PERMITTED ON EXPOSED SURFACES OR EXCAVATED SOIL AREAS. DUST WILL BE CONTROLLED ON-SITE USING STABILIZATION METHODS, FENCING, AND IRRIGATION IN COMBINATION WITH SWEEPING THE SITE, AS NEEDED.

3. EXISTING INLETS AND CATCH BASINS LOCATED AT THE FACILITY TYPICALLY HAVE FILTER BAG INLET PROTECTION (FBIP) CURRENTLY, SEMI-PERMANENTLY INSTALLED AND MAINTAINED BY ON-SITE COMPANY CONTRACTED BY PEPCO. PROVIDE AT GRADE INLET PROTECTION (AGIP) OR CURB INLET PROTECTION (CIP) (WITHOUT DISTURBING THE FBIP) ON ALL STORM DRAIN INLETS AND CATCH BASINS LOCATED IMMEDIATELY DOWNSTREAM FROM TRENCHES AND EXCAVATIONS ASSOCIATED WITH THIS PROJECT (EVEN IF LOCATED OUTSIDE OF THE LIMITS OF DISTURBANCE (LODs) OR OUTSIDE THE LIMITS OF THE PLAN VIEW CONTAINED HEREIN) IF NOT ALREADY INSTALLED AND IN USE.

4. SILT FENCE (SF) AND STRAW BALE DIKES (SBDs) PROVIDED FOR PERIMETER CONTROL SHALL BE INSPECTED DAILY FOR INTEGRITY. DOCUMENTATION OF INSPECTION IS REQUIRED. REMOVE ACCUMULATIONS OF SEDIMENT DAILY. PROVIDE SF IN PERVIOUS SURFACE AREAS AND SBDs ON IMPERVIOUS SURFACES. DO NOT USE SF IN PAVEMENT UNLESS APPROVED BY ESC INSPECTOR AT SITE.

5. PERFORM GROUNDWATER TESTING AS NEEDED AND IN ACCORDANCE WITH APPLICABLE DC WATER AND SEWER (DC WATER) AND DOEE REQUIREMENTS AND PERMITS. USE DOEE APPROVED DEWATERING AND FILTERING PRACTICES (WITH APPROVAL FROM THE DOEE INSPECTOR) TO DISCHARGE FILTERED STORMWATER RUNOFF AND GROUNDWATER WHICH HAS BEEN REMOVED FROM EXCAVATIONS INTO THE DC STORM DRAIN SYSTEM AND/OR WATERWAYS REGULATED BY DOEE. SIZE AND LOCATE SUMP PITS, PUMPS, SUCTION AND DISCHARGE HOSES, FILTER BAGS, AND/OR SEDIMENT TANKS, ETC. AS NECESSARY. HAUL WATER OFF-SITE AND DISPOSE OF IN DOEE APPROVED LOCATION IF NOT PERMITTED BY INSPECTOR TO DISCHARGE FILTERED WATER ON-SITE.

DESIGN NOTES/LEGEND:

1	LIMITS OF DISTURBANCE	LOD
2	STRAW BALE DIKE (SBD)	SBD
3	SILT FENCE (SF)	SF
4	INLET PROTECTION (IP)	
5	SUMP PIT (BY CONTRACTOR)	
6	PORTABLE SEDIMENT TANK (BY CONTRACTOR)	
7	PUMPED WATER FILTER BAG (BY CONTRACTOR)	

SITE DESCRIPTION:

LIMITS OF DISTURBANCE (LOD) = 11,480 SF OR 0.26 AC.

VOLUME OF CUT = 84,834 CF

VOLUME OF FILL = 66,150 CF

0' 20' 40' 60'
SCALE: 1" = 20'

	DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM

8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

EROSION AND SEDIMENT
CONTROL PLAN 3 OF 4

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0114	SHEET OF 28	REV. NEW

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0114-EROSION AND SEDIMENT CONTROL PLAN 3 OF 4.dwg

PROJECT SITE INFORMATION:

PROPERTY ADDRESS: 3400 BENNING ROAD NE, WASHINGTON, DC 20019

SSL: PAR 01690114

PROPERTY OWNER:

FARIBA MAHVI, PEPCO HOLDINGS, INC.; 701 9TH STREET NW, WASHINGTON, DC 20001; OFFICE: (202) 331-6641; CELL: (202) 345-7647

CONTRACTOR:

(TBD AND SUBMITTED TO DCRA INSPECTION AND COMPLIANCE DIVISION)

DESIGNER OF RECORD:

SARAH J. NAPIER, PE; AECOM; 12420 MILESTONE CENTER DRIVE, SUITE 150, GERMANTOWN, MD 20876; OFFICE: (301) 820-3198; CELL: (301) 502-2657

SOIL TYPE: URBAN LAND (Ub)

PERMANENT STABILIZATION:

REPLACE EXISTING ASPHALT AND CONCRETE PAVEMENT IN LINE AND GRADE; REPLACE EXISTING COMPACTED COVER IN LINE AND GRADE AND USE DC/DOEE APPROVED SEED MIX

ENVIRONMENT:

NO WILDLIFE HABITAT OR WATER AREAS; ADJACENT TO ANACOSTIA RIVER; 100-YEAR FLOODPLAIN LOCATED AT WEST LIMIT OF PROPERTY OUTSIDE OF LIMITS OF DISTURBANCE (LOD)

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

GENERAL NOTES:

1. SCHEDULE PRE-CONSTRUCTION MEETING WITH DEPARTMENT OF ENERGY AND ENVIRONMENT (DDOE) EROSION AND SEDIMENT CONTROL (ESC) INSPECTOR 3-DAYS PRIOR TO BREAKING GROUND.

2. STABILIZED CONSTRUCTION ENTRANCES WILL NOT BE REQUIRED BECAUSE CONSTRUCTION AREAS AND VEHICLES WILL BE SWEPT CLEAN DAILY USING BRUSHES AND BROOMS TO REMOVE DEBRIS. NO TRACT VEHICLES SHALL BE PERMITTED ON EXPOSED SURFACES OR EXCAVATED SOIL AREAS. DUST WILL BE CONTROLLED ON-SITE USING STABILIZATION METHODS, FENCING, AND IRRIGATION IN COMBINATION WITH SWEEPING THE SITE, AS NEEDED.

3. EXISTING INLETS AND CATCH BASINS LOCATED AT THE FACILITY TYPICALLY HAVE FILTER BAG INLET PROTECTION (FBIP) CURRENTLY, SEMI-PERMANENTLY INSTALLED AND MAINTAINED BY ON-SITE COMPANY CONTRACTED BY PEPCO. PROVIDE AT GRADE INLET PROTECTION (AGIP) OR CURB INLET PROTECTION (CIP) (WITHOUT DISTURBING THE FBIP) ON ALL STORM DRAIN INLETS AND CATCH BASINS LOCATED IMMEDIATELY DOWNSTREAM FROM TRENCHES AND EXCAVATIONS ASSOCIATED WITH THIS PROJECT (EVEN IF LOCATED OUTSIDE OF THE LIMITS OF DISTURBANCE (LODs) OR OUTSIDE THE LIMITS OF THE PLAN VIEW CONTAINED HEREIN) IF NOT ALREADY INSTALLED AND IN USE.

4. SILT FENCE (SF) AND STRAW BALE DIKES (SBDs) PROVIDED FOR PERIMETER CONTROL SHALL BE INSPECTED DAILY FOR INTEGRITY. DOCUMENTATION OF INSPECTION IS REQUIRED. REMOVE ACCUMULATIONS OF SEDIMENT DAILY. PROVIDE SF IN PERVIOUS SURFACE AREAS AND SBDs ON IMPERVIOUS SURFACES. DO NOT USE SF IN PAVEMENT UNLESS APPROVED BY ESC INSPECTOR AT SITE.

5. PERFORM GROUNDWATER TESTING AS NEEDED AND IN ACCORDANCE WITH APPLICABLE DC WATER AND SEWER (DC WATER) AND DOEE REQUIREMENTS AND PERMITS. USE DOEE APPROVED DEWATERING AND FILTERING PRACTICES (WITH APPROVAL FROM THE DOEE INSPECTOR) TO DISCHARGE FILTERED STORMWATER RUNOFF AND GROUNDWATER WHICH HAS BEEN REMOVED FROM EXCAVATIONS INTO THE DC STORM DRAIN SYSTEM AND/OR WATERWAYS REGULATED BY DOEE. SIZE AND LOCATE SUMP PITS, PUMPS, SUCTION AND DISCHARGE HOSES, FILTER BAGS, AND/OR SEDIMENT TANKS, ETC. AS NECESSARY. HAUL WATER OFF-SITE AND DISPOSE OF IN DOEE APPROVED LOCATION IF NOT PERMITTED BY INSPECTOR TO DISCHARGE FILTERED WATER ON-SITE.

DESIGN NOTES/LEGEND:

1	LIMITS OF DISTURBANCE	LOD
2	STRAW BALE DIKE (SBD)	SBD
3	SILT FENCE (SF)	SF
4	INLET PROTECTION (IP)	
5	SUMP PIT (BY CONTRACTOR)	
6	PORTABLE SEDIMENT TANK (BY CONTRACTOR)	
7	PUMPED WATER FILTER BAG (BY CONTRACTOR)	

SITE DESCRIPTION:

LIMITS OF DISTURBANCE (LOD) = 1,180 SF OR 0.03 AC.

VOLUME OF CUT = 16,929 CF

VOLUME OF FILL = 14,850 CF

0' 20' 40' 60'
SCALE: 1" = 20'

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

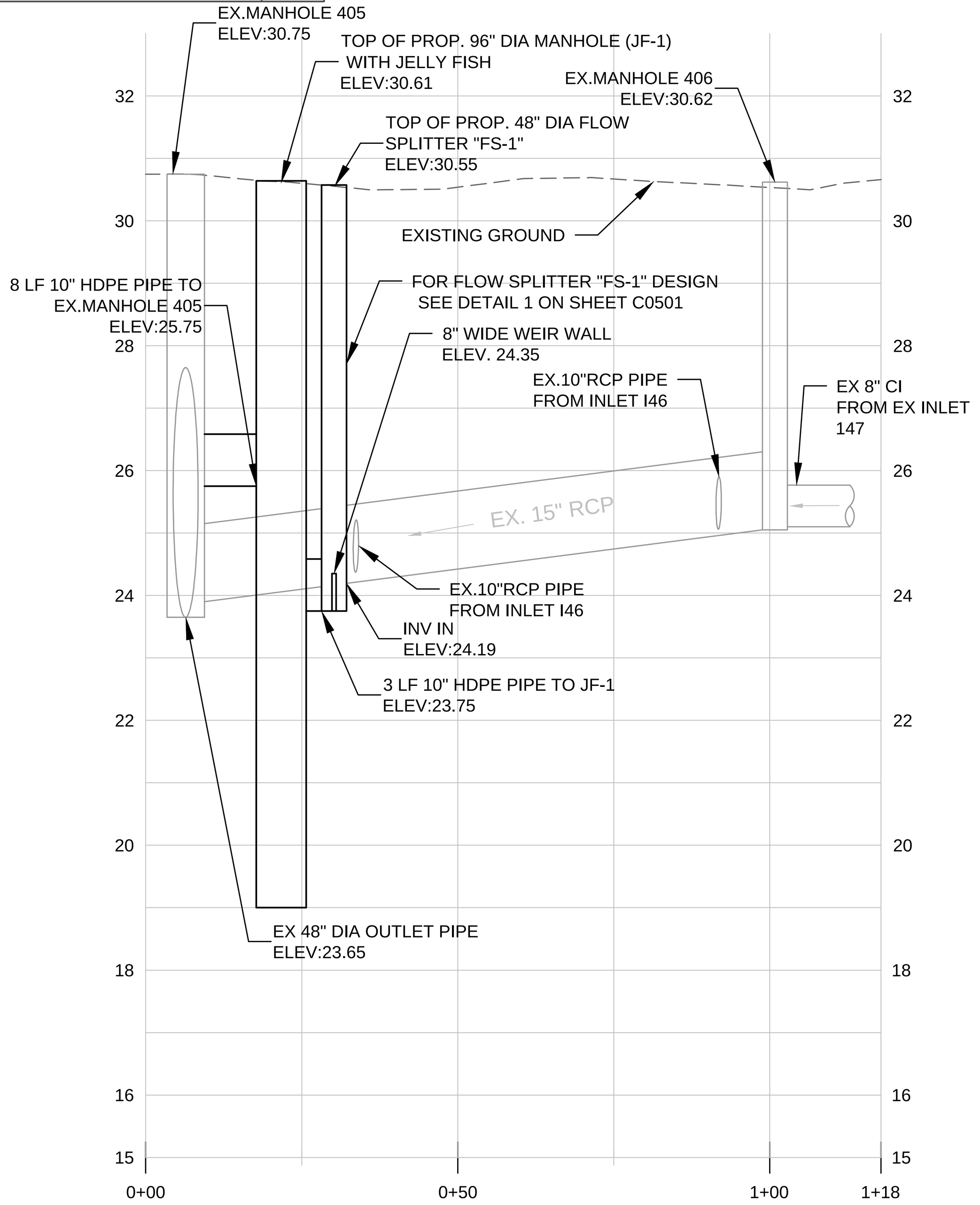
BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EROSION AND SEDIMENT
CONTROL PLAN 4 OF 4

POTOMAC ELECTRIC POWER CO.

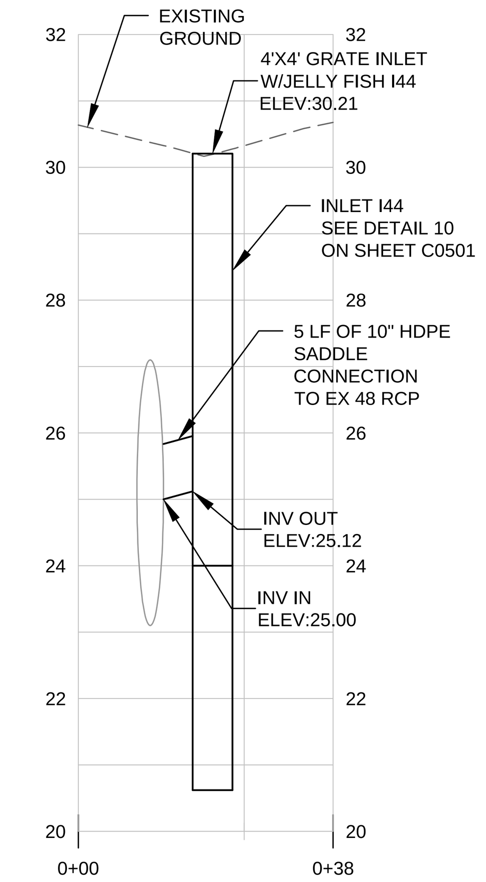
CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0115	SHEET OF 28	REV. NEW

C0201 SHEET OF 28 REV. NEW

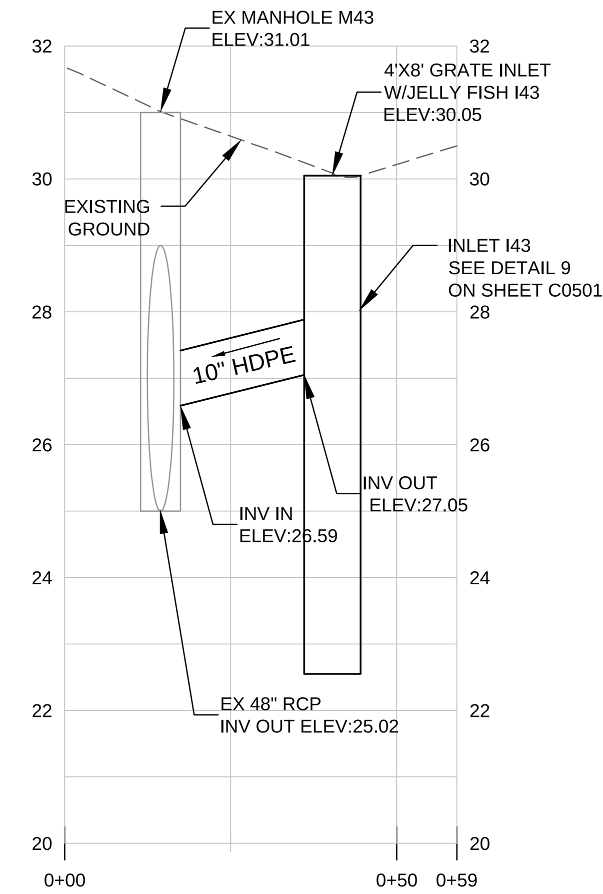
STORM DRAIN PROFILES FOR HOTSPOT-1



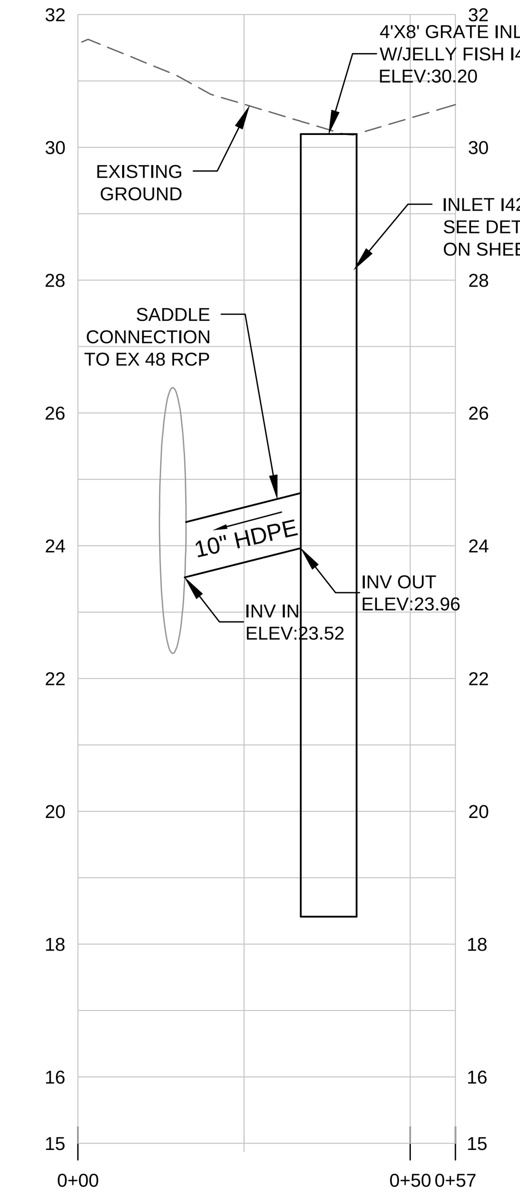
1 STORM DRAIN PROFILE FROM M45 TO M46
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'



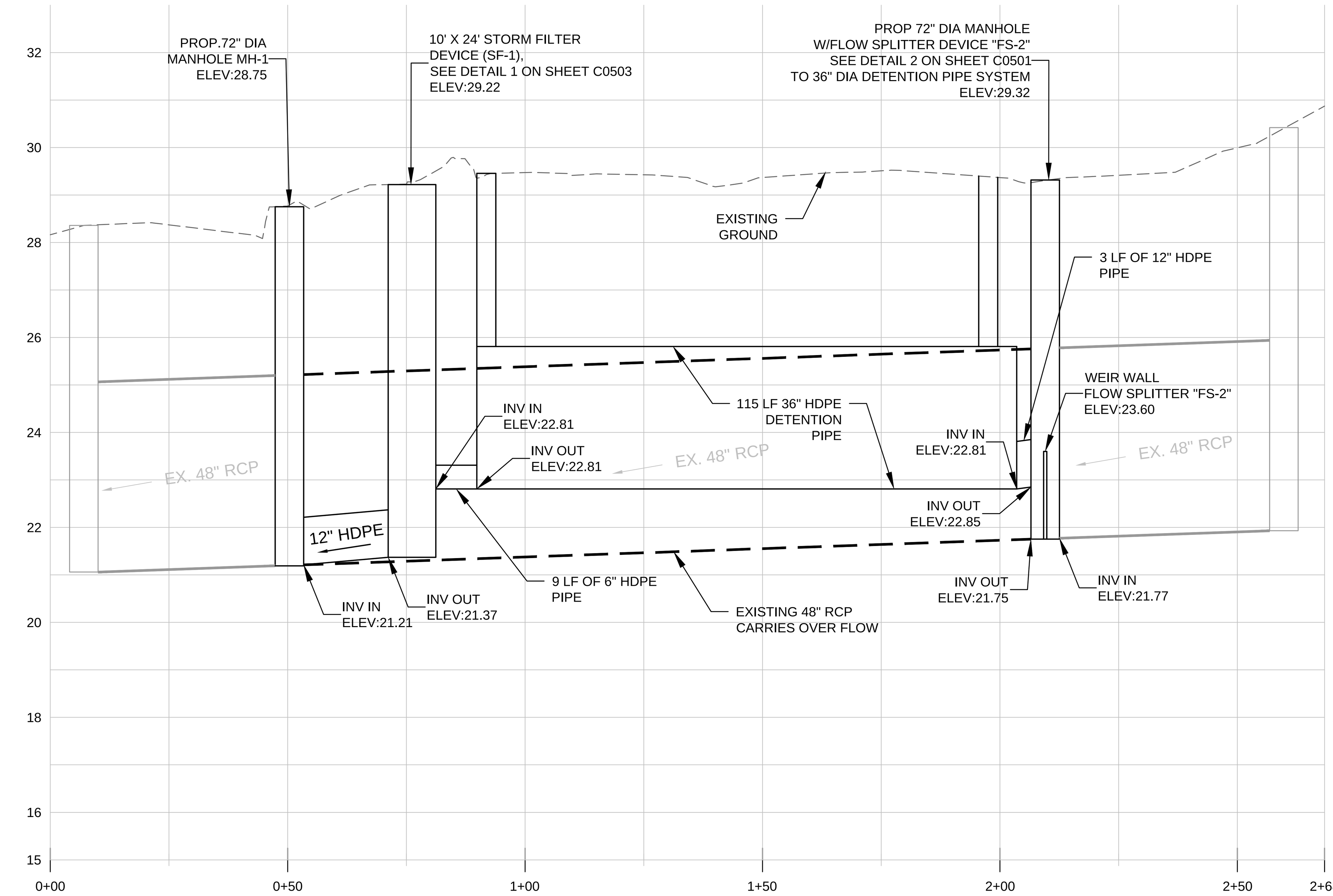
2 STORM DRAIN PROFILE FROM I 44 TO 48" MAIN
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'



3 STORM DRAIN PROFILE FROM I43 TO M43
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'

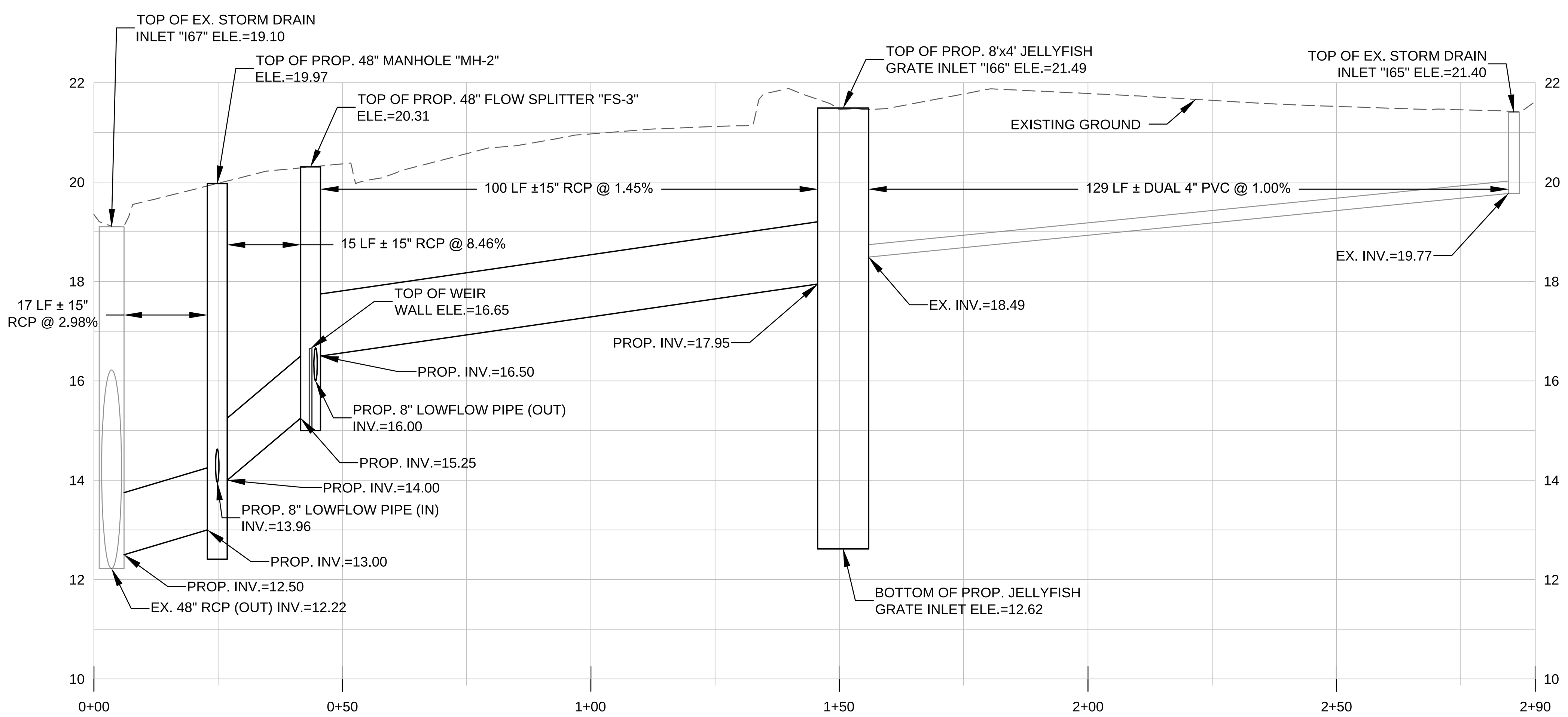


4 STORM DRAIN PROFILE FROM I 42 TO 48" MAIN
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'

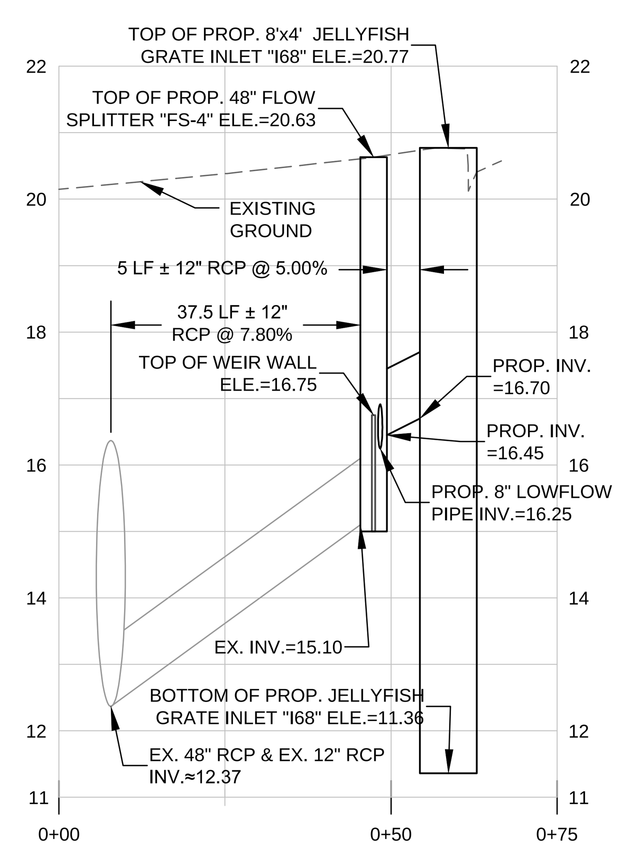


5 STORM DRAIN PROFILE FROM 405 TO M404
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'

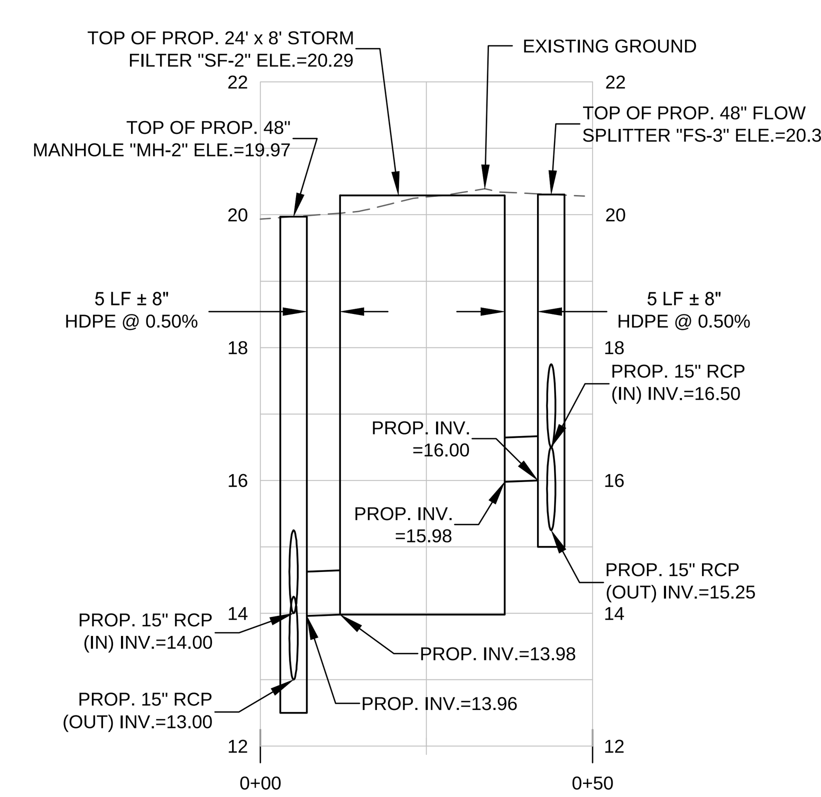
STORM DRAIN PROFILES FOR HOTSPOT-2



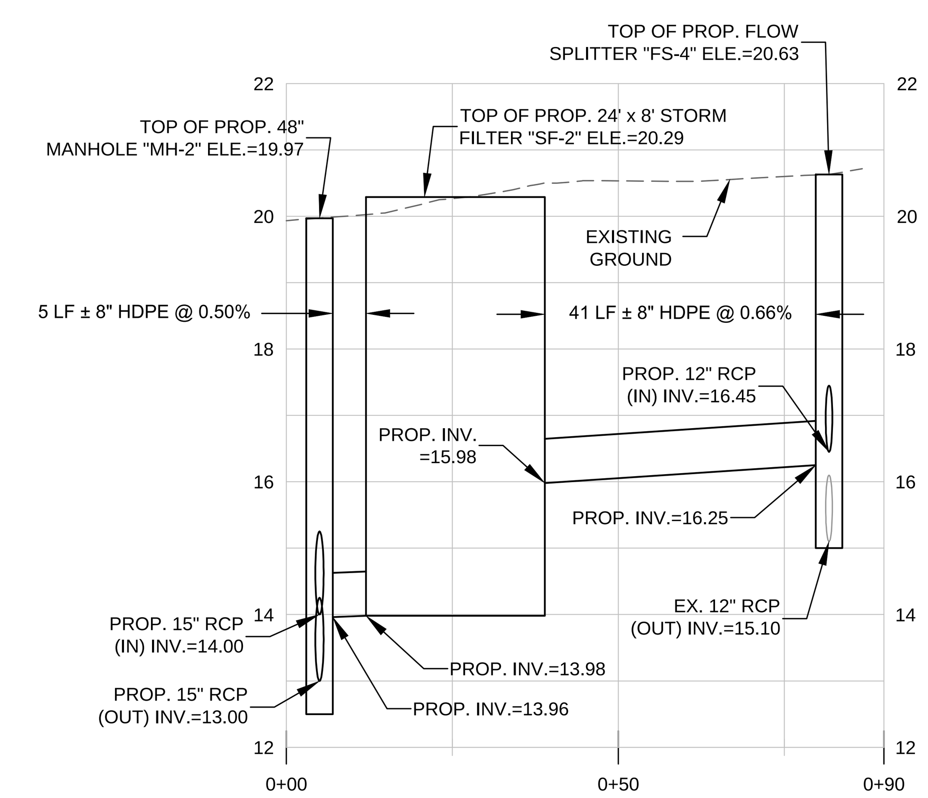
6 STORM DRAIN INLET I67 TO STORM DRAIN INLET I65
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'



7 STORM DRAIN CONNECTION 419 TO STORM DRAIN INLET I68
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'



8 PROP. MANHOLE "I66B" TO PROP. FLOW SPLITER "I66A"
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'



9 PROP. MANHOLE "I66B" TO PROP. FLOW SPLITTER "I68A"
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

STORM DRAIN PROFILES 1 OF 3

POTOMAC ELECTRIC POWER CO.

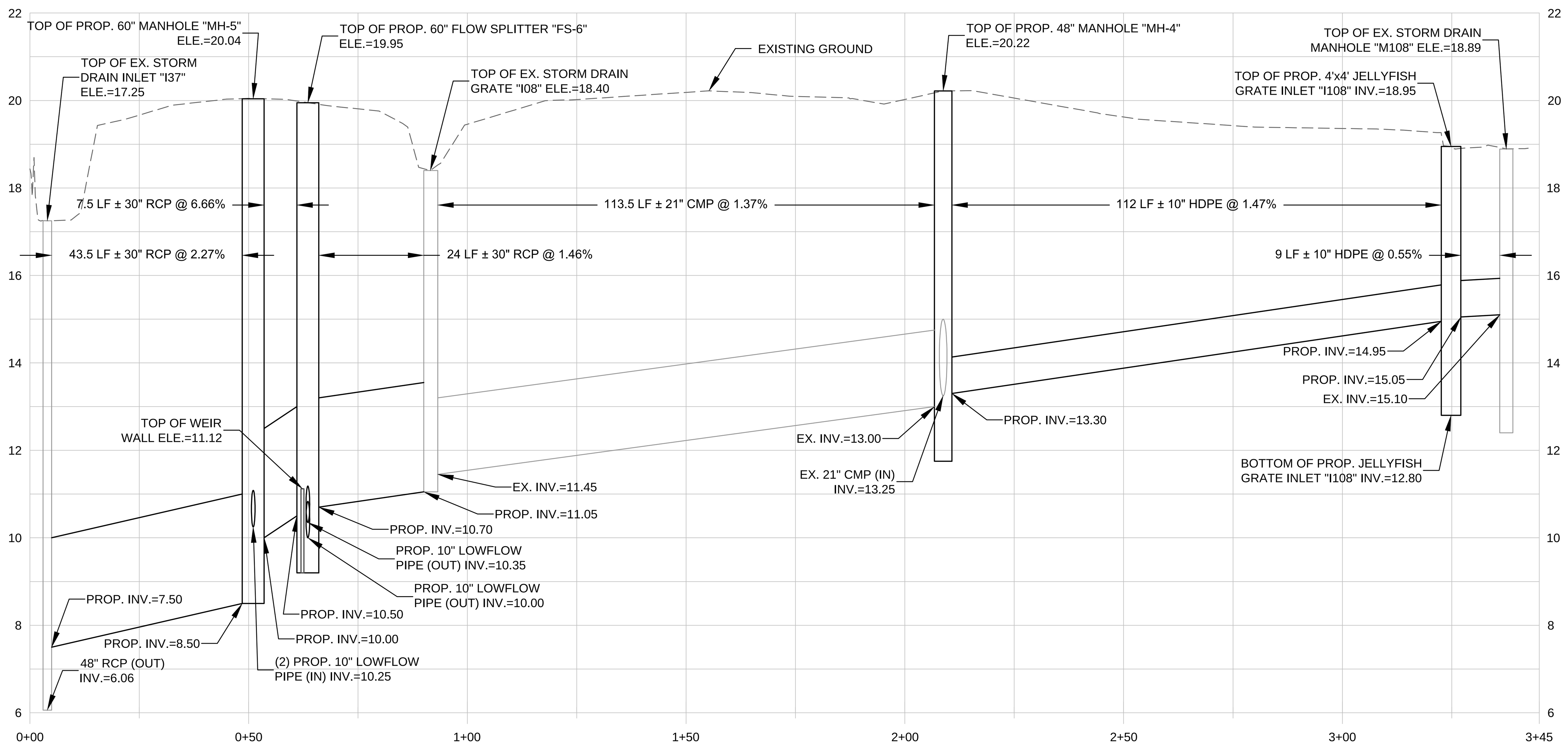
CHKD | APPD | APPD | APPD | APPD | APPD | DR BY: EP | ENGR.: SJN | CLASS
DATE: 01/27/17 | SCALE: 1"=80'

C0201 SHEET OF 28 REV. NEW

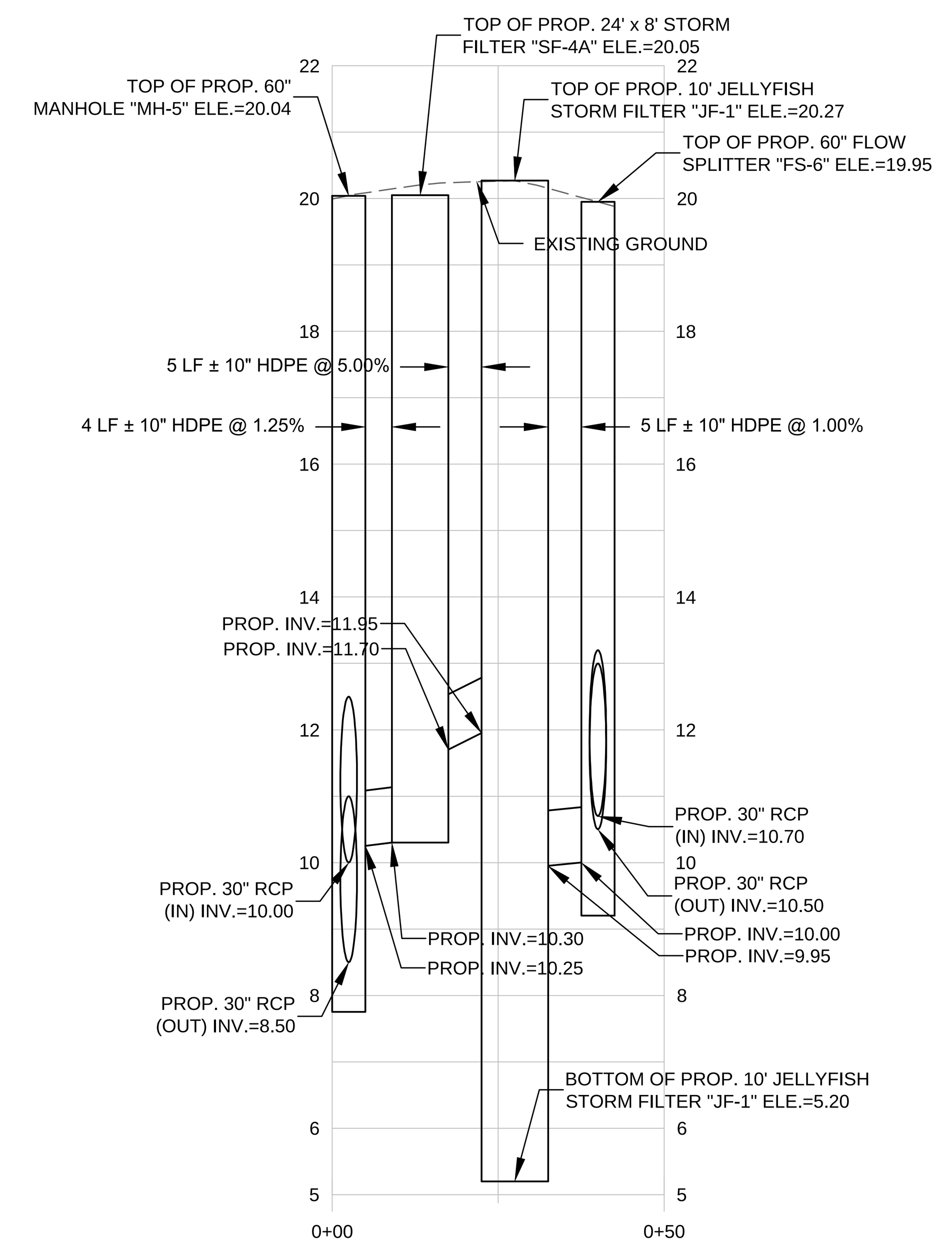
PLOTTED: 2/15/2017 11:26 AM

C0202 SHEET OF 28 | REV. NEW

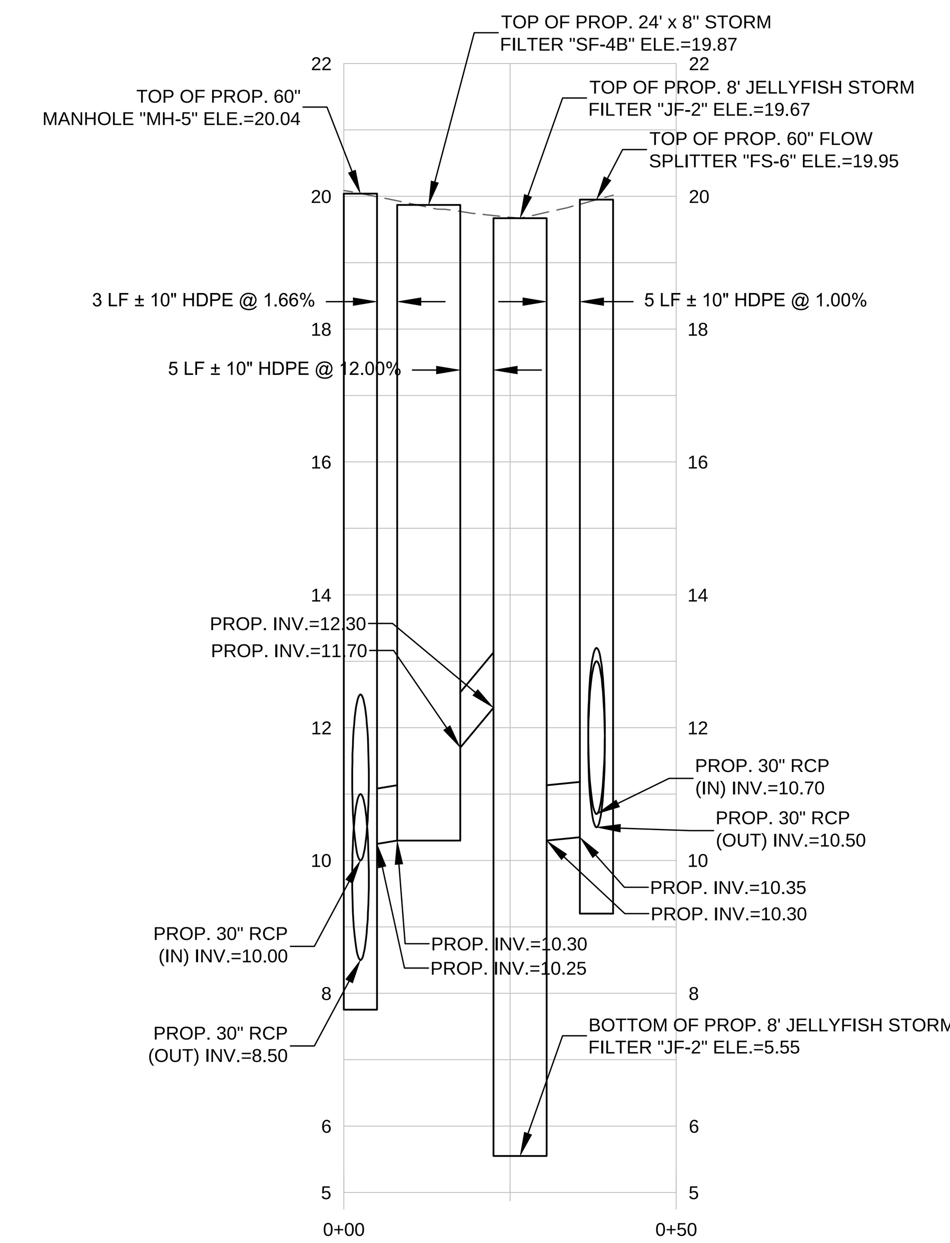
STORM DRAIN PROFILES FOR HOTSPOT-3



1 STORM DRAIN INLET I37 TO STORM DRAIN INLET M108
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'



2 PROP MANHOLE "I08B" TO PROP. FLOW SPLITTER "I08A" (EAST)
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'



3 PROP MANHOLE "I08B" TO PROP. FLOW SPLITTER "I08B" (WEST)
SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'

FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0202-STORM DRAIN PROFILES 2 OF 3.dwg

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900
12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

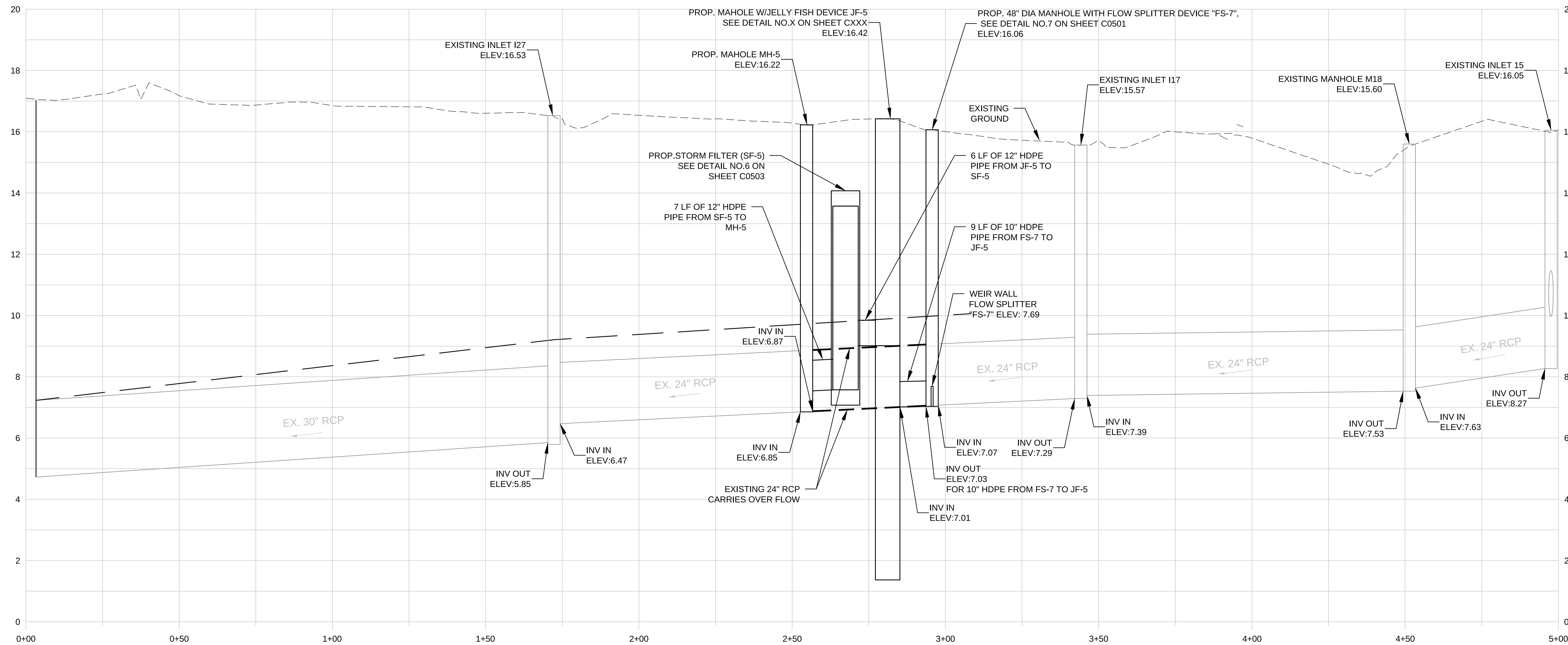
STORM DRAIN PROFILES 2 OF 3

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	
						C0202	SHEET OF 28	REV. NEW

PLOTTED: 2/15/2017 10:13 AM

STORM DRAIN PROFILES FOR HOTSPOT-4



1 EX. STORM DRAIN "PUMP" TO EX. STORM DRAIN STRUCTURE "15"

SCALE:
HORIZONTAL 1"= 20'
VERTICAL 1"= 2'

STORM DRAIN STRUCTURES SCHEDULE

HOTSPOT No.	ID.	SIZE	INV. IN (PIPE)	FROM	INV. OUT (PIPE)	TO	NOTES
1	FS-1	60"	21.56 (48" RCP)	EX. M46	21.56 (48" RCP)	EX. M45	DETAIL 1 ON SHEET C0501
					22.85 (10" HDPE)	JF-1	
	FS-2	88"	21.65 (48" RCP)	EX. 405	23.50 (12" RCP)	DP-1	DETAIL 2 ON SHEET C0501
					21.60 (48" RCP)	MH-1	
	MH-1	84"	21.42 (48" RCP)	FS-2	21.40 (48" RCP)	EX. 404	DETAIL 7 ON SHEET C0504
			21.42 (12" RCP)	SF-1			
2	FS-3	48"	16.50 (15" RCP)	I66	15.25 (15" RCP)	MH-2	DETAIL 3 ON SHEET C0501
					16.00 (8" HDPE)	SF-2	
	MH-2	48"	13.96 (8" HDPE)	SF-2	13.00 (15" RCP)	EX. I67	DETAIL 6 ON SHEET C0504
			14.00 (15" RCP)	FS-3			
	EX. I67		12.28 (EX. 48" RCP)	EX. M55C	12.22 (EX. 48" RCP)	EX. 416	NEW INVERT FROM MH-2
			12.50 (15" RCP)	MH-2			
	FS-4	48"	16.45 (12" RCP)	I68	16.25 (8" HDPE)	SF-2	DETAIL 4 ON SHEET C0501
					15.10 (EX. 12" RCP)	EX. 419	
3	MH-4	48"	13.25 (EX. 21" CMP)	EX. I07	13.00 (EX. 21" CMP)	EX. I08	DETAIL 6 ON SHEET C0504
			13.30 (10" HDPE)	I108			
	EX. I08		11.15 (EX. 18" RCP)	M07A	11.05 (30" RCP)	FS-6	EXISTING 24" PVC LEAVING STURCUTRE TO BE ABANDONNED
			11.45 (EX. 21" CMP)	MH-4			
			17.10 (EX. 4" PERFORATED PIPE)				
	FS-6	60"	10.70 (30" RCP)	EX. I08	10.00 (10" HDPE)	JF-3	DETAIL 6 ON SHEET C0501
					10.35 (10" HDPE)	JF-4	
					10.50 (30" RCP)	MH-5	
	MH-5	60"	10.00 (30" RCP)	FS-6	8.50 (30" RCP)	EX. I37	DETAIL 6 ON SHEET C0504
			10.25 (10" HDPE)	SF-4A			
			10.25 (10" HDPE)	SF-4B			
	EX. I37		7.50 (30" RCP)	MH-5	6.06 (EX. 54" DATR)	EX. I33	NEW INVERT FROM MH-5
			10.41 (EX. 48" RCP)	EX. 416			
4	FS-7	48"	7.03 (EX. 24" RCP)	EX. I17	7.03 (10" HDPE)	JF-5	DETAIL 7 ON SHEET C0501
					7.03 (24" RCP)	MH-6	
	MH-6	48"	6.87 (EX. 24" RCP)	FS-7	6.85 (EX. 24" RCP)	EX. I27	DETAIL 6 ON SHEET C0504
			(12" HDPE)	SF-5			

TREATMENT STRUCTURES SCHEDULE

HOTSPOT No.	ID.	TREATMENT STRUCTURE	SIZE	INV. IN (PIPE)	FROM	INV. OUT (PIPE)	TO	NOTES
1	RD-1	DOWNSPOUT STORM FILTER						
	RD-2	DOWNSPOUT STORM FILTER						
	RD-3	DOWNSPOUT STORM FILTER						
	RD-4	DOWNSPOUT STORM FILTER						
	JF-1	MANHOLE WITH JELLYFISH	8'	30.66 (10" HDPE)				
	I44	GRATE INLET WITH JELLYFISH	3' x 5'	30.22		27.20 (10" HDPE)	48" RCP	DETAIL 10 ON SHEET C0501
	I43	GRATE INLET WITH JELLYFISH	4' x 8'	30.10		27.10 (10" HDPE)	48" RCP	DETAIL 9 ON SHEET C0501
	I42	GRATE INLET WITH JELLYFISH	4' x 8'	30.30		27.30 (10" HDPE)	48" RCP	DETAIL 8 ON SHEET C0501
	SF-1	STORM FILTER	24' x 10'	22.81 (6" HDPE)	DP-1	21.37 (12" HDPE)	MH-1	DETAIL 1 ON SHEET C0503
2	I66	GRATE INLET WITH JELLYFISH	4' x 8'	18.49 (EX. 4" PVC)	EX. I65	17.95 (15" RCP)	FS-3	DETAIL 1 ON SHEET C0502
	SF-2	STORM FILTER	24' x 8'	15.98 (8" HDPE)	FS-3	13.98 (8" HDPE)	MH-2	DETAIL 2 ON SHEET C0503
	I68	CATCH BASIN WITH JELLYFISH	4' x 8'	20.77		16.70 (12" RCP)	FS-4	DETAIL 2 ON SHEET C0502
3	I108	GRATE INLET WITH JELLYFISH	4' x 8'	15.05 (10" HDPE)	EX. M108	14.95 (10" HDPE)	MH-4	
	JF-3	MANHOLE WITH JELLYFISH	10'	9.95 (10" HDPE)	FS-6	11.95 (10" HDPE)	SF4-A	DETAIL 3 ON SHEET C0502
	SF-4A	STORM FILTER	24' x 8'	11.70 (10" HDPE)	JF-3	10.30 (10" HDPE)	MH-5	DETAIL 4 ON SHEET C0503
	JF-4	MANHOLE WITH JELLYFISH	8'	10.30 (10" HDPE)	FS-6	12.30 (10" HDPE)	SF-4B	DETAIL 4 ON SHEET C0502
	SF-4B	STORM FILTER	24' x 8'	11.70 (10" HDPE)	JF-4	10.30 (10" HDPE)	MH-5	DETAIL 5 ON SHEET C0503
4	JF-5	MANHOLE WITH JELLYFISH	8'	7.01 (10" HDPE)	FS-7	(12" HDPE)	SF-5	DETAIL 6 ON SHEET C0502
	SF-5	STORM FILTER	24' x 10'	(12" HDPE)	JF-5	(12" HDPE)	MH-6	DETAIL 6 ON SHEET C0503

STORM DRAIN PIPES SCHEDULE

HOTSPOT No.	PIPE SIZE	TYPE	CLASS	LENGTH (FEET)
1	6"	HDPE		10
	10"	HDPE		50
	12"	HDPE		33
	36"	RCP	IV	121
2	8"	HDPE		53
	12"	RCP	IV	5
	15"	RCP	IV	133
3	10"	HDPE		145
	30"	RCP	IV	75
4	10"	HDPE		9
	12"	HDPE		13

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

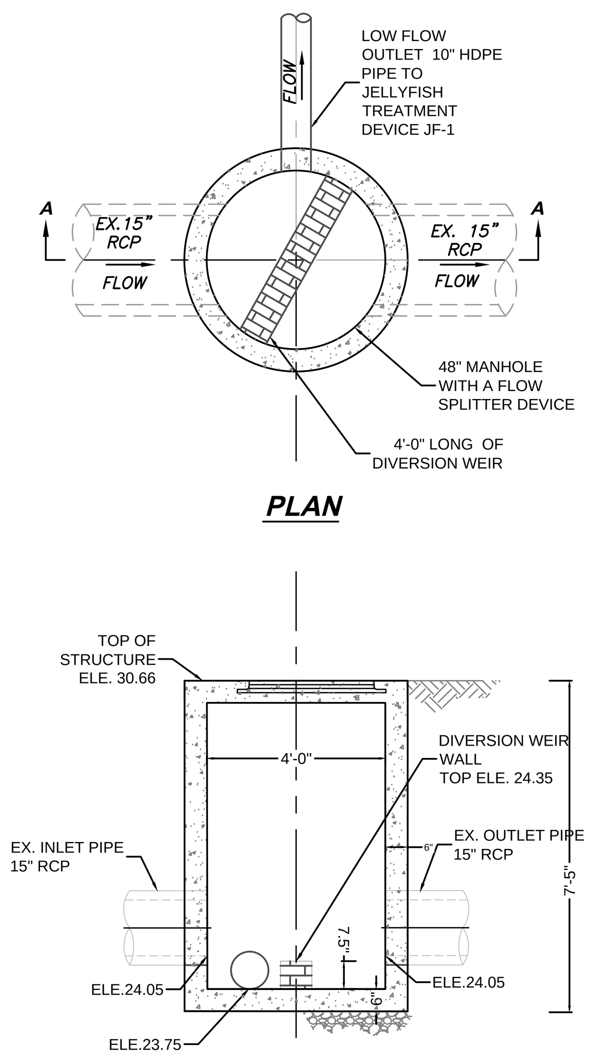
STORM DRAIN PROFILES 3 OF 3

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: 1"=20'	

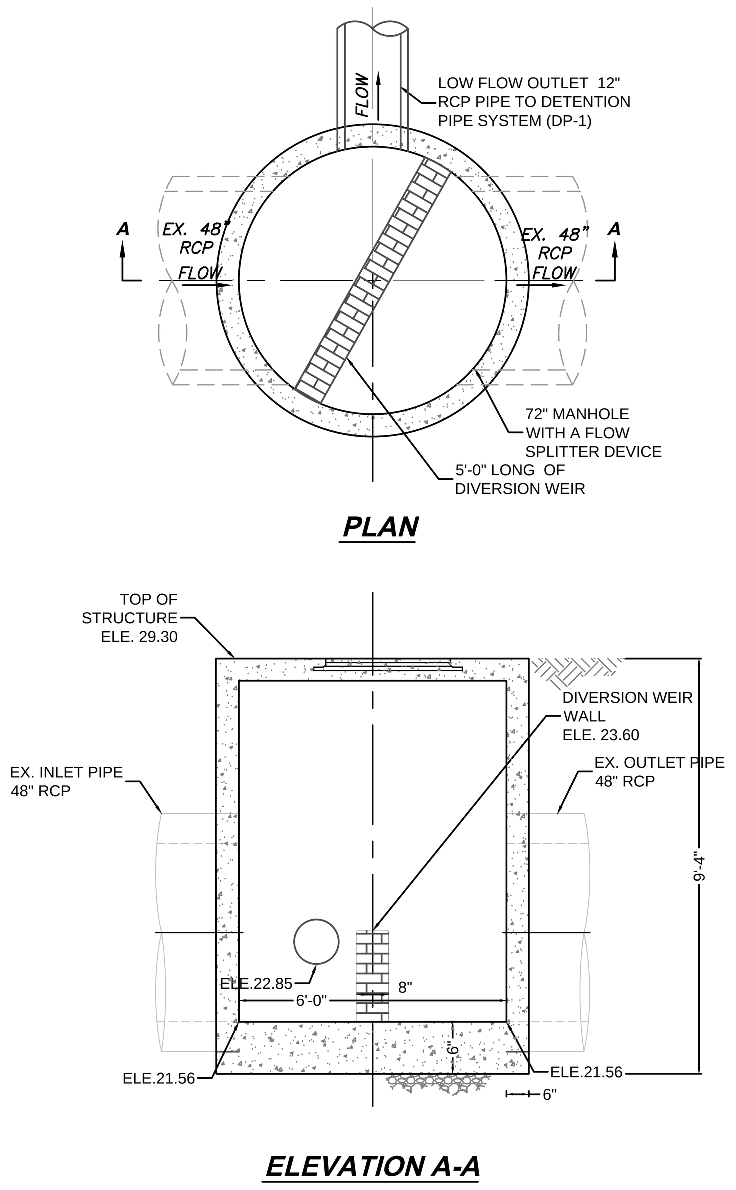
FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0203-STORM DRAIN PROFILES 3 OF 3.dwg

C0501 SHEET OF 28 REV. NEW



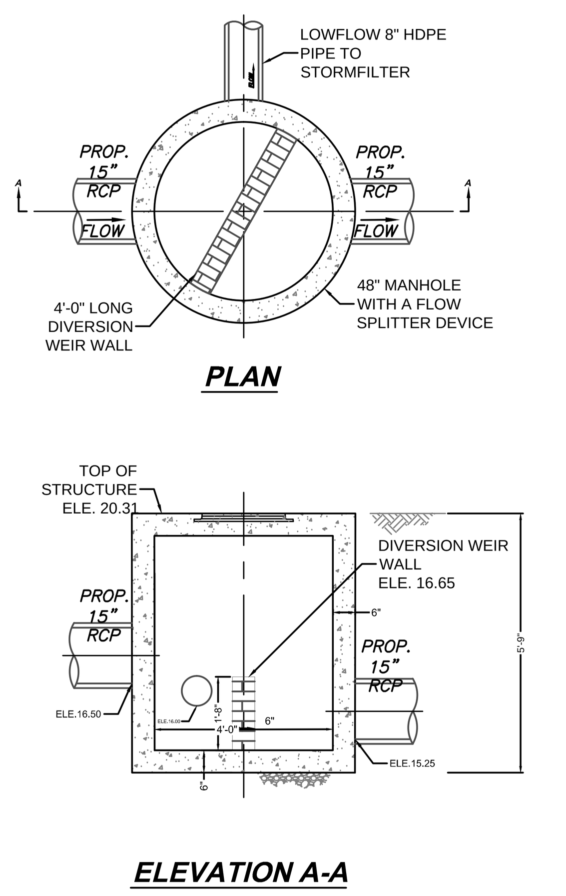
FOR FLOW-SPLITTER MANHOLE REFER TO DETAIL 6 ON SHEET C0504 (DOGHOUSE MANHOLES).

1 FLOW SPLITTER FS-1 U/S M45 (HOTSPOT-1)
SCALE: N.T.S

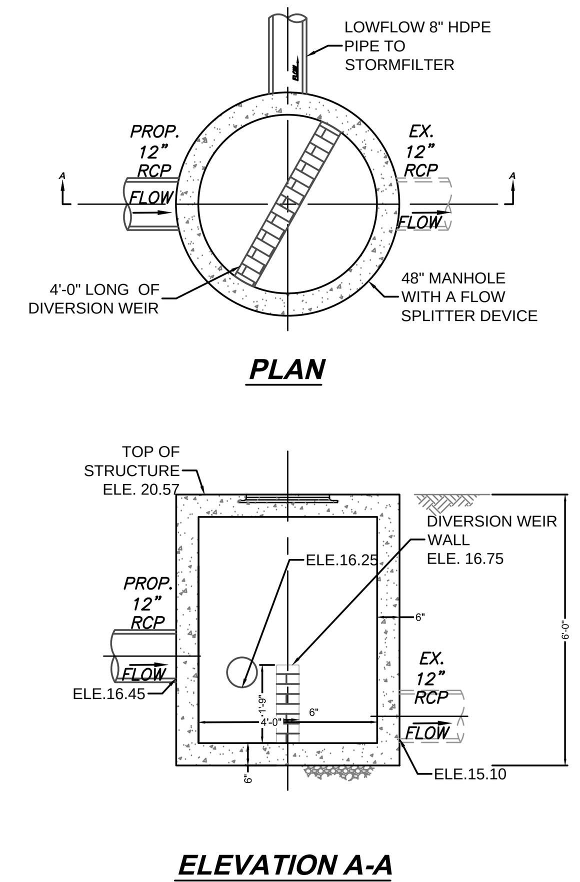


FOR FLOW-SPLITTER MANHOLE REFER TO DETAIL 7 ON SHEET C0504 (DOGHOUSE MANHOLES).

2 FLOW SPLITTER FS-2 D/S 405 (HOTSPOT-1)
SCALE: N.T.S



3 FLOW SPLITTER FS-3 D/S I-66 (HOTSPOT-2)
SCALE: N.T.S



FOR FLOW-SPLITTER MANHOLE REFER TO DETAIL 6 ON SHEET C0504 (DOGHOUSE MANHOLES).

4 FLOW SPLITTER FS-4 D/S I-68 (HOTSPOT-2)
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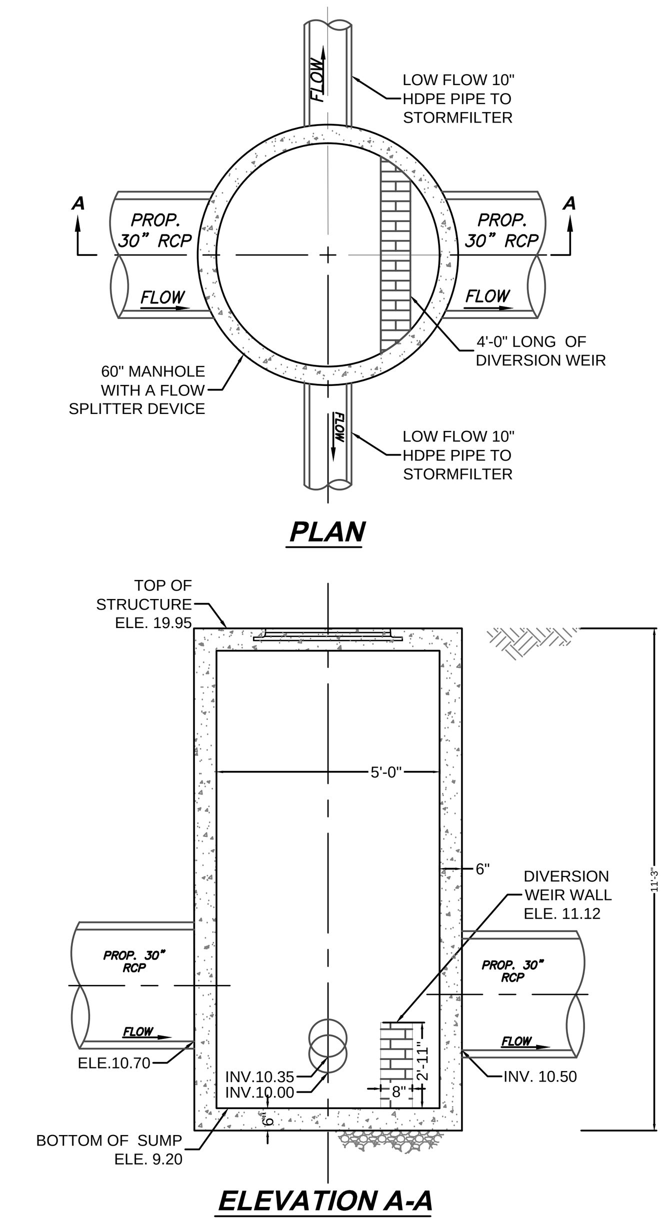
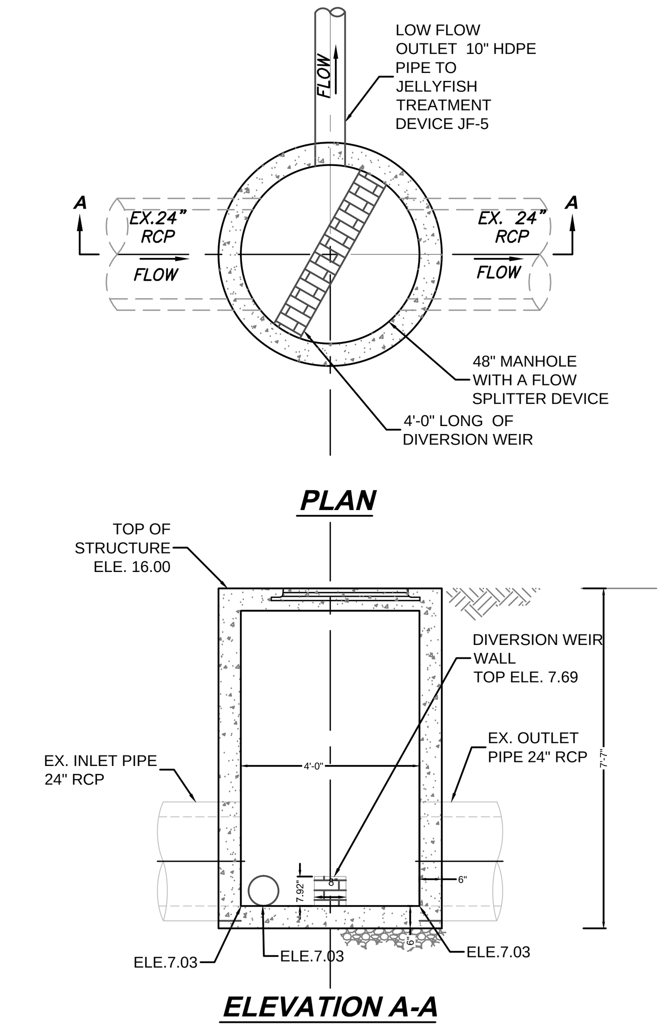


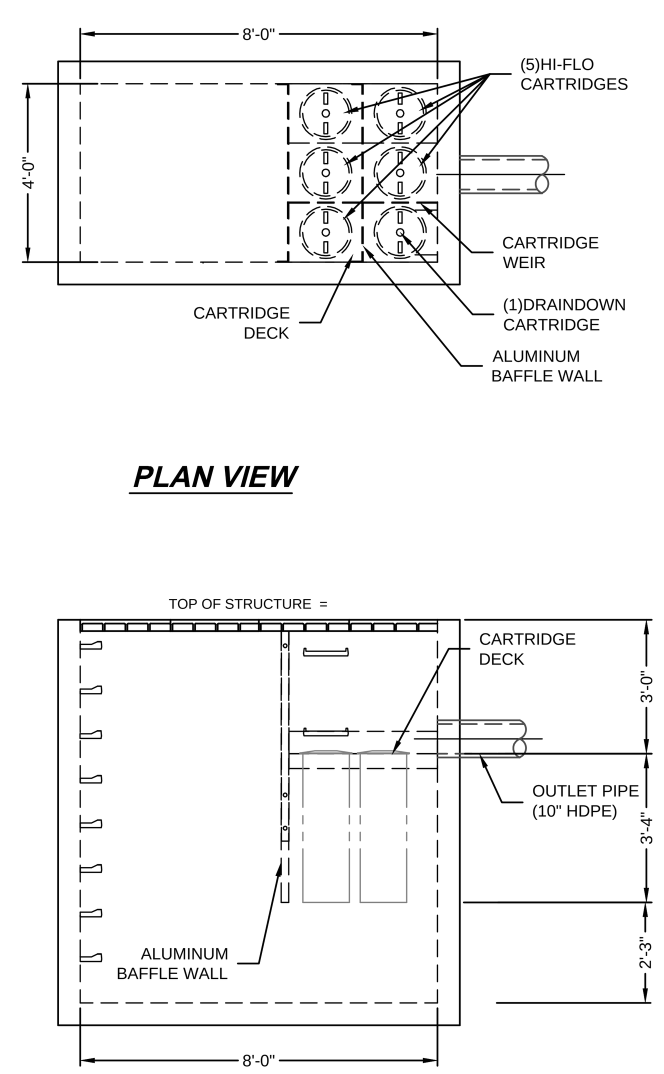
FOR FLOW-SPLITTER MANHOLE REFER TO DETAIL 6 ON SHEET C0504 (DOGHOUSE MANHOLES).

5 FLOW SPLITTER FS-6 D/S I108 (HOTSPOT-3)
SCALE: N.T.S

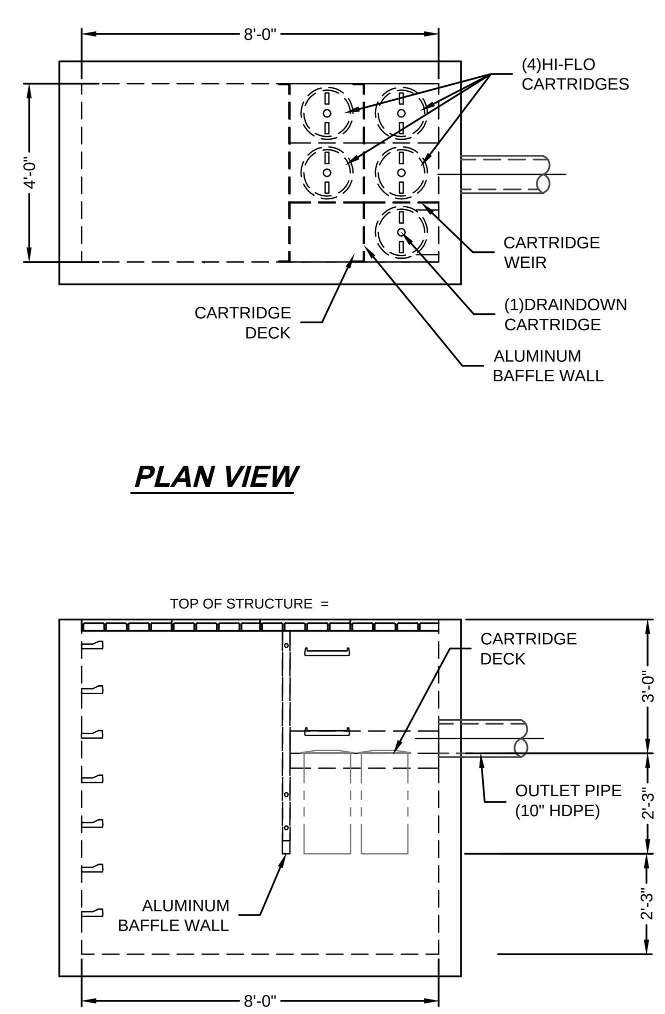


FOR FLOW-SPLITTER MANHOLE REFER TO DETAIL 6 ON SHEET C0504 (DOGHOUSE MANHOLES).

6 FLOW SPLITTER FS-7 D/S I17 (HOTSPOT-4)
SCALE: N.T.S



8 GRATE INLET WITH JELLY FISH INLET I42
SCALE: N.T.S



9 GRATE INLET WITH JELLY FISH INLET I43
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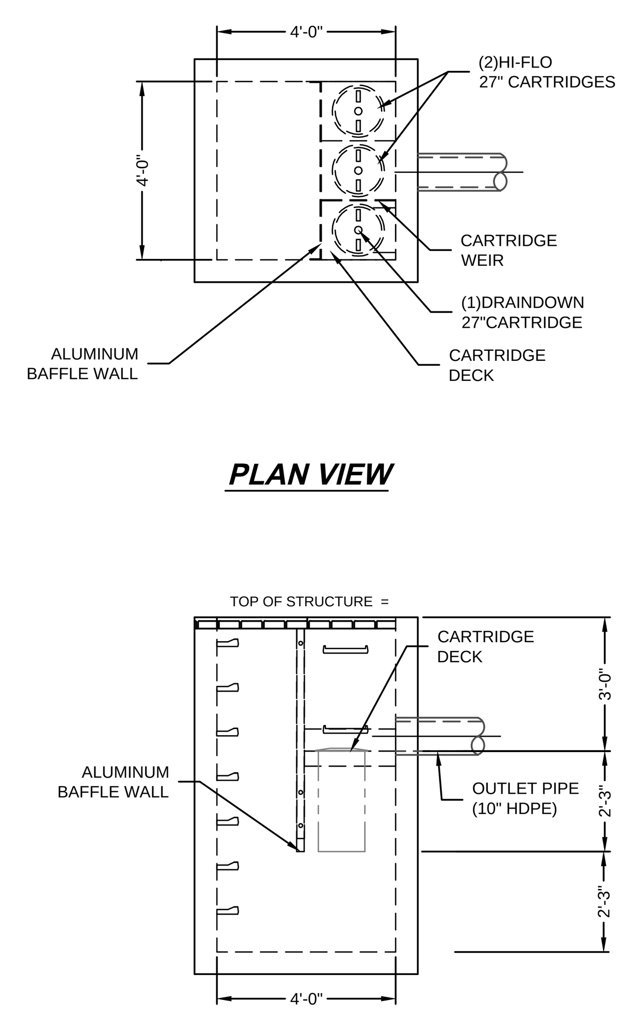

10 GRATE INLET WITH JELLY FISH INLET I44 (HOTSPOT-1)
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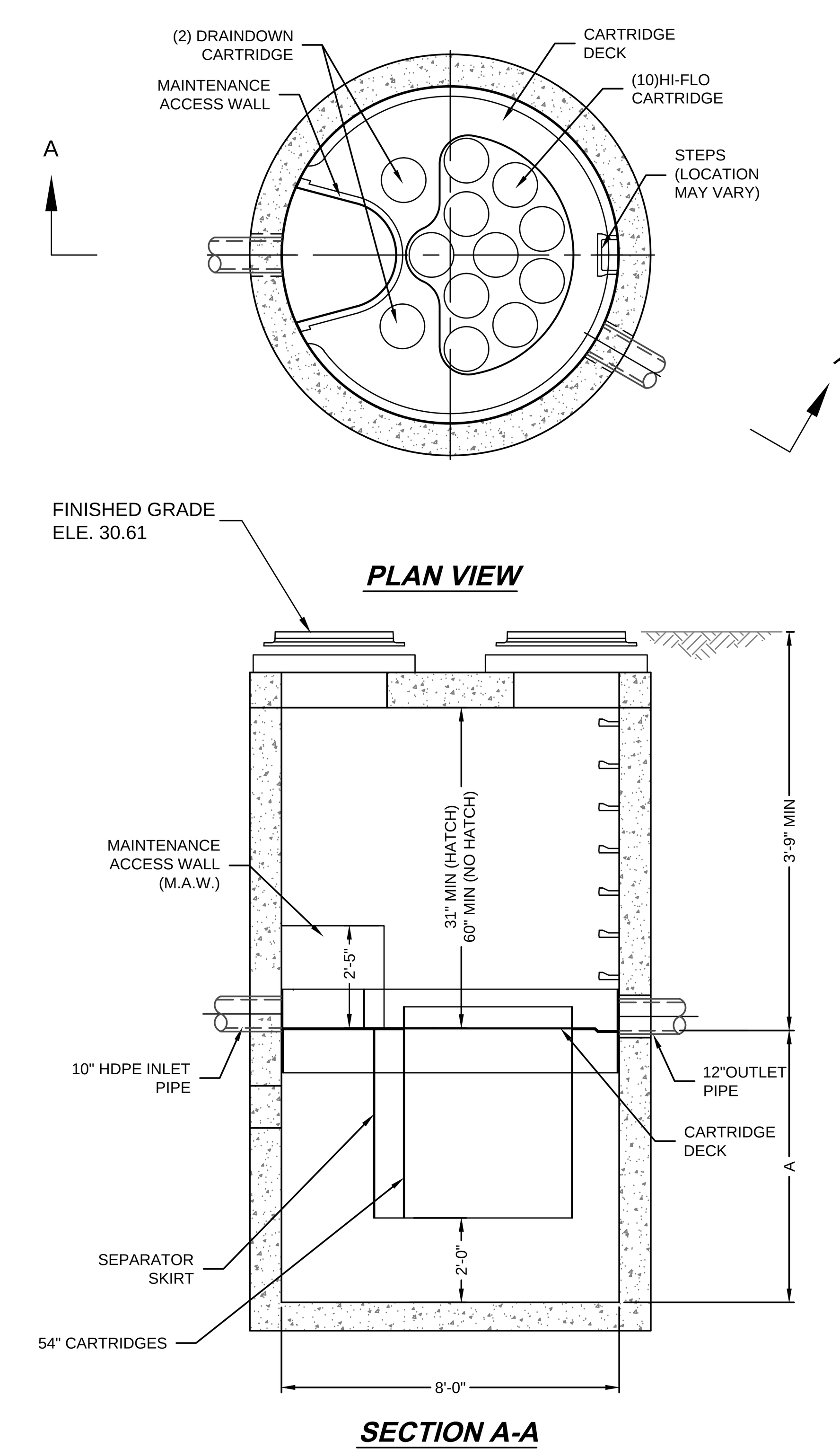

11 MANHOLE WITH JELLY FISH INLET JF-1 (HOTSPOT-1)
SCALE: N.T.S

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.
NAME:
LICENSE NO.: SARAH J. NAPIER
EXPIRATION DATE: PE905830
08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
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BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
STORMWATER MANAGEMENT DETAILS 1 OF 3

POTOMAC ELECTRIC POWER CO.

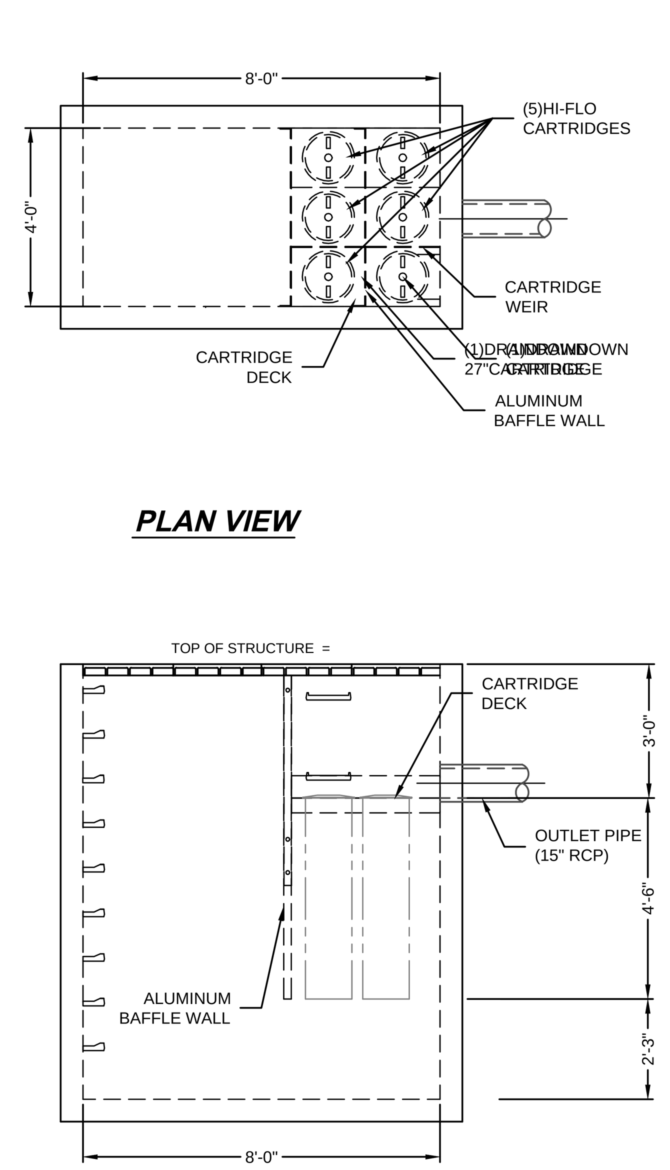
CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP / DATE: 01/27/17	ENGR.: SJN / SCALE: N.T.S	CLASS

C0501 SHEET OF 28 REV. NEW

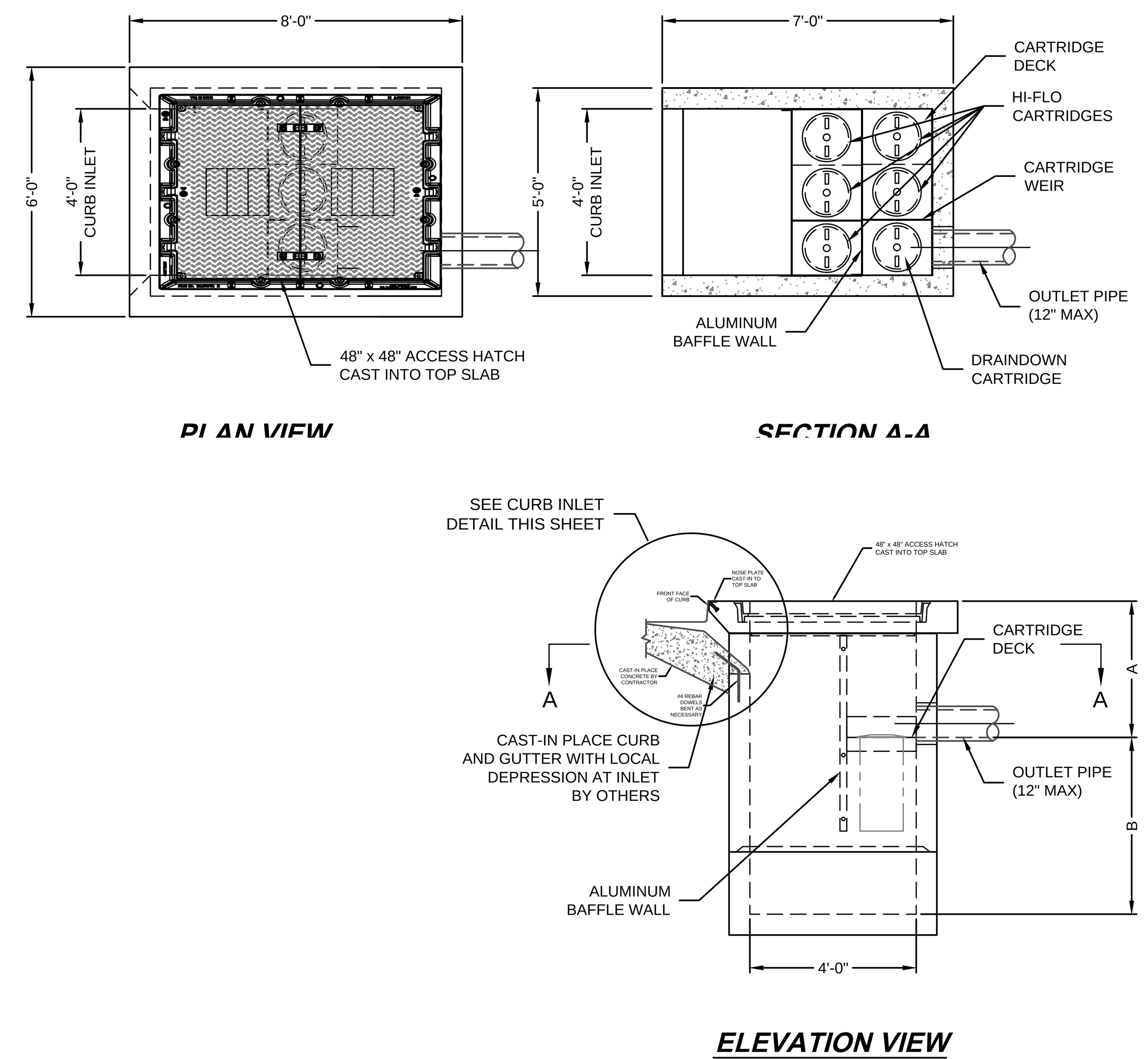
PLOTTED: 2/15/2017 10:13 AM

PLOTTED: 2/15/2017 9:15 AM

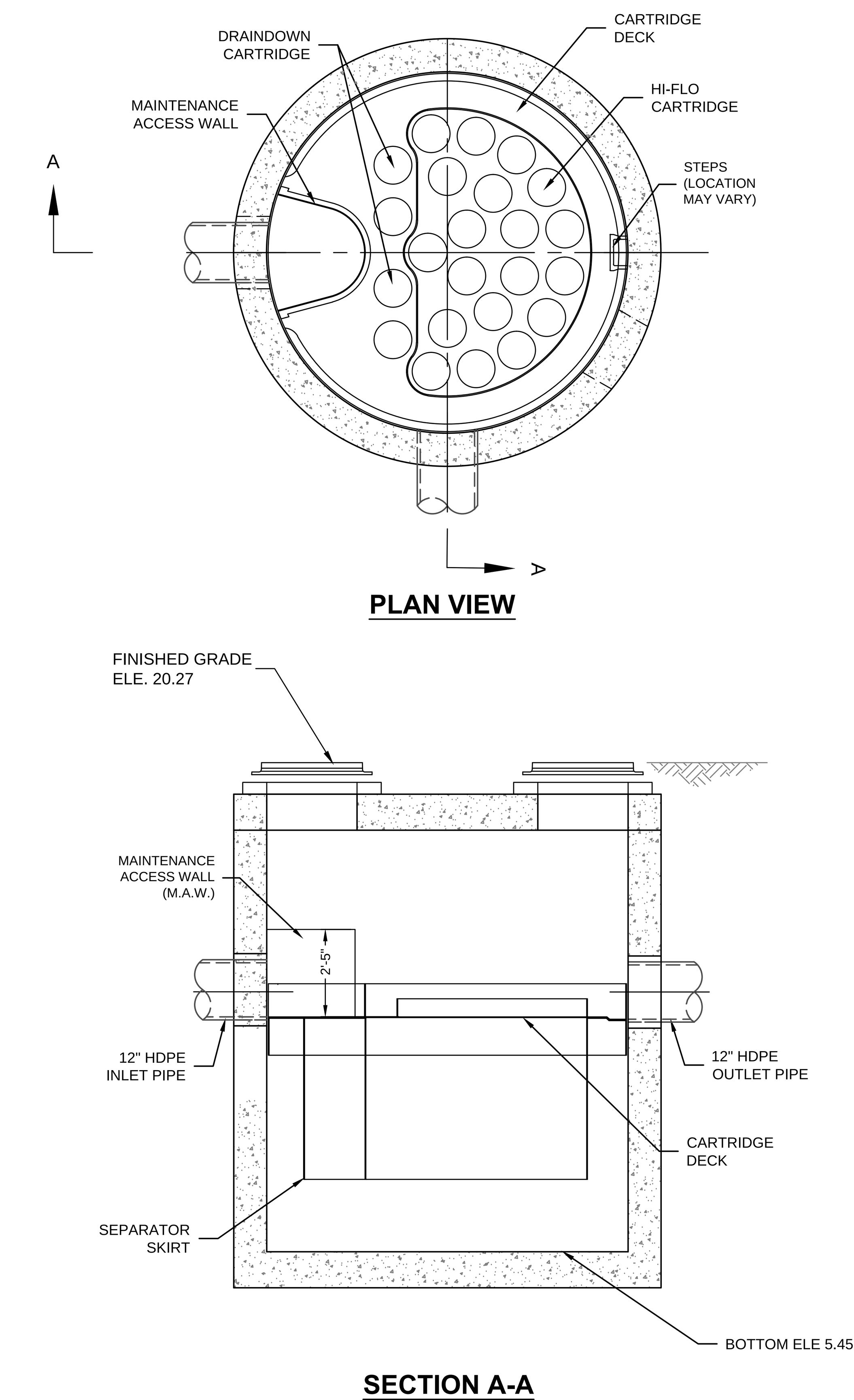
C0502 SHEET OF 28 REV. NEW



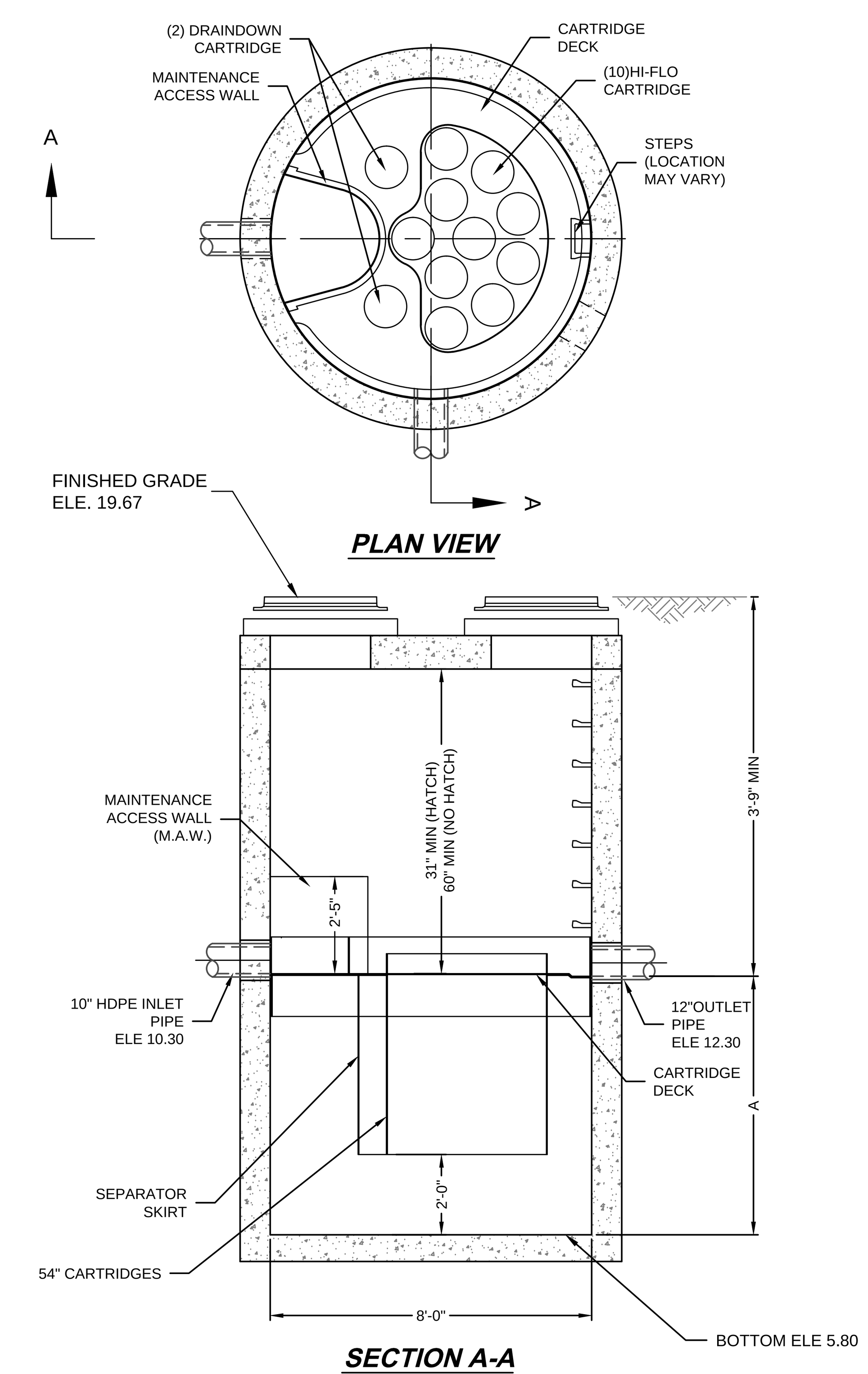
1 GRATE INLET WITH JELLY FISH INLET I66 (HOTSPOT-2)
SCALE: N.T.S



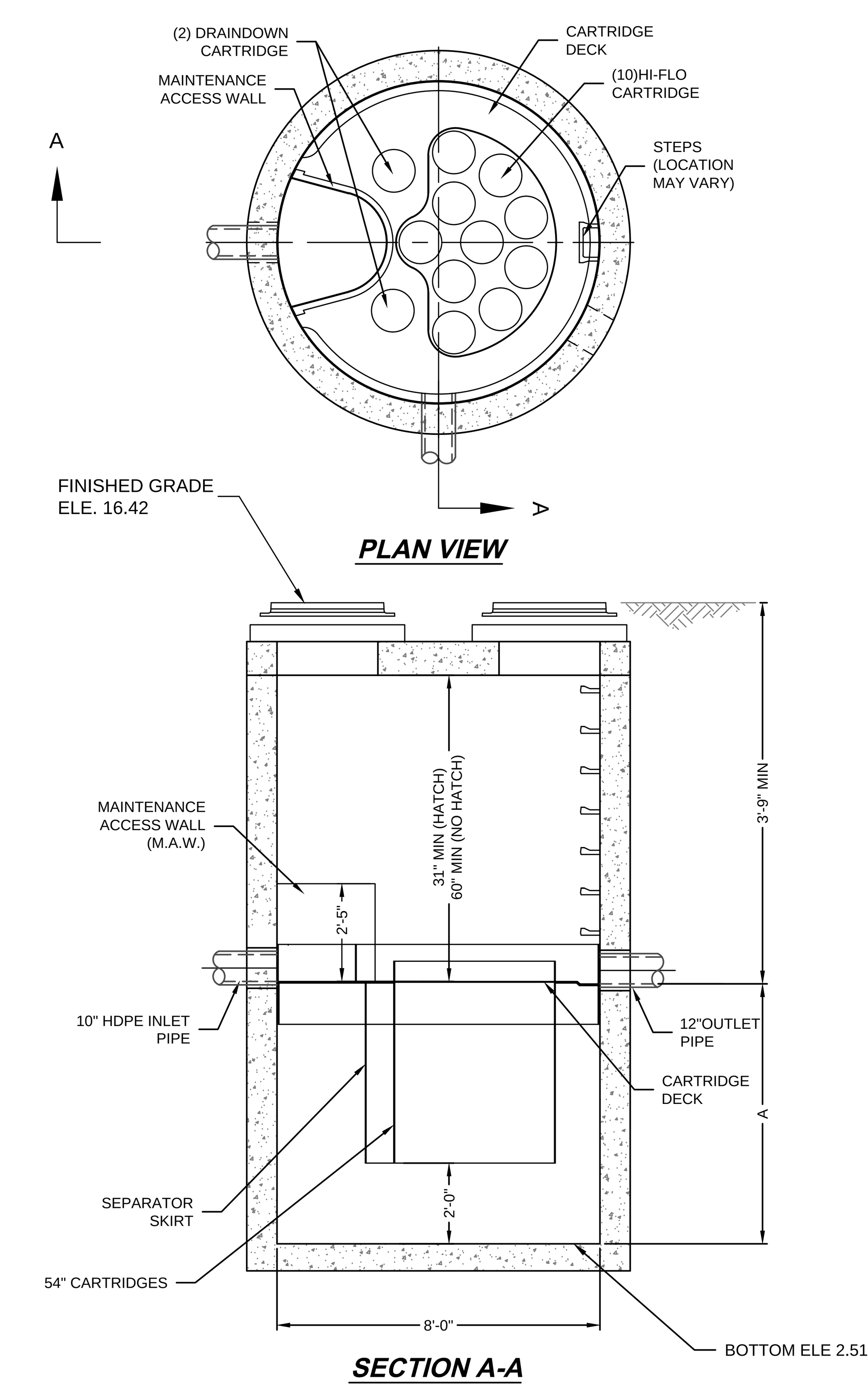
2 CATCH BASIN WITH JELLYFISH I68 (HOTSPOT-2)
SCALE: N.T.S



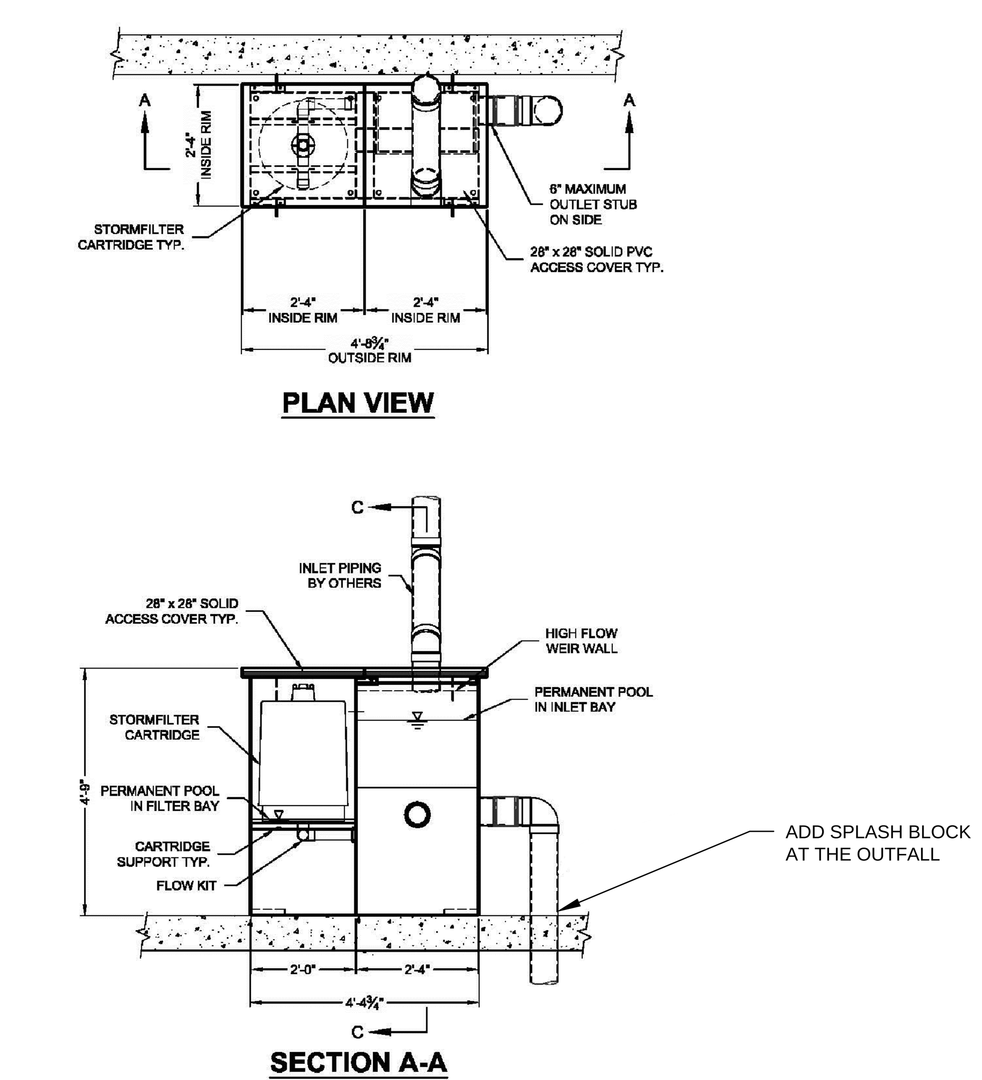
3 MANHOLE WITH JELLYFISH JF-3 (HOTSPOT-3)



4 MANHOLE WITH JELLYFISH JF-4 (HOTSPOT-3)



5 MANHOLE WITH JELLYFISH JF-5 (HOTSPOT-4)



6 DOWNSPOUT TREATMENT

PROFESSIONAL CERTIFICATION:
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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

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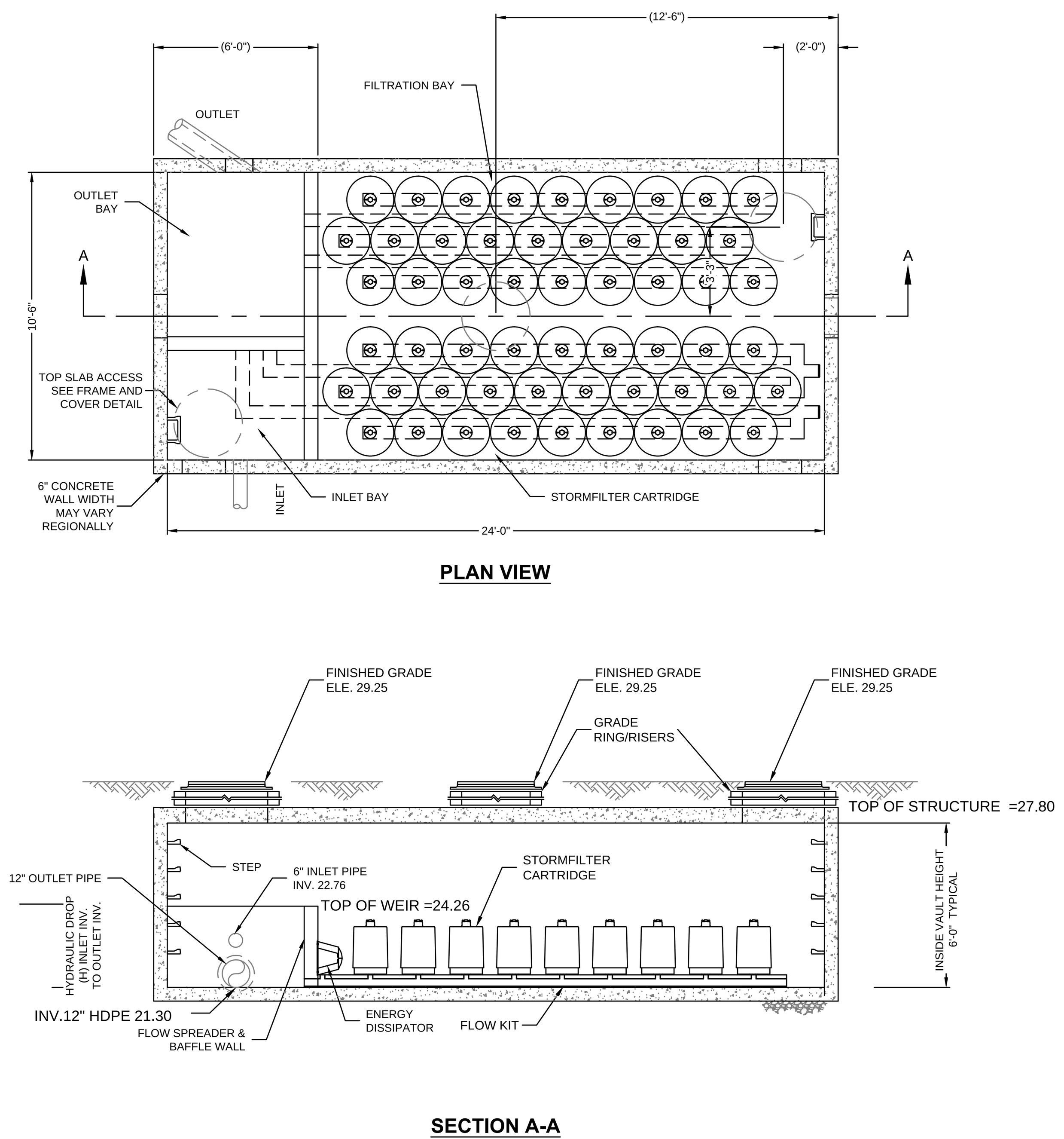
STORMWATER MEASURES

STORMWATER MANAGEMENT DETAILS 2 OF 3

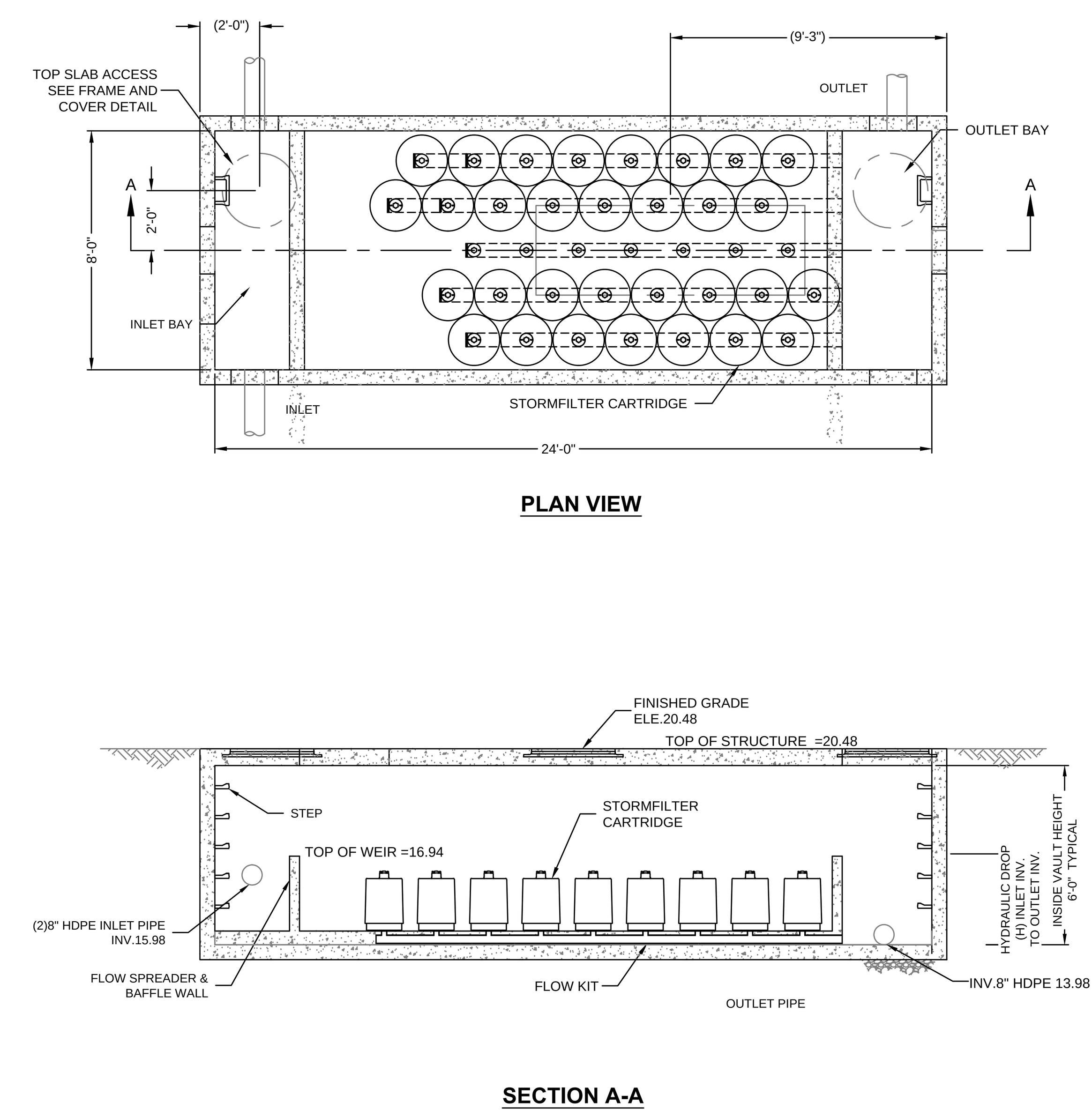
POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: N.T.S	
						C0502	SHEET OF 28	REV. NEW

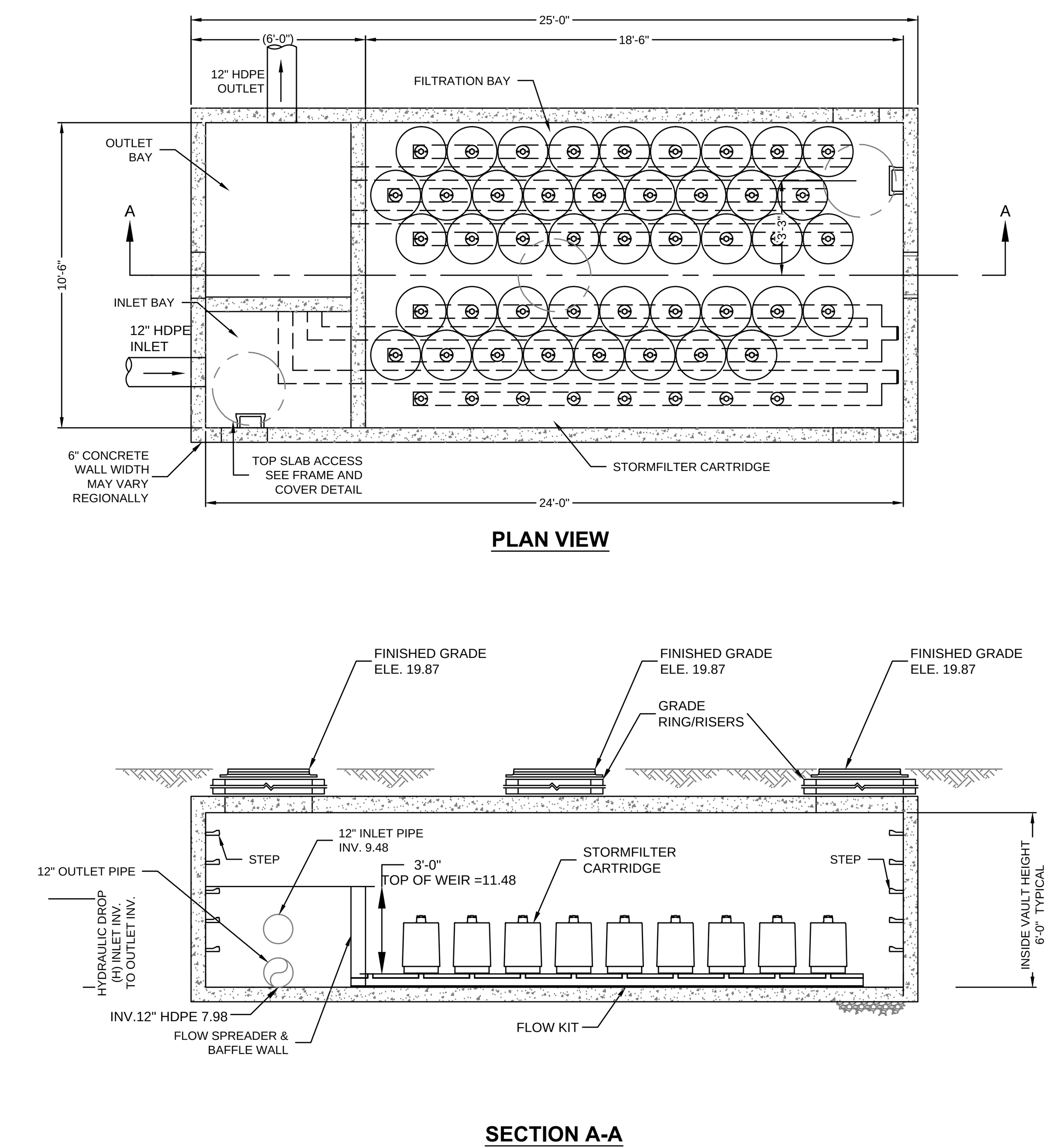
C0503 SHEET OF 28 REV. NEW



1 STORM FILTER (SF-1) TREATMENT DEVICE HOTSPOT-1
SCALE: N.T.S



2 STORM FILTER (SF-2) TREATMENT DEVICE HOTSPOT-2
SCALE: N.T.S



3 STORM FILTER (SF-4A) TREATMENT DEVICE HOTSPOT-3
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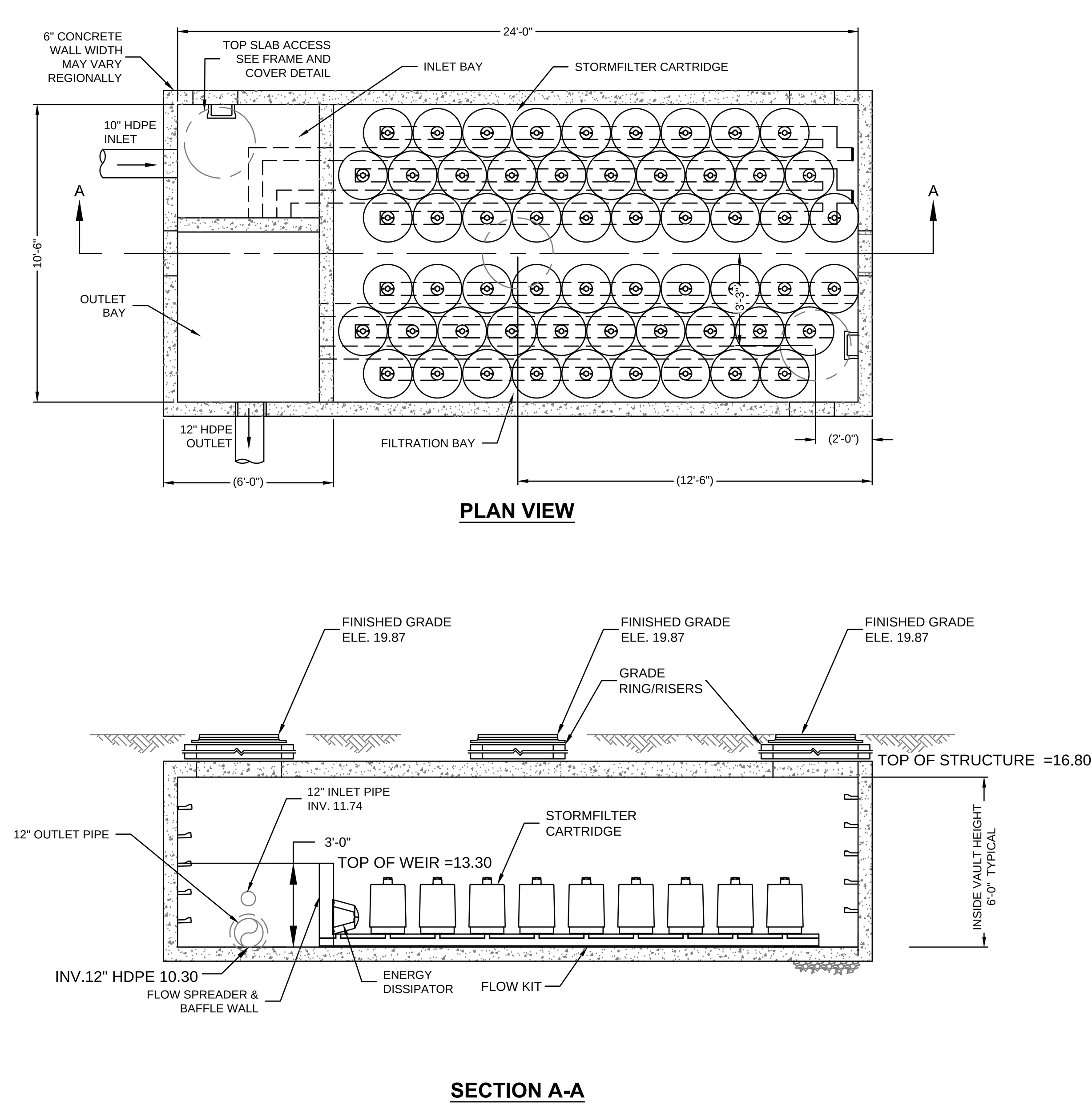

4 STORM FILTER (SF-4B) TREATMENT DEVICE HOTSPOT-3
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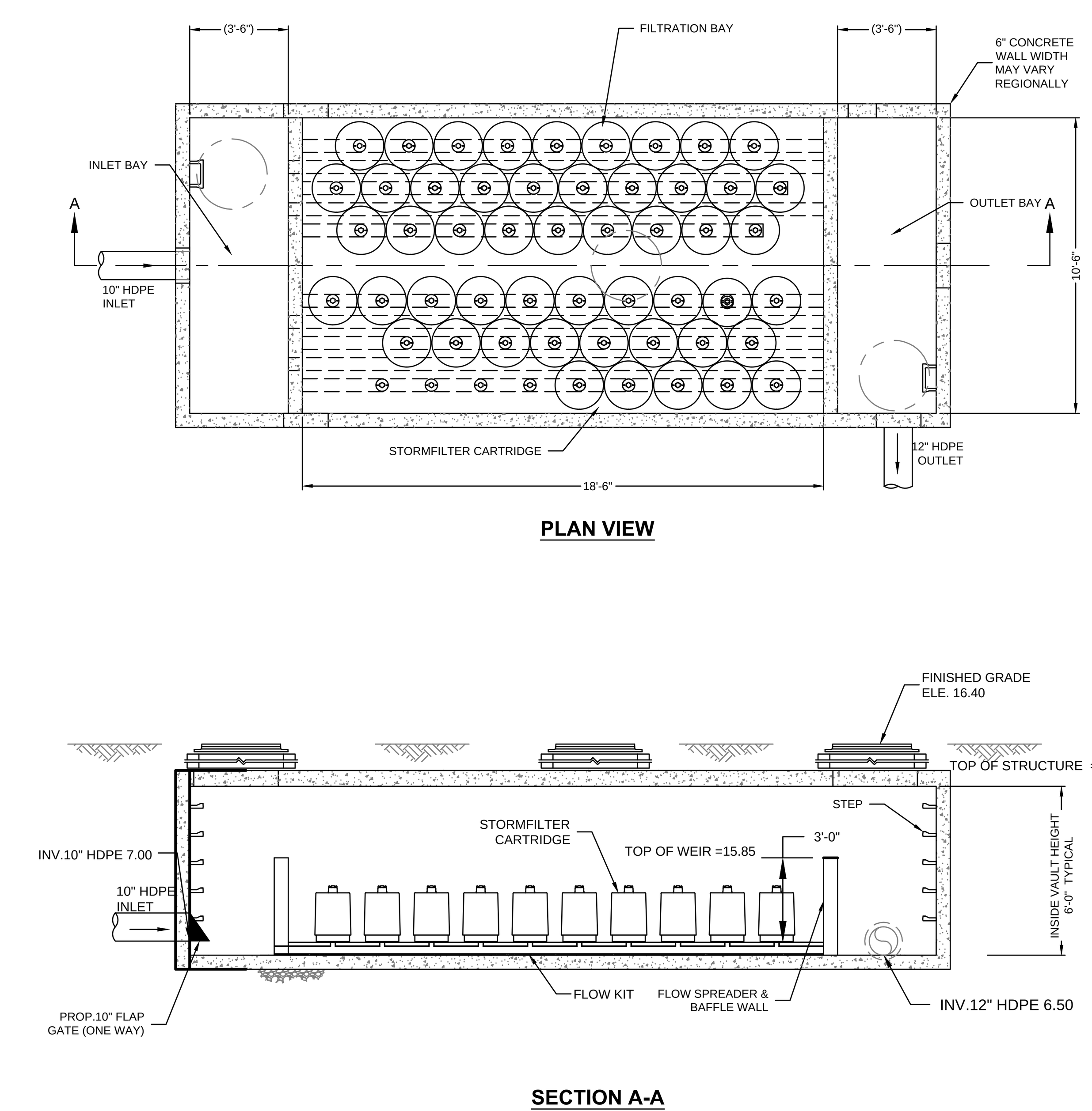

5 STORM FILTER (SF-5) TREATMENT DEVICE HOTSPOT-4
SCALE: N.T.S

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NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

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STORMWATER MEASURES

STORMWATER MANAGEMENT DETAILS 3 OF 3

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: N.T.S	

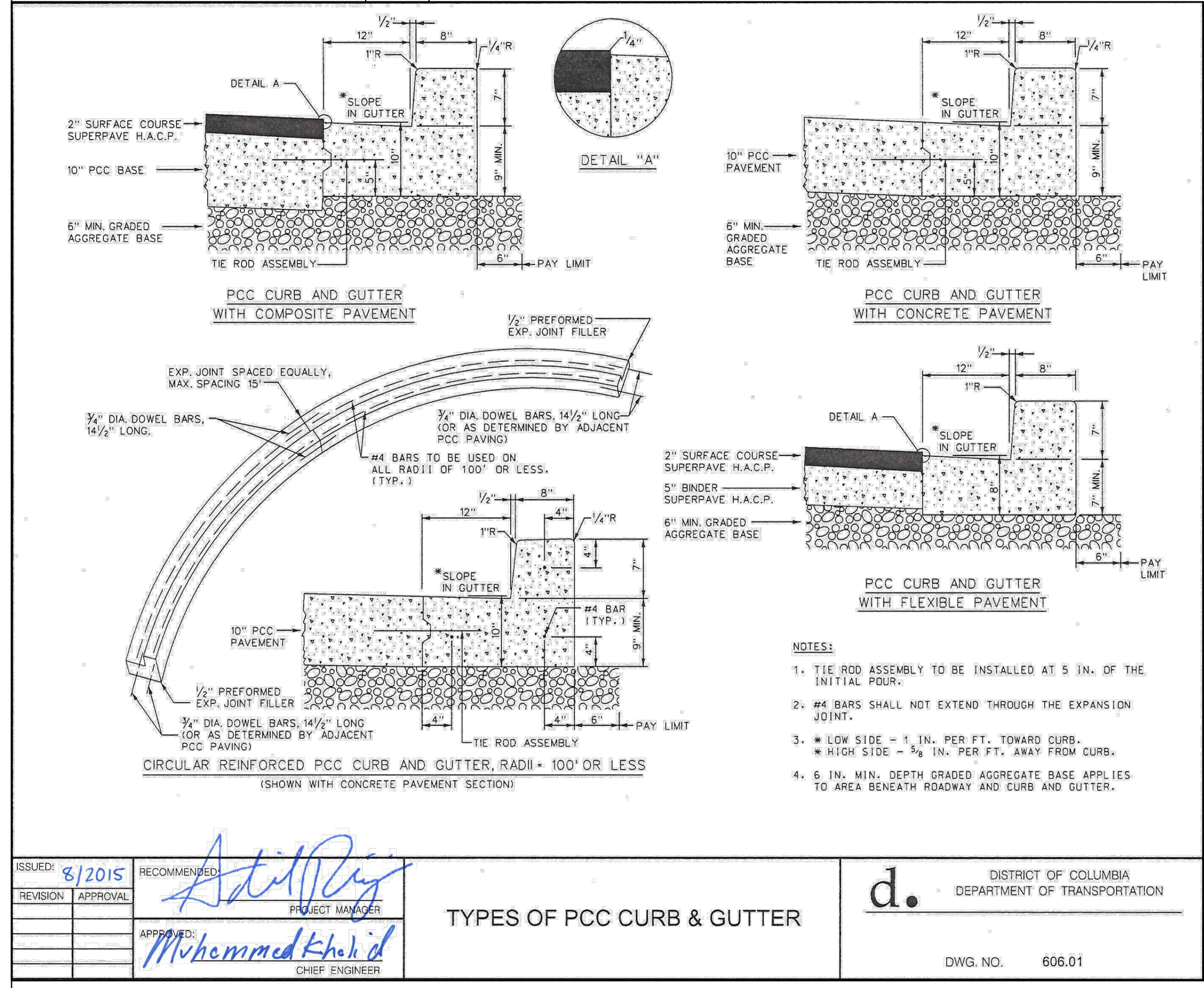
C0503 SHEET OF 28 REV. NEW

PLOTTED: 2/15/2017 11:55 AM

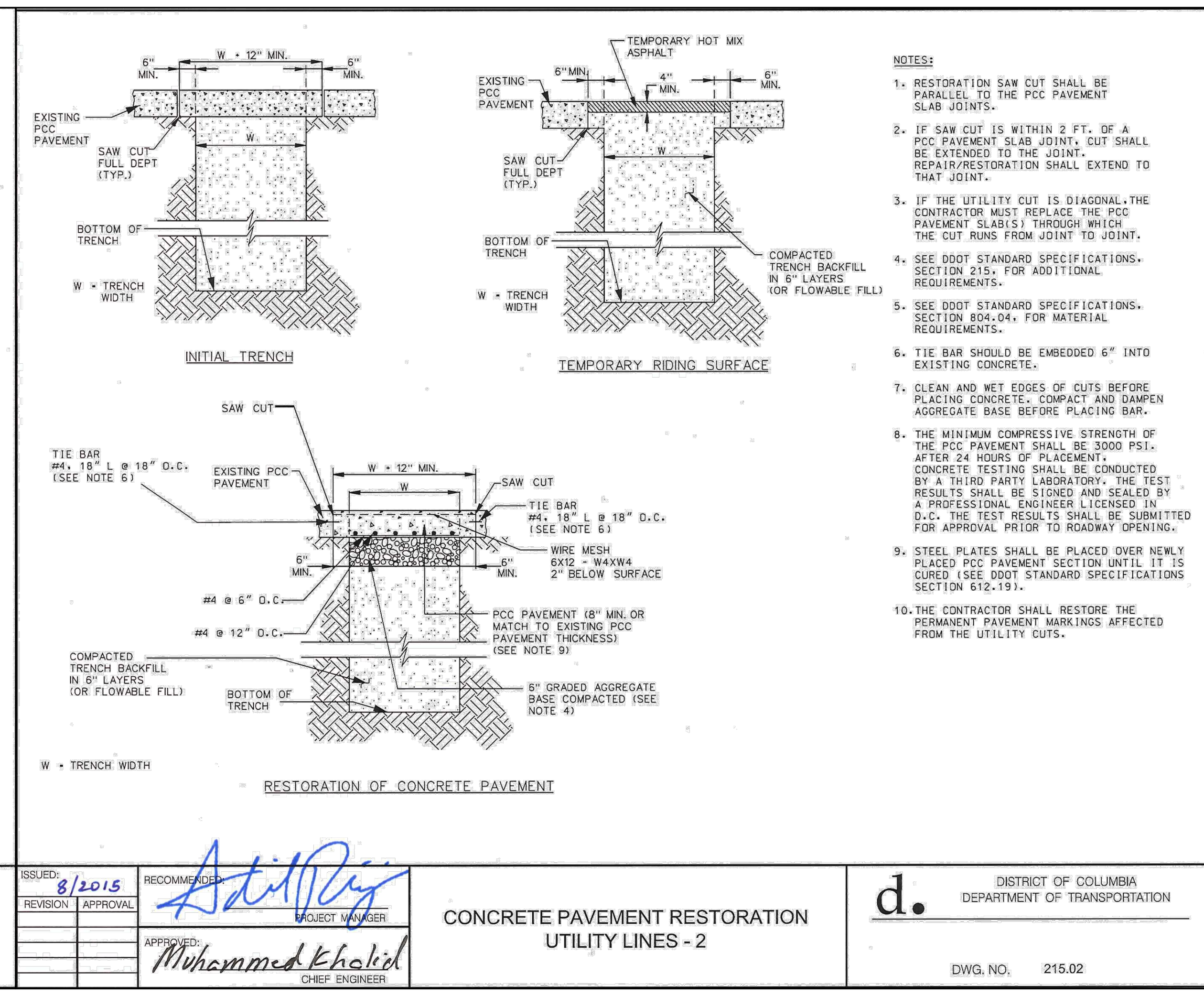
FILE: \\URSgermantown.us.le.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0501-C0503- STORMWATER MANAGEMENT DETAILS.dwg

PLOTTED: 2/15/2017 9:16 AM

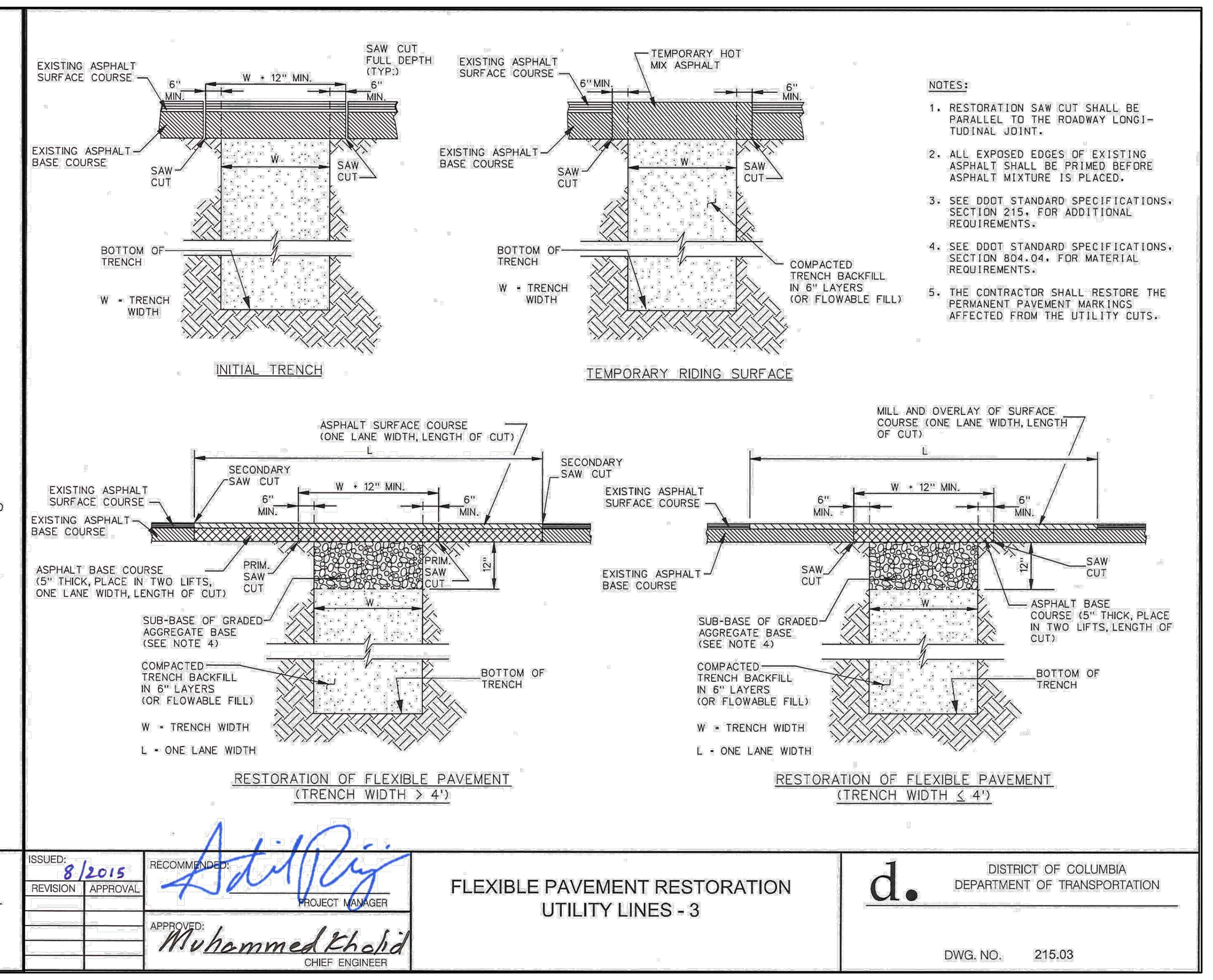
FILE: \\URSgermantown.us.ie.urs\Germantown\Projects\ENG\PHI Substations\SWT for Benning\Drawings\Working\C-SHEET\C0504-CONSTRUCTION DETAILS.dwg



1 CONCRETE CURB AND GUTTER DETAIL
SCALE: N.T.S



2 CONCRETE PAVEMENT RESTORATION DETAIL
SCALE: N.T.S



3 FLEXIBLE PAVEMENT RESTORATION DETAIL
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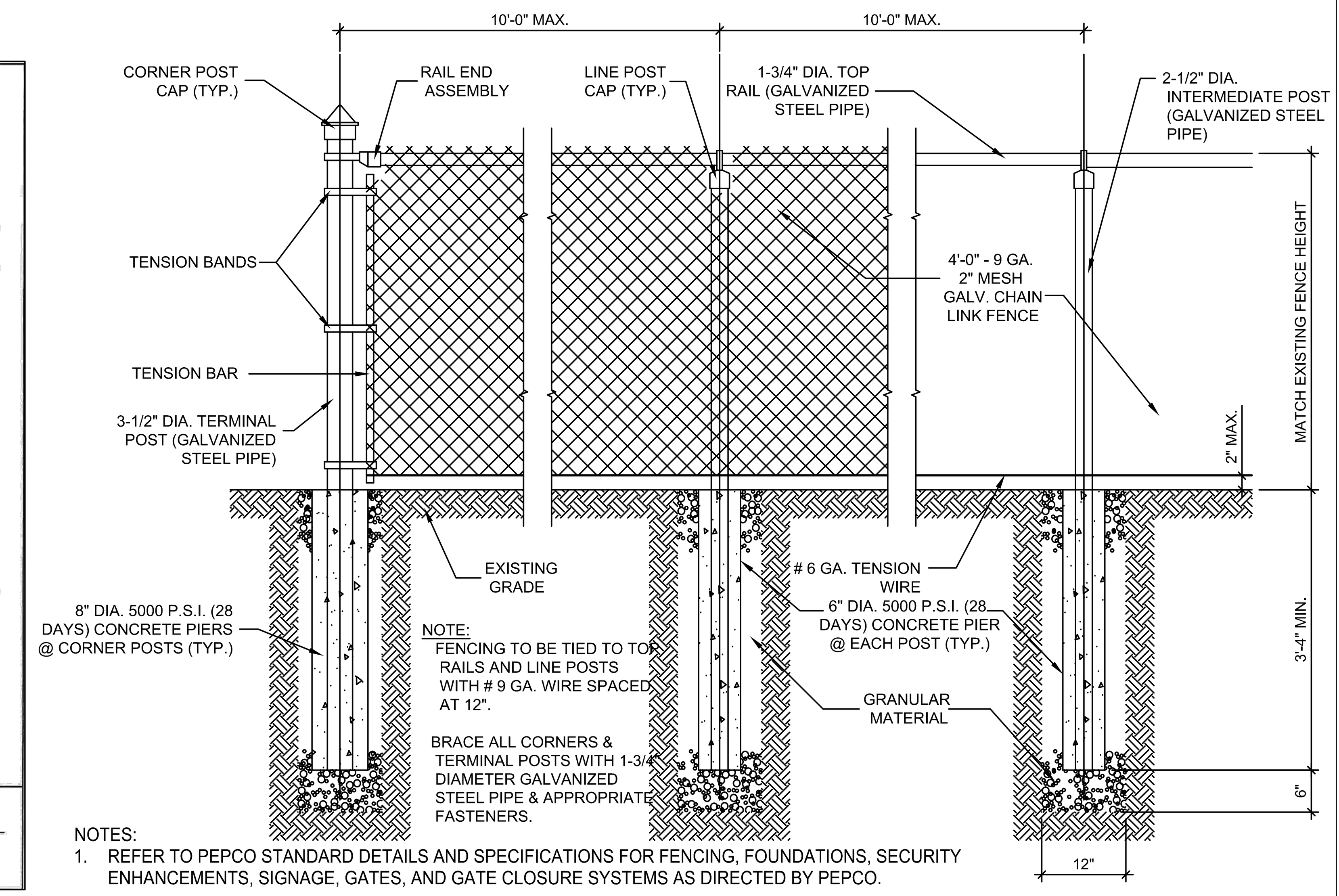
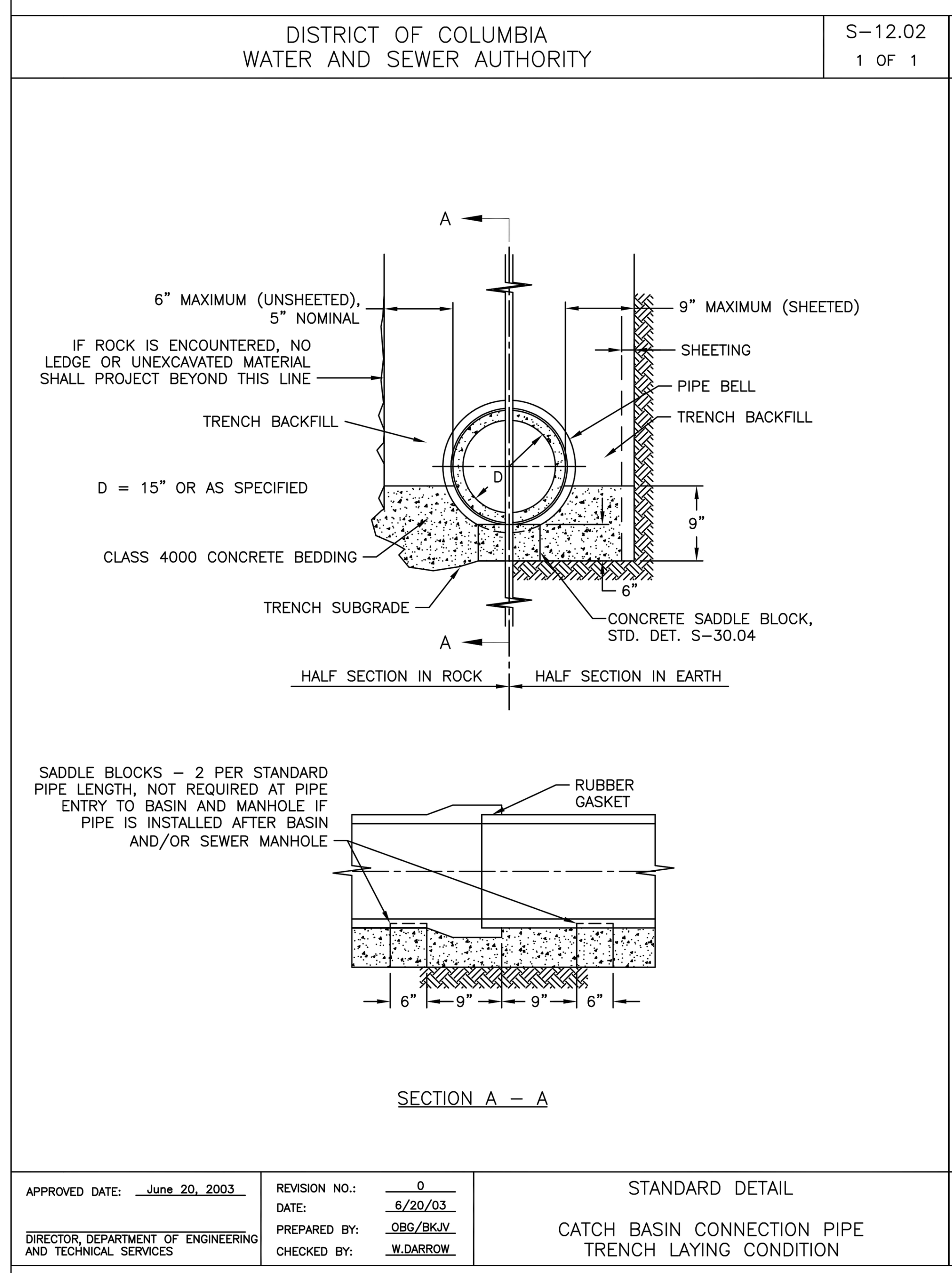
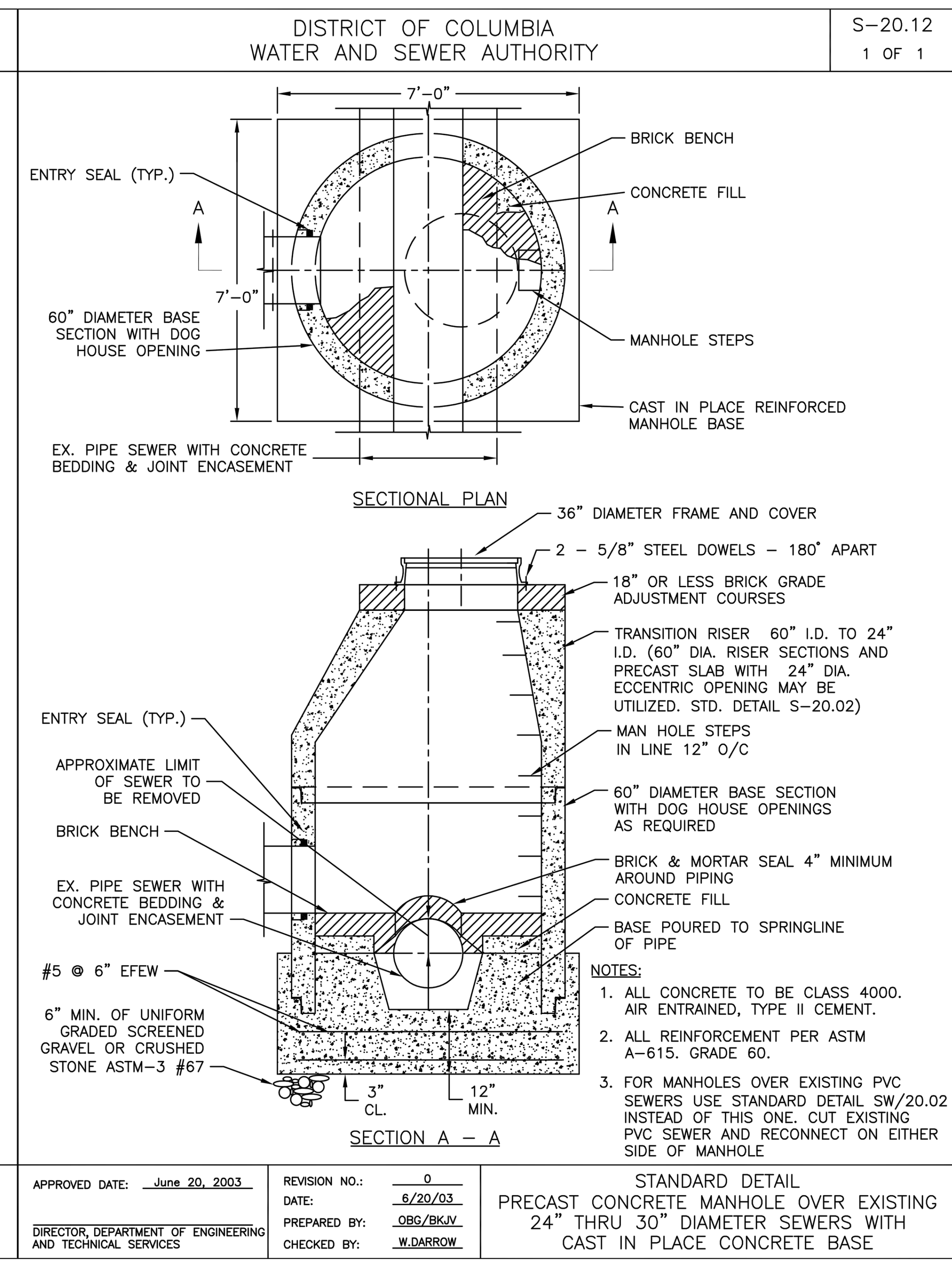


NOTES:
1. REFER TO PEPCO STANDARD DETAILS AND SPECIFICATIONS FOR FENCING, FOUNDATIONS, SECURITY ENHANCEMENTS, SIGNAGE, GATES, AND GATE CLOSURE SYSTEMS AS DIRECTED BY PEPCO.

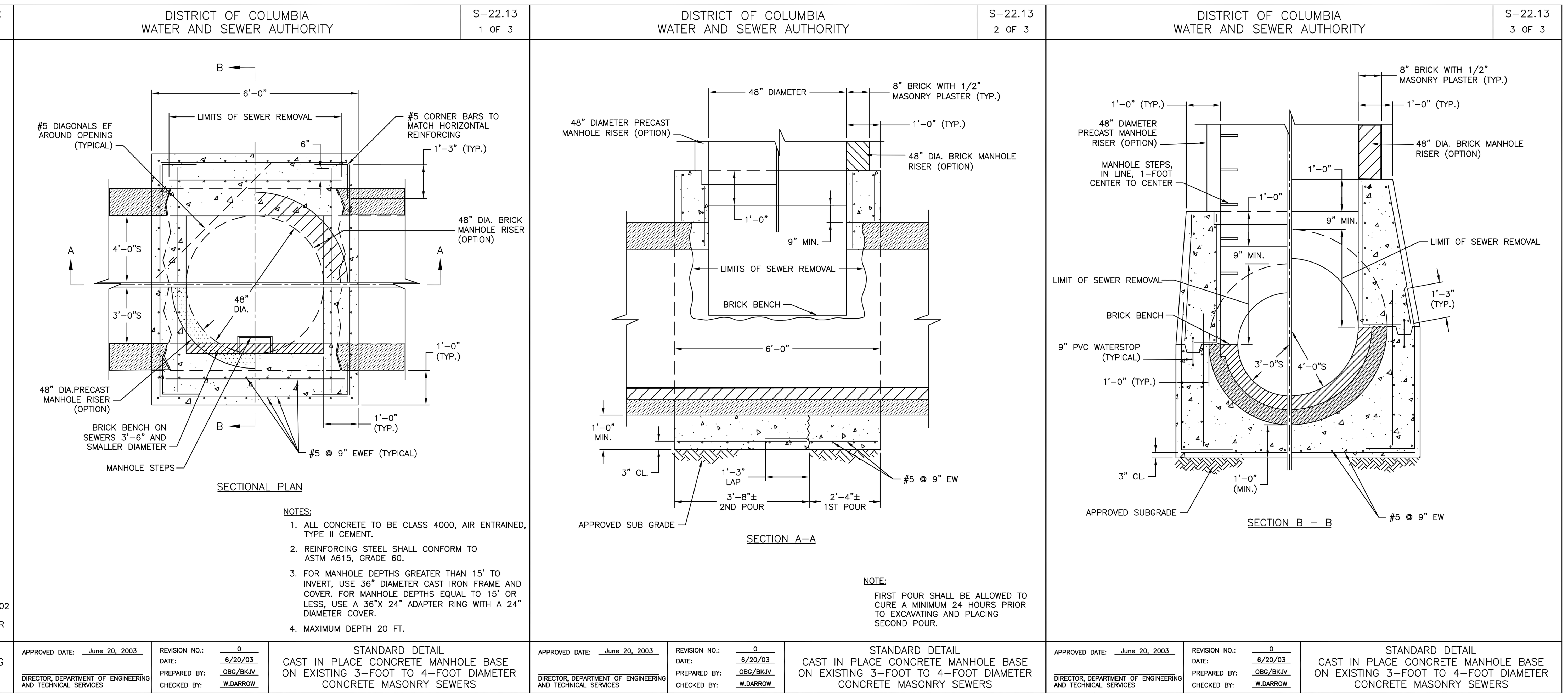
4 CHAIN LINK FENCE DETAIL
SCALE: N.T.S



5 PIPE TRENCH LAYING DETAIL
SCALE: N.T.S



6 DOGHOUSE MANHOLE DETAIL (24" - 30" PIPES)
SCALE: N.T.S



7 DOGHOUSE MANHOLE DETAIL (36" - 48" PIPES)
SCALE: N.T.S

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LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

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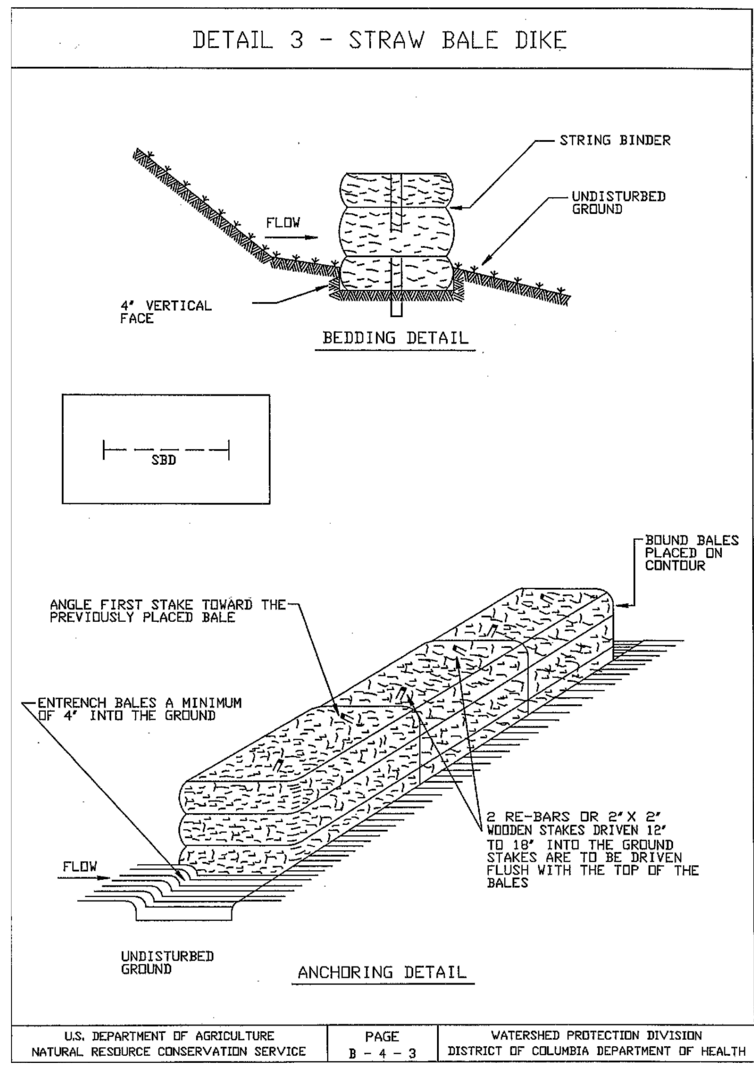
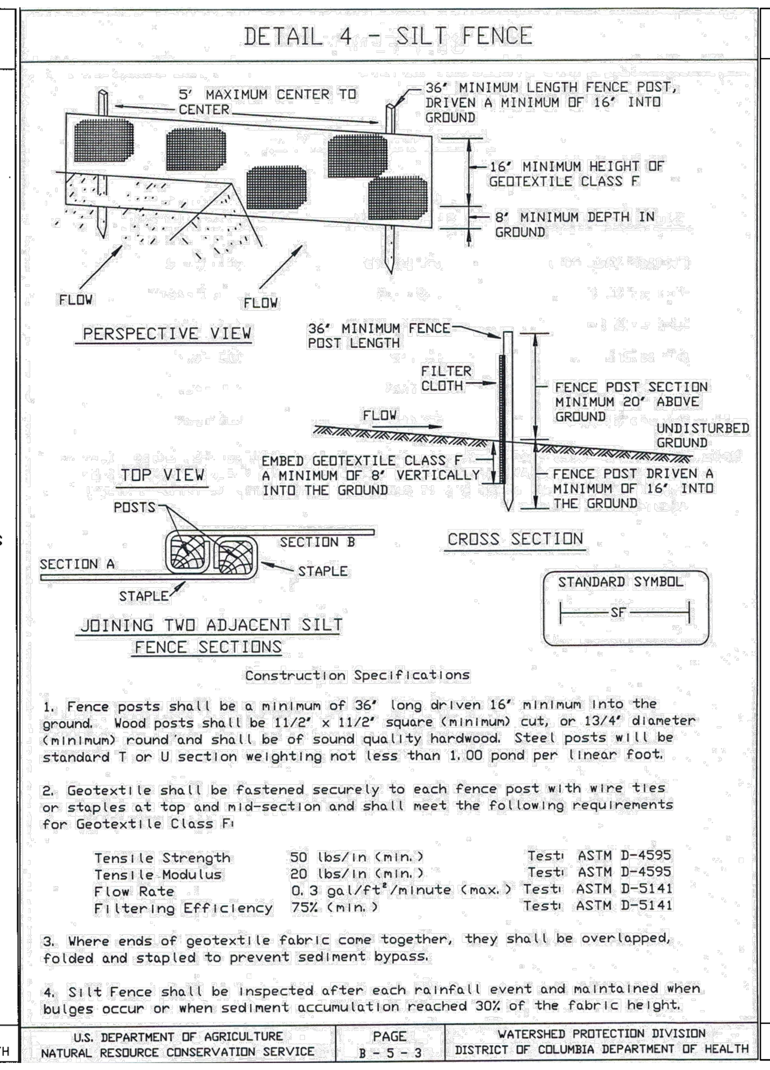
STORMWATER MEASURES
CONSTRUCTION DETAILS

POTOMAC ELECTRIC POWER CO.

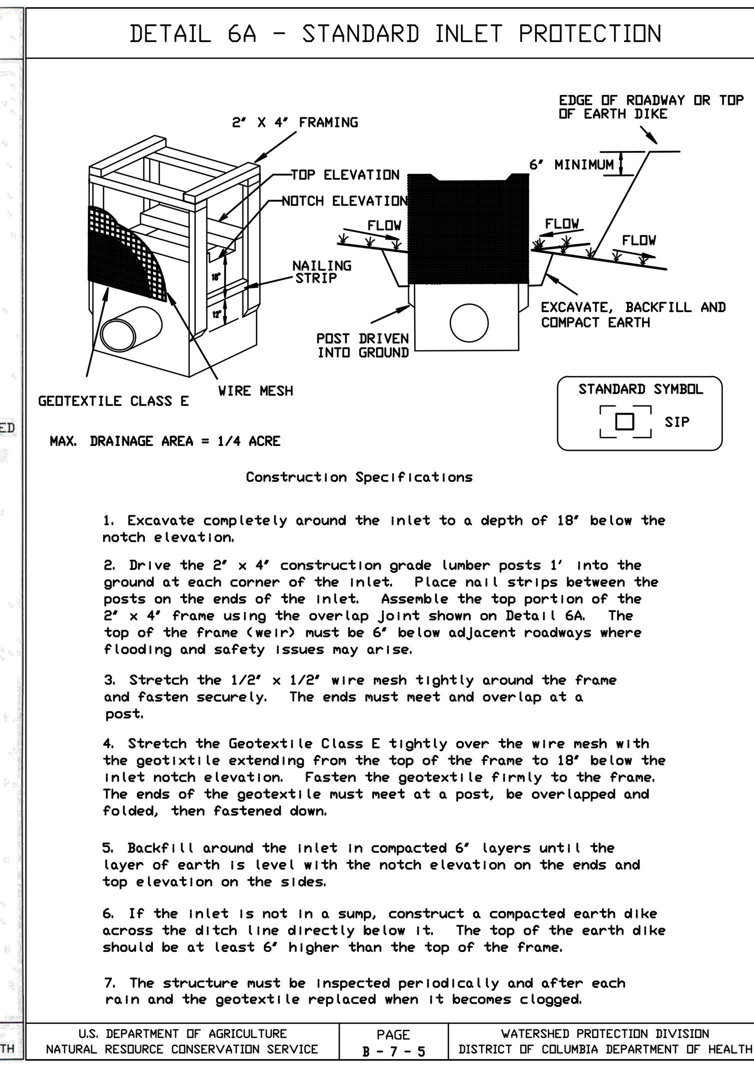
CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: N.T.S	
						C0501	SHEET OF 28	REV. NEW

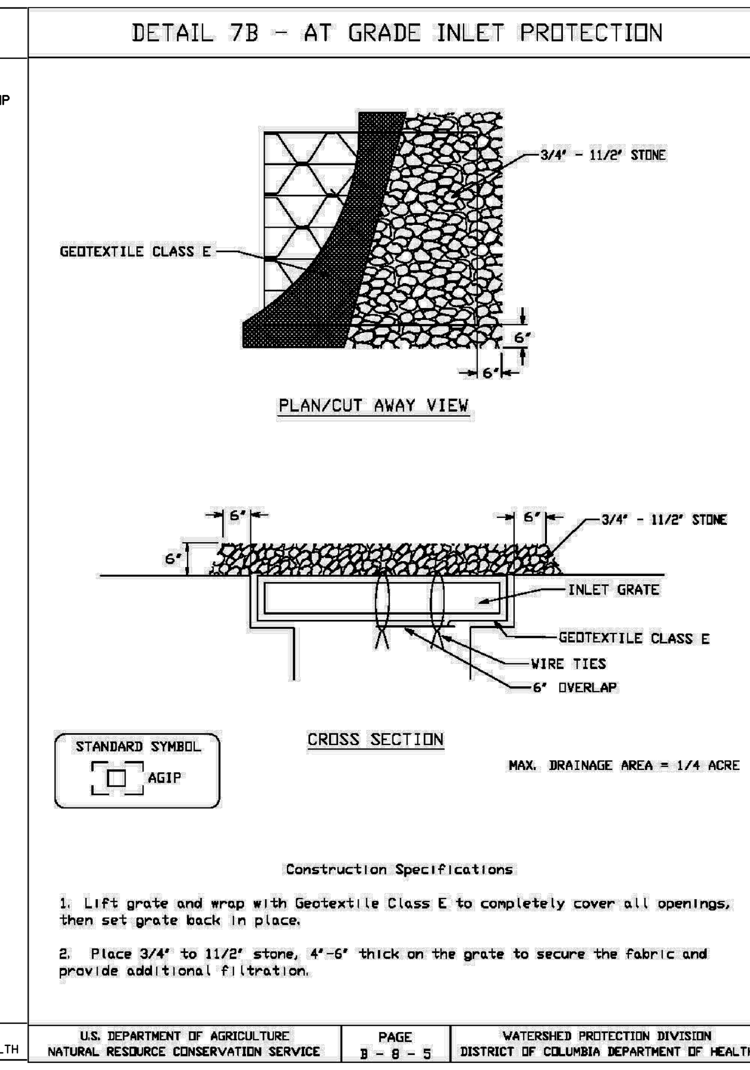


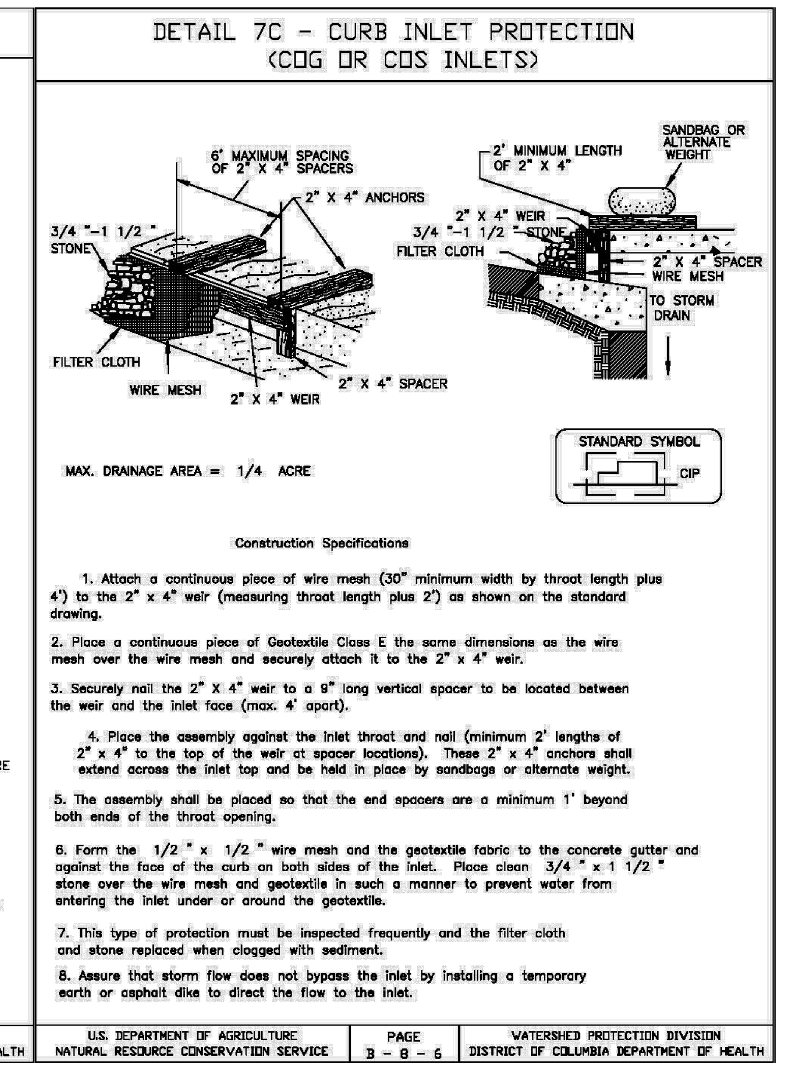
1 STRAW BALE DIKE DETAIL
SCALE: N.T.S



2 SILT FENCE DETAIL
SCALE: N.T.S







3 INLET PROTECTION DETAILS
SCALE: N.T.S

Q.2 STORMWATER MANAGEMENT PLAN (SWMP) GOOD HOUSEKEEPING STAMP NOTES:

FUELS AND OILS. ON-SITE REFUELING WILL BE CONDUCTED IN A DEDICATED LOCATION AWAY FROM ACCESS TO SURFACE WATERS. INSTALL CONTAINMENT BERMS AND, OR SECONDARY CONTAINMENTS AROUND REFUELING AREAS AND STORAGE TANKS. SPILLS WILL BE CLEANED UP IMMEDIATELY AND CONTAMINATED SOILS DISPOSED OF IN ACCORDANCE WITH ALL FEDERAL AND DISTRICT OF COLUMBIA REGULATIONS. PETROLEUM PRODUCTS WILL BE STORED IN CLEARLY LABELED TIGHTLY SEALED CONTAINERS. ALL VEHICLES ON SITE WILL BE MONITORED FOR LEAKS AND RECEIVE REGULAR PREVENTIVE MAINTENANCE ACTIVITIES. ANY ASPHALT SUBSTANCES USED ON SITE WILL BE APPLIED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. SPILL KITS WILL BE INCLUDED WITH ALL FUELING SOURCES AND MAINTENANCE ACTIVITIES.

SOLID WASTE. NO SOLID MATERIALS SHALL BE DISCHARGED TO SURFACE WATER. SOLID MATERIALS INCLUDING BUILDING MATERIALS, GARBAGE AND PAINT DEBRIS SHALL BE CLEANED UP DAILY AND DEPOSITED INTO DUMPSTERS, WHICH WILL BE PERIODICALLY REMOVED AND DEPOSITED INTO A LANDFILL.

ABRASIVE BLASTING. WATER BLASTING, SANDBLASTING, AND OTHER FORMS OF ABRASIVE BLASTING ON PAINTED SURFACES BUILT PRIOR TO 1978 MAY ONLY BE PERFORMED IF AN EFFECTIVE CONTAINMENT SYSTEM PREVENTS DISPERSAL OF PAINT DEBRIS.

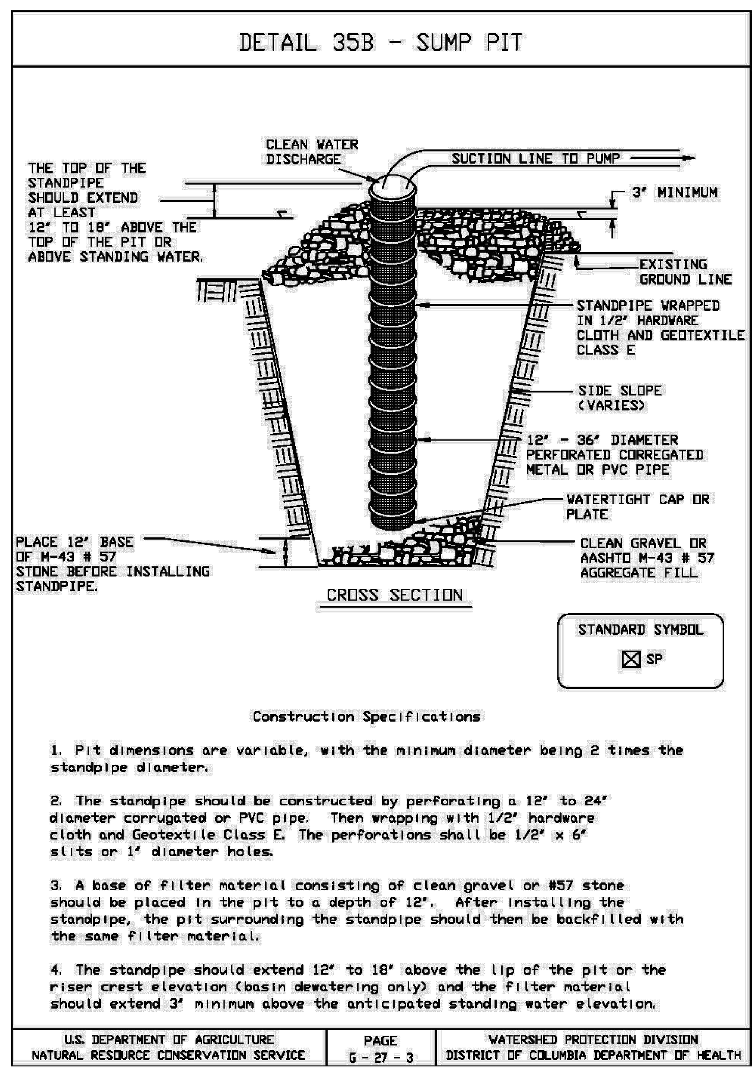
FERTILIZER. FERTILIZERS WILL BE APPLIED ONLY IN THE MINIMUM AMOUNTS RECOMMENDED BY THE MANUFACTURER, WORKED INTO THE SOIL TO LIMIT EXPOSURE TO STORMWATER, AND STORED IN A COVERED SHED. PARTIALLY USED BAGS WILL BE TRANSFERRED TO A SEALABLE BIN TO AVOID SPILLS.

PAINT AND OTHER CHEMICALS. ALL PAINT CONTAINERS AND CURING COMPOUNDS WILL BE TIGHTLY SEALED AND STORED WHEN NOT REQUIRED FOR USE. EXCESS PAINT WILL NOT BE DISCHARGES TO THE STORM SEWERS, BUT WILL BE PROPERLY DISPOSED OF ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. SPRAY GUNS WILL BE CLEANED ON A REMOVABLE TARP. CHEMICALS USED ON SITE ARE KEPT IN SMALL QUANTITIES AND IN CLOSED CONTAINERS UNDERCOVER AND KEPT OUT OF DIRECT CONTACT WITH STORMWATER. AS WITH FUELS AND OILS, ANY INADVERTENT SPILLS WILL BE CLEANED UP IMMEDIATELY AND DISPOSED OF ACCORDING FEDERAL AND DISTRICT OF COLUMBIA REGULATIONS.

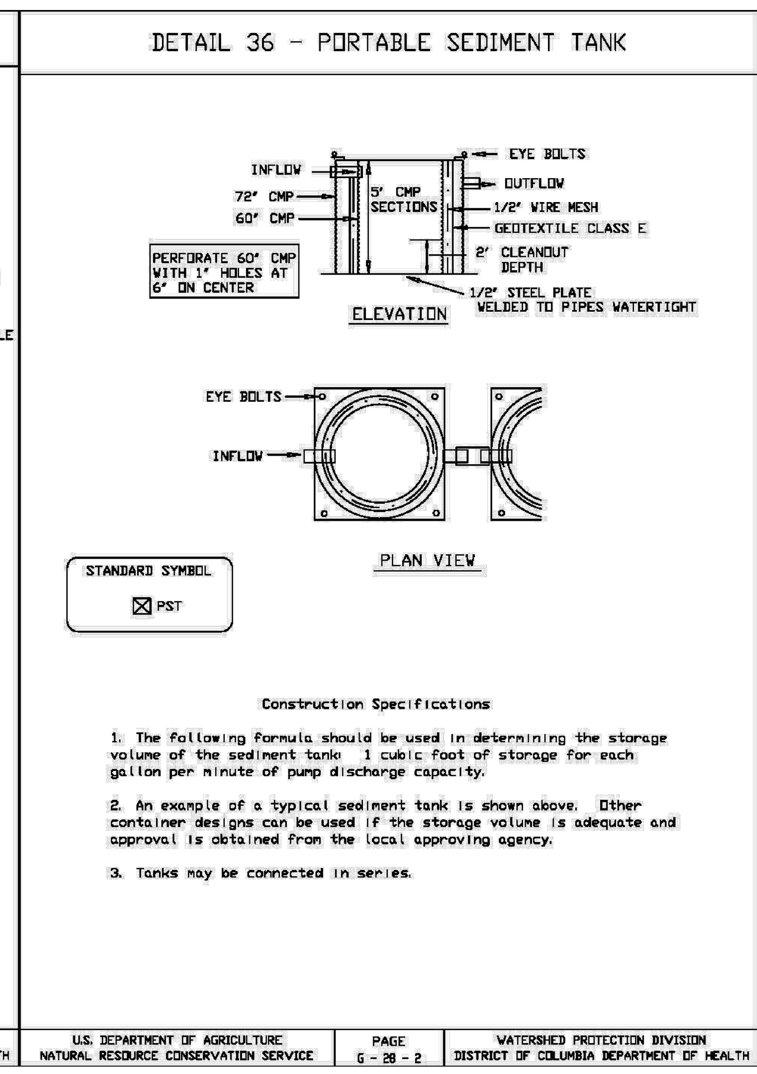
CONCRETE. CONCRETE TRUCKS WILL NOT BE ALLOWED TO WASH OUT OR DISCHARGE SURPLUS CONCRETE OR DRUM WASH ON SITE, EXCEPT IN A SPECIALLY DESIGNATED CONCRETE DISPOSAL AREA. FORM RELEASE OIL FOR DECORATIVE STONE WORK WILL BE APPLIED OVER A PALLET COVERED WITH AN ABSORBENT MATERIAL TO COLLECT EXCESS FLUID. THE ABSORBENT MATERIAL WILL BE REPLACED AND DISPOSED OF PROPERLY WHEN SATURATED.

WATER TESTING. WHEN TESTING AND, OR CLEANING WATER SUPPLY LINES, THE DISCHARGE FROM THE TESTED PIPE WILL BE COLLECTED AND CONVEYED TO A COMPLETED STORMWATER CONVEYANCE SYSTEM FOR ULTIMATE DISCHARGE INTO A STORMWATER BEST MANAGEMENT PRACTICE (BMP).

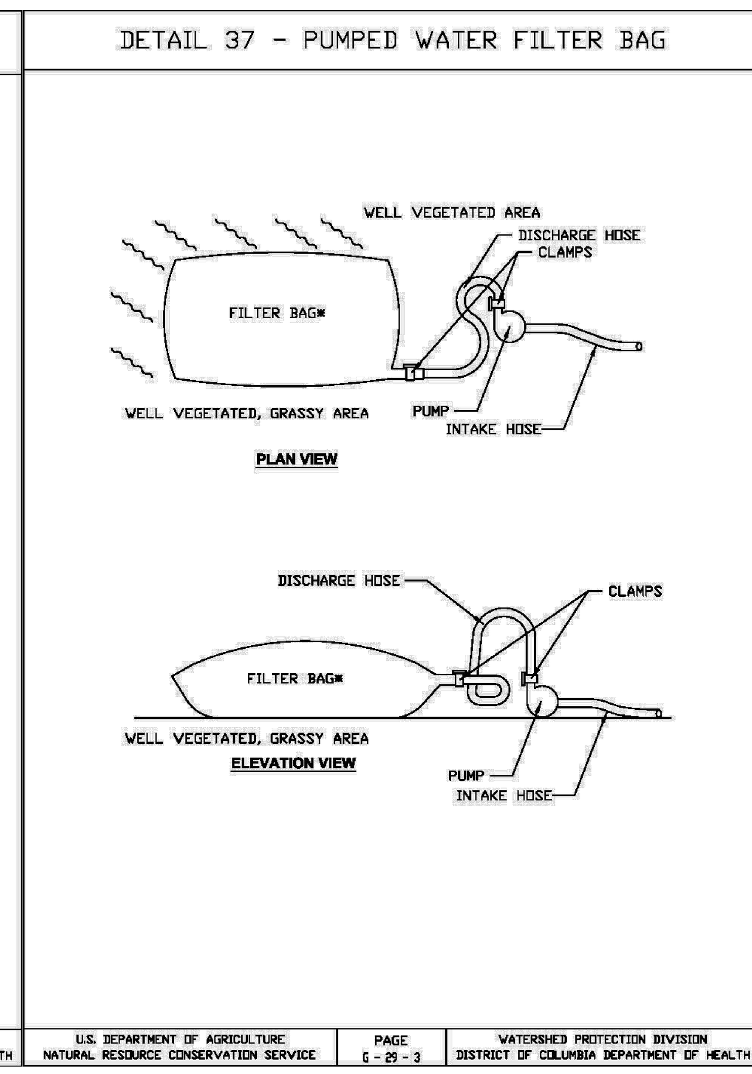
SANITARY WASTE. PORTABLE LAVATORIES LOCATED ON SITE WILL BE SERVICES ON A REGULAR BASIS BY A CONTRACTOR. PORTABLE LAVATORIES WILL BE LOCATED IN AN UPLAND AREA AWAY FROM DIRECT CONTACT WITH SURFACE WATERS. ANY SPILLS OCCURRING DURING SERVICING WILL BE CLEANED IMMEDIATELY AND CONTAMINATED SOILS DISPOSED OF IN ACCORDANCE WITH ALL FEDERAL AND DISTRICT OF COLUMBIA REGULATIONS.



4 SUMP PIT DETAIL
SCALE: N.T.S



5 PORTABLE SEDIMENT TANK DETAIL
SCALE: N.T.S



6 PUMPED WATER FILTER BAG DETAIL
SCALE: N.T.S

STATEMENT BY PROFESSIONAL ENGINEER REGISTERED IN THE DISTRICT OF COLUMBIA

This is to certify that the engineering features of all stormwater best management practices (BMPs), stormwater infrastructure, and land covers (collectively the "Facility") have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the treatment and disposal of stormwater pollutants. I further certify that the Facility has been designed in accordance with the specification required under Chapter 5 of Title 21 of the District of Columbia Municipal Regulations. It is also stated that the undersigned has furnished the applicant with a set of instructions for the maintenance and operation of the site's Facility.

SARAH J. NAPIER, PE; CIVIL ENGINEER
Name and Title (please type)

12420 MILESTONE CENTER DRIVE, SUITE 150
Address
GERMANTOWN, MD 20876

Date XX/XX/2017 Phone No: 301-820-3198

Affix Seal:

STATEMENT BY PERSON RESPONSIBLE FOR MAINTENANCE

The undersigned agrees to maintain and operate the stormwater best management practices (BMPs), stormwater infrastructure, and land covers in such a manner as to comply with the provisions of Chapter 5 of Title 21 of the District of Columbia Municipal Regulations (DCMR).

Responsibility for maintenance and operation may be transferred to another entity upon written notice to the Watershed Protection Division of the District Department of the Environment from the undersigned and the entity assuming responsibility. This notice must certify that the transfer of responsibility for maintenance and operation is in compliance with 21 DCMR Chapter 5.

Signature of the person responsible for maintenance (it may be the applicant)

FARIBA MAHVI, FACILITY MANAGER
Name and Title (please type)

701 9TH ST NW
Address
WASHINGTON, DC 20001

Date XX/XX/2017 Phone No: 202-331-6641

AS-BUILT CERTIFICATION BY PROFESSIONAL ENGINEER

Within 21 days after completion of construction of the Stormwater discharge facility, please send this page to the Watershed Protection Division of the District Department of the Environment.

1. ***Stormwater discharge facility information:***

Source Name:__________

Source Location: Street:__________

City:__________

DCRA Permit No.:__________

Date Issued:__________

2. ***As Built Certification***

I hereby certify that Stormwater discharge facility has been built substantially in accordance with the approved plans and specifications, and that any substantial deviations (noted below) will not prevent the system from functioning in compliance with the requirements of Section 526 through 535 of DCMR-21, Chapter 5 when properly maintained and operated. These determinations have been based upon on-site observation of construction, scheduled and conducted by me or by a project representative under my direct supervision. I have enclosed one set of as-built engineering drawings.

Signature of Engineer | Name (Please Type) D.C. Reg. No.

Affix Seal:

Company Name

Company Address

Date:__________ Phone No.__________

Substantial deviations from the approved plans and specifications (attach additional sheets if required).

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES
EROSION AND SEDIMENT CONTROL DETAILS

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP / DATE: 01/27/17	ENGR.: SJN / SCALE: N.T.S	CLASS

DDOE SOIL EROSION AND SEDIMENT CONTROL PLAN GENERAL NOTES:

1. FOLLOWING INITIAL LAND DISTURBANCE OR RE-DISTURBANCE, PERMANENT OR INTERIM STABILIZATION MUST BE COMPLETED WITHIN SEVEN (7) CALENDAR DAYS FOR THE SURFACES OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND SLOPES GREATER THAN THREE (3) HORIZONTAL TO ONE (1) VERTICAL (3:1); AND FOURTEEN (14) DAYS FOR ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE. THESE REQUIREMENTS DO NOT APPLY TO AREAS SHOWN ON THE PLAN THAT ARE USED FOR MATERIAL STORAGE OTHER THAN STOCKPILING, OR FOR THOSE AREAS ON THE PLAN WHERE ACTUAL CONSTRUCTION ACTIVITIES ARE BEING PERFORMED. MAINTENANCE SHALL BE PERFORMED AS NECESSARY SO THAT STABILIZED AREAS CONTINUOUSLY MEET THE APPROPRIATE REQUIREMENTS OF THE DISTRICT OF COLUMBIA STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL (ESC). [21 DCMR § 542.9 (O)]
2. ESC MEASURES SHALL BE IN PLACE BEFORE AND DURING LAND DISTURBANCE. [21 DCMR § 543.6]
3. CONTACT DDOE INSPECTION (202) 535-2977 TO SCHEDULE A PRECONSTRUCTION MEETING AT LEAST THREE (3) BUSINESS DAYS BEFORE THE COMMENCEMENT OF A LAND-DISTURBING ACTIVITY. [21 DCMR § 503.7 (A)]
4. A COPY OF THE APPROVED PLAN SET WILL BE MAINTAINED AT THE CONSTRUCTION SITE FROM THE DATE THAT CONSTRUCTION ACTIVITIES BEGIN TO THE DATE OF FINAL STABILIZATION AND WILL BE AVAILABLE FOR DDOE INSPECTORS. [21 DCMR § 542.15]
5. ESC MEASURES SHALL BE IN PLACE TO STABILIZE AN EXPOSED AREA AS SOON AS PRACTICABLE AFTER CONSTRUCTION ACTIVITY HAS TEMPORARILY OR PERMANENTLY CEASED BUT NO LATER THAN FOURTEEN (14) DAYS FOLLOWING CESSATION, EXCEPT THAT TEMPORARY OR PERMANENT STABILIZATION SHALL BE IN PLACE AT THE END OF EACH DAY OF UNDERGROUND UTILITY WORK THAT IS NOT CONTAINED WITHIN A LARGER DEVELOPMENT SITE. [21 DCMR § 543.7]
6. STOCKPILED MATERIAL BEING ACTIVELY USED DURING A PHASE OF CONSTRUCTION SHALL BE PROTECTED AGAINST EROSION BY ESTABLISHING AND MAINTAINING PERIMETER CONTROLS AROUND THE STOCKPILE. [21 DCMR § 543.16 (A)]
7. STOCKPILED MATERIAL NOT BEING ACTIVELY USED OR ADDED TO SHALL BE STABILIZED WITH MULCH, TEMPORARY VEGETATION, HYDRO-SEED OR PLASTIC WITHIN FIFTEEN (15) CALENDAR DAYS AFTER ITS LAST USE OR ADDITION. [21 DCMR § 543.16 (B)]
8. PROTECT BEST MANAGEMENT PRACTICES FROM SEDIMENTATION AND OTHER DAMAGE DURING CONSTRUCTION FOR PROPER POST CONSTRUCTION OPERATION. [21 DCMR § 543.5]
9. REQUEST A DDOE INSPECTOR'S APPROVAL AFTER THE INSTALLATION OF PERIMETER EROSION AND SEDIMENT CONTROLS, BUT BEFORE PROCEEDING WITH ANY OTHER EARTH DISTURBANCE OR GRADING. [21 DCMR § 542.12 (A)]
10. REQUEST A DDOE INSPECTOR'S APPROVAL AFTER FINAL STABILIZATION OF THE SITE AND BEFORE THE REMOVAL OF EROSION AND SEDIMENT CONTROLS. [21 DCMR § 542.12 (B)]
11. FINAL STABILIZATION MEANS THAT ALL LAND-DISTURBING ACTIVITIES AT THE SITE HAVE BEEN COMPLETED AND EITHER OF THE FOLLOWING TWO CRITERIA HAVE BEEN MET: (1) A UNIFORM (FOR EXAMPLE, EVENLY DISTRIBUTED, WITHOUT LARGE BARE AREAS) PERENNIAL VEGETATIVE COVER WITH A DENSITY OF SEVENTY PERCENT (70%) OF THE NATIVE BACKGROUND VEGETATIVE COVER FOR THE AREA HAS BEEN ESTABLISHED ON ALL UNPAVED AREAS AND AREAS NOT COVERED BY PERMANENT STRUCTURES, OR (2) EQUIVALENT PERMANENT STABILIZATION MEASURES HAVE BEEN EMPLOYED (SUCH AS THE USE OF RIPRAP, GABIONS, OR GEOTEXTILES). [21 DCMR § 542.12 (B.1, B.2)]
12. FOLLOW THE REQUIREMENTS OF THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY APPROVED STORMWATER POLLUTION PREVENTION PLAN (SWPPP) AND MAINTAIN A LEGIBLE COPY OF THIS SWPPP ON SITE. [21 DCMR § 543.10 (B)]
13. POST A SIGN ON SITE THAT NOTIFIES THE PUBLIC TO CONTACT DDOE IN THE EVENT OF EROSION OR OTHER POLLUTION. THIS SIGN MUST BE IN PLAIN VIEW OF AND READABLE BY THE PUBLIC AT A DISTANCE OF TWELVE FEET (12 FT). THE SIGN WILL BE PLACED AT EACH ENTRANCE TO THE SITE OR AS DIRECTED BY THE DDOE INSPECTOR. THE SIGN WILL PROVIDE DDOE'S TELEPHONE NUMBER (202-535-2977) AND EMAIL ADDRESS. [21 DCMR § 543.22]
14. A RESPONSIBLE PERSON MUST BE PRESENT OR AVAILABLE WHILE THE SITE IS IN A LAND-DISTURBING PHASE. THE RESPONSIBLE PERSON IS CHARGED WITH BEING AVAILABLE TO (A) INSPECT THE SITE AND ITS ESC MEASURES AT LEAST ONCE BIWEEKLY AND AFTER A RAINFALL EVENT TO IDENTIFY AND REMEDY EACH POTENTIAL OR ACTUAL EROSION PROBLEM, (B) RESPOND TO EACH POTENTIAL OR ACTUAL EROSION PROBLEM IDENTIFIED BY CONSTRUCTION PERSONNEL, AND (C) SPEAK ON SITE WITH DDOE TO REMEDY EACH POTENTIAL OR ACTUAL EROSION PROBLEM. A RESPONSIBLE PERSON SHALL BE (A) LICENSED IN THE DISTRICT OF COLUMBIA AS A CIVIL OR GEOTECHNICAL ENGINEER, A LAND SURVEYOR, OR ARCHITECT; OR (B) CERTIFIED THROUGH A TRAINING PROGRAM THAT DDOE APPROVES, INCLUDING A COURSE ON EROSION CONTROL PROVIDED BY ANOTHER JURISDICTION OR PROFESSIONAL ASSOCIATION. DURING CONSTRUCTION, THE RESPONSIBLE PERSON SHALL KEEP ON SITE PROOF OF PROFESSIONAL LICENSING OR OF SUCCESSFUL COMPLETION OF A DDOE-APPROVED TRAINING PROGRAM. [21 DCMR § 547]

SEQUENCE OF CONSTRUCTION:

1. CONTACT DDOE INSPECTION (202) 535-2977 TO SCHEDULE A PRE-CONSTRUCTION MEETING AT LEAST THREE (3) BUSINESS DAYS BEFORE THE COMMENCEMENT OF A LAND-DISTURBING ACTIVITY.
2. OPERATIONS SCHEDULED TO START UPON ISSUANCE OF PERMIT AND AFTER PRE-CONSTRUCTION MEETING.
3. CONSTRUCT ALL SEDIMENT CONTROL MEASURES BEFORE ANY OTHER CLEARING AND GRUBBING.
4. CLEAR AND GRUB AS NEEDED.
5. SAWCUT PAVEMENT (ASPHALT AND CONCRETE) AS NEEDED.
6. EXCAVATE FOR NEW WATER QUALITY STRUCTURES AND NEW STORM DRAIN STRUCTURES. TRENCH FOR NEW STORM DRAIN PIPING. MINIMIZE LENGTH OF TIME OF OPEN EXCAVATIONS AND TRENCHES AS MUCH AS POSSIBLE.
7. PREPARE SUBGRADE AND PLACE GRAVEL BEDDING ON SUBGRADE FOR WATER QUALITY AND STORM DRAIN STRUCTURES AND STORM DRAIN PIPING.
8. INSTALL/CONSTRUCT WATER QUALITY STRUCTURES AND STORM DRAIN STRUCTURES (INCLUDING BUT NOT LIMITED TO ALL CARTRIDGES, EQUIPMENT, UNDER DRAINS, WEIR WALLS, STORAGE DEVICES, FRAME AND COVERS, INLET AND OUTLET PIPE CONNECTIONS, ETC.) AND LAY NEW STORM DRAIN PIPING.
9. TEST FOR WATER TIGHT CONNECTIONS.
10. BACKFILL EXCAVATIONS AND TRENCHES.
11. RESTORE PAVEMENT (ASPHALT AND CONCRETE) IN LINE AND GRADE, AS NEEDED.
12. GRADE AND STABILIZE ALL REMAINING GROUND SURFACE(S). PROVIDE VEGETATIVE STABILIZATION, AS NEEDED.
13. SEDIMENT CONTROL MEASURES SHALL NOT BE REMOVED UNTIL ALL THE CONTRIBUTING DRAINAGE AREAS ARE COMPLETELY STABILIZED (SEE SEDIMENT CONTROL NOTES) AND APPROVAL IS GRANTED BY THE DOEE INSPECTOR.

DEMOLITION NOTES:

1. ANY UNKNOWN ENVIRONMENTAL CONDITIONS TO BE HANDLED IN AN APPROPRIATE MANNER AND ARE ULTIMATELY THE RESPONSIBILITY OF THE PROPERTY OWNER.
2. THE WATER TABLE LEVEL ON SITE MAY NOT BE LOWER THAN THE VERTICAL LIMITS OF EXCAVATION REQUIRED FOR CONSTRUCTION AND INSTALLATION OF THE UNDERGROUND WATER QUALITY STRUCTURES, STORM DRAIN STRUCTURES, AND STORM DRAIN PIPING (BASED ON RECORDS PROVIDED BY PEPCO); THEREFORE, DEWATERING USING SUMP PUMPS, SUCTION AND DISCHARGE HOSES, SEDIMENT FILTERING BAGS AND TANKS, ETC. AND DISCHARGE AND TESTING OF GROUNDWATER EXTRACTED FROM THE EXCAVATION INTO THE STORM SEWER SYSTEM MAY BE REQUIRED (TO BE DETERMINE BY CONTRACTOR). NEW WATER QUALITY STRUCTURES MAY NEED TO BE ANCHORED BASED ON WATER TABLE (TO BE DETERMINE BY CONTRACTOR).

DUST CONTROL NOTES:

1. THE CONTRACTOR SHALL CONDUCT OPERATIONS AND MAINTAIN THE PROJECT SITE AS TO MINIMIZE THE CREATION AND DISPERSIONS ON-SITE CONTROL SHALL BE USED THROUGHOUT THE WORK SITE.
2. THE CONTRACTOR MUST PROVIDE CLEAN WATER, FREE FROM SALT, OIL AND OTHER DELETERIOUS MATERIAL TO BE USED FOR ON-SITE CONTROL.
3. THE CONTRACTOR SHALL SUPPLY WATER SPRAYING EQUIPMENT CAPABLE OF ACCESSING ALL WORK AREAS.
4. THE CONTRACTOR SHALL IMPLEMENT STRICT DUST CONTROL MEASURES DURING ACTIVE CONSTRUCTION PERIODS ON-SITE. THESE MEASURES WILL GENERALLY CONSIST OF WATER APPLICATIONS THAT SHALL BE APPLIED A MINIMUM OF ONCE PER DAY DURING DRY CONDITIONS AS OFTEN AS REQUIRED TO PREVENT DUST EMISSIONS.
5. FOR WATER APPLICATION TO UNDISTURBED SOIL SURFACES, THE CONTRACTOR SHALL:

A. APPLY WATER WITH EQUIPMENT CONSISTING OF TANK, SPRAY BAR, PUMP WITH DISCHARGE PRESSURE GAUGE.
B. ARRANGED SPRAY BAR HEIGHT, NOZZLE SPACING AND SPRAY PATTERN TO PROVIDE COMPLETE COVERAGE OF GROUND WITH WATER.
C. DISPERSE WATER THROUGH NOZZLES ON SPRAY BAR AT 20 PSI (137.8 kPa) MINIMUM. KEEP AREAS DAMP WITHOUT CREATING NUISANCE CONDITIONS SUCH AS PONDING.

6. FOR WATER APPLICATION TO SOIL SURFACES DURING DEMOLITION AND/OR EXCAVATION THE CONTRACTOR SHALL:

A. APPLY WATER WITH EQUIPMENT CONSISTING OF A TANK, PUMP WITH DISCHARGE GAUGE, HOSES AND MIST NOZZLES.
B. LOCATE TANK AND SPRAYING EQUIPMENT SO THAT THE ENTIRE EXCAVATION AREA CAN BE MISTED WITHOUT INTERFERING WITH DEMOLITION AND/OR EXCAVATION EQUIPMENT OR OPERATIONS SUCH AS PONDING.
C. APPLY WATER SPRAY IN A MANNER TO PREVENT MOVEMENT OF SPRAY BEYOND THE SITE BOUNDARIES.

EROSION AND SEDIMENT CONTROL NOTE:

PER THE USDA-NRCS SOIL SURVEY, THE SOILS ON SITE ARE CLASSIFIED AS URBAN LAND (Ub). EROSION AND SEDIMENTATION CONTROLS TO BE UTILIZED INCLUDE INLET PROTECTION, SILT FENCE, STRAW BALE DIKES, DEWATERING MEASURES, AND DUST CONTROL. PROVIDE SUMP PITS AND PUMPS, HOSES, FILTER BAGS, AND/OR PORTABLE SEDIMENT TANKS TO DEWATER ALL TRENCHES AND EXCAVATIONS, AS NEEDED. FIELD LOCATE AND SIZE AS REQUIRED TO KEEP AREAS DRY DURING TRENCHING AND EXCAVATION. FILTERED STORMWATER SHALL BE STAGED ONSITE IN TEMPORARY TANKS BEFORE BEING DISCHARGED INTO THE ON-STIE STORM SEWER SYSTEM (WITH DC WATER AND DDOE APPROVAL) OR TRUCKED OFF-SITE BY CONTRACTOR TO AN APPROVED LOCATION FOR DISPOSAL (IF REQUIRED); COORDINATE WITH PEPCO, DC WATER, AND DOEE. LIMIT AREAS OF SOIL DISTURBANCE AND OPEN EXCAVATIONS AND/OR TRENCHES AS MUCH AS POSSIBLE TO PREVENT SEDIMENT AND EROSION. STABILIZE DISTURBED AREAS IMMEDIATELY. PREVENT DUST FROM LEAVING THE LIMITS OF DISTURBANCE (LOD) AND KEEP ADJACENT AREAS OF FACILITY AND PROPERTIES CLEAN AND CLEAR.

TEMPORARY SEEDING SUMMARY

HARDINESS ZONE: 6B SEED MIXTURE: N/A					FERTILIZER RATE (10-10-10)	LIME RATE
NO.	SPECIES	APPLICATION RATE (LB/AC)	SEEDING DATES	SEEDING DEPTHS		
1	ANNUAL RYE GRASS	50	8/15 - 11/1	¼" - ½"	600 LB/AC (14 LB/1000 SF)	2 TONS/AC (92 LB/ 1000 SF)
1	FOXTAIL MILLET	150	5/1 - 11/15	1"		

PERMANENT SEEDING SUMMARY

HARDINESS ZONE: 6B SEED MIXTURE: 3					FERTILIZER RATE (10-20-20)			LIME RATE
NO.	SPECIES	APPLICATION RATE (LB/AC)	SEEDING DATES	SEEDING DEPTHS	N	P_2O_5	K_2O	
3	TALL FESCUE(85%) PERENNIAL RYEGRASS(10%) KENTUCKY BLUEGRASS(5%)	125 15 10	3/1-5/15; 8/15-10/15	1/4"-1/2"	90 LB/AC (2.0LB/ 1000SF)	175 LB/AC (4.0LB/ 1000SF)	175 LB/AC (4.0LB/ 1000SF)	2 TONS/AC (90 LB/ 1000SF)

VEGETATIVE STABILIZATION METHODS AND MATERIALS:

A. SITE PREPARATION
 i. INSTALL EROSION AND SEDIMENT CONTROL STRUCTURES (EITHER TEMPORARY OR PERMANENT) SUCH AS DIVERSIONS, GRADE STABILIZATION STRUCTURES, BERMS, WATERWAYS, OR SEDIMENT CONTROL BASINS.
 ii. PERFORM ALL GRADING OPERATIONS AT RIGHT ANGLES TO THE SLOPE. FINAL GRADING AND SHAPING IS NOT USUALLY NECESSARY FOR TEMPORARY SEEDING.
 iii. SCHEDULE REQUIRED SOIL TESTS TO DETERMINE SOIL AMENDMENT COMPOSITION AND APPLICATION RATES FOR SITES HAVING DISTURBED AREA OVER 5 ACRES.

B. SOIL AMENDMENTS (FERTILIZER AND LIME SPECIFICATIONS)
 i. SOIL TESTS MUST BE PERFORMED TO DETERMINE THE EXACT RATIOS AND APPLICATION RATES FOR BOTH LIME AND FERTILIZER ON SITES HAVING DISTURBED AREAS OVER 5 ACRES. SOIL ANALYSIS MAY BE PERFORMED BY THE UNIVERSITY OF THE DISTRICT OF COLUMBIA OR A CERTIFIED COMMERCIAL LABORATORY. SOIL SAMPLES TAKEN FOR ENGINEERING PURPOSES MAY ALSO BE USED FOR CHEMICAL ANALYSES.
 ii. FERTILIZERS SHALL BE UNIFORM IN COMPOSITION, FREE FLOWING AND SUITABLE FOR ACCURATE APPLICATION BY APPROVED EQUIPMENT. MANURE MAY BE SUBSTITUTED FOR FERTILIZER WITH PRIOR APPROVAL FROM THE APPROPRIATE APPROVAL AUTHORITY. FERTILIZERS SHALL ALL BE DELIVERED TO THE SITE FULLY LABELED ACCORDING TO THE APPLICABLE STATE FERTILIZER LAWS AND SHALL BEAR THE NAME, TRADE NAME OR TRADEMARK AND WARRANTEE OF THE PRODUCER.
 iii. LIME MATERIALS SHALL BE GROUND LIMESTONE (HYDRATED OR BURNT LIME MAY BE SUBSTITUTED) WHICH CONTAINS AT LEAST 50% TOTAL OXIDES (CALCIUM OXIDE PLUS MAGNESIUM OXIDE). LIMESTONE SHALL BE GROUND TO SUCH FINENESS THAT AT LEAST 50% WILL PASS THROUGH A #100 MESH SIEVE AND 98 - 100% WILL PASS THROUGH A #20 MESH SIEVE.
 iv. INCORPORATE LIME AND FERTILIZER INTO THE TOP 3 - 5" OF SOIL BY DISKING OR OTHER SUITABLE MEANS.

C. SEEDBED PREPARATION
 i. TEMPORARY SEEDING
 a. SEEDBED PREPARATION SHALL CONSIST OF LOOSENING SOIL TO A DEPTH OF 3" TO 5" BY
  1. MEANS OF SUITABLE AGRICULTURAL OR CONSTRUCTION EQUIPMENT, SUCH AS DISC HARROWS OR CHISEL PLOWS OR RIPPERS MOUNTED ON CONSTRUCTION EQUIPMENT. AFTER THE SOIL IS LOOSENED, IT SHOULD NOT BE ROLLED OR DRAGGED SMOOTH BUT LEFT IN THE ROUGHENED CONDITION. SLOPED AREAS (GREATER THAN 3: 1) SHOULD BE TRACKED LEAVING THE SURFACE IN AN IRREGULAR CONDITION WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE.
 b. APPLY FERTILIZER AND LIME AS PRESCRIBED ON THE PLANS.
 c. INCORPORATE LIME AND FERTILIZER INTO THE TOP 3 - 5" OF SOIL BY DISKING OR OTHER SUITABLE MEANS.
 ii. PERMANENT SEEDING
 a. MINIMUM SOIL CONDITIONS REQUIRED FOR PERMANENT VEGETATIVE ESTABLISHMENT:
  1. SOIL PH SHALL BE BETWEEN 6.0 AND 7.0.
  2. SOLUBLE SALTS SHALL BE LESS THAN 500 PARTS PER MILLION (PPM).
  3. THE SOIL SHALL CONTAIN LESS THAN 40% CLAY BUT ENOUGH FINE GRAINED MATERIAL (> 30% SILT PLUS CLAY) TO PROVIDE THE CAPACITY TO HOLD A MODERATE AMOUNT OF MOISTURE. AN EXCEPTION IS IF LOVEGRASS OR SERECIA LESPEDEZA IS TO BE PLANTED. THEN A SANDY SOIL (< 30% SILT PLUS CLAY) WOULD BE ACCEPTABLE SOIL SHALL CONTAIN 1.5% MINIMUM ORGANIC MATTER BY WEIGHT.
  4. SOIL MUST CONTAIN SUFFICIENT PORE SPACE TO PERMIT ADEQUATE ROOT PENETRATION.
  5. IF THESE CONDITIONS CANNOT BE MET BY SOILS ON SITE, ADDING TOPSOIL IS REQUIRED IN ACCORDANCE WITH SECTION 38 STANDARD AND SPECIFICATION FOR TOPSOIL.
 b. AREAS PREVIOUSLY GRADED IN CONFORMANCE WITH THE DRAWINGS SHALL BE MAINTAINED IN A TRUE AND EVEN GRADE, THEN SCARIFIED OR OTHERWISE LOOSENED TO A DEPTH OF 3 - 5" TO PERMIT BONDING OF THE TOPSOIL TO THE SURFACE AREA AND TO CREATE HORIZONTAL EROSION CHECK SLOTS TO PREVENT TOPSOIL FROM SLIDING DOWN A SLOPE.
 c. APPLY SOIL AMENDMENTS AS PER SOIL TEST OR AS INCLUDED ON THE PLANS.
 d. MIX SOIL AMENDMENTS INTO THE TOP 3- 5" OF TOPSOIL BY DISKING OR OTHER SUITABLE LAWN AREAS SHOULD BE RAKED TO SMOOTH THE SURFACE, REMOVE LARGE OBJECTS LIKE STONES AND BRANCHES, AND READY THE AREA FOR SEED APPLICATION. WHERE SITE CONDITIONS WILL NOT PERMIT NORMAL SEEDBED PREPARATION, LOOSEN SURFACE SOIL BY DRAGGING WITH A HEAVY CHAIN OR OTHER EQUIPMENT TO ROUGHEN THE SURFACE. STEEP SLOPES (STEEPER THAN 3: 1) SHOULD BE TRACKED BY A DOZER LEAVING THE SOIL IN AN IRREGULAR CONDITION WITH RIDGES RUNNING PARALLEL TO THE CONTOUR OF THE SLOPE. THE TOP 1 - 3" OF SOIL SHOULD BE LOOSE AND FRIABLE. SEEDBED LOOSENING MAY NOT BE NECESSARY ON NEWLY DISTURBED AREAS.

D. SEED SPECIFICATIONS
 i. ALL SEED MUST MEET THE REQUIREMENTS OF THE DISTRICT OF COLUMBIA DPW STANDARD AND SPECIFICATIONS FOR HIGHWAYS AND STRUCTURES AND SPECIFICATION 42.0 VEGETATIVE STABILIZATION. ALL SEED SHALL BE SUBJECT TO RE-TESTING BY A RECOGNIZED SEED LABORATORY. ALL SEED USED SHALL HAVE BEEN TESTED WITHIN THE 6 MONTHS IMMEDIATELY PRECEDING THE DATE OF SOWING SUCH MATERIAL ON THIS JOB.
 NOTE: SEED TAGS SHALL BE MADE AVAILABLE TO THE INSPECTOR TO VERIFY TYPE AND RATE OF SEED USED.
 ii. INOCULANT - THE INOCULANT FOR TREATING LEGUME SEED IN THE SEED MIXTURES SHALL BE A PURE CULTURE OF NITROGEN-FIXING BACTERIA PREPARED SPECIFICALLY FOR THE SPECIES. INOCULANTS SHALL NOT BE USED LATER THAN THE DATE INDICATED ON THE CONTAINER. ADD FRESH INOCULANT AS DIRECTED ON PACKAGE. USE FOUR TIMES THE RECOMMENDED RATE WHEN HYDROSEEDING. NOTE: IT IS VERY IMPORTANT TO KEEP INOCULANT AS COOL AS POSSIBLE UNTIL USED. TEMPERATURES ABOVE 75-80o F. CAN WEAKEN BACTERIA AND MAKE THE INOCULANT LESS EFFECTIVE.

E. METHODS OF SEEDING: APPLY SEED UNIFORMLY WITH HYDROSEEDER (SLURRY INCLUDES SEED AND FERTILIZER), BROADCAST OR DROP SEEDER, OR A CULTIPACKER SEEDER.
 i. HYDROSEEDING:
 a. IF FERTILIZER IS BEING APPLIED AT THE TIME OF SEEDING, THE APPLICATION RATES AMOUNTS WILL NOT EXCEED THE FOLLOWING: NITROGEN; MAXIMUM OF 100 LBS. PER ACRE TOTAL OF SOLUBLE NITROGEN; P2O5 (PHOSPHOROUS): 200 LBS/AC; K2O (POTASSIUM): 200 LBS/AC.
 b. LIME - USE ONLY GROUND AGRICULTURAL LIMESTONE, (UP TO 3 TONS PER ACRE MAY BE APPLIED BY HYDROSEEDING). NORMALLY, NOT MORE THAN 2 TONS ARE APPLIED BY HYDROSEEDING AT ANYONE TIME. DO NOT USE BURNT OR HYDRATED LIME WHEN HYDROSEEDING.
 c. SEED AND FERTILIZER SHALL BE MIXED ON SITE AND SEEDING SHALL BE DONE IMMEDIATELY AND WITHOUT INTERRUPTION.
 ii. DRY SEEDING: THIS INCLUDES USE OF CONVENTIONAL DROP OR BROADCAST SPREADERS.
 a. SEED SPREAD DRY SHALL BE INCORPORATED INTO THE SUBSOIL AT THE RATES PRESCRIBED ON THE TEMPORARY OR PERMANENT SEEDING SUMMARIES OR TABLES 42 OR 43. THE SEEDED AREA SHALL THEN BE ROLLED WITH A WEIGHTED ROLLER TO PROVIDE GOOD SEED TO SOIL CONTACT.
 b. WHERE PRACTICAL, SEED SHOULD BE APPLIED IN TWO DIRECTIONS PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION.
 iii. DRILL OR CULTIPACKER SEEDING: MECHANIZED SEEDERS THAT APPLY AND COVER SEED WITH SOIL.
 a. CULTIPACKING SEEDERS ARE REQUIRED TO BURY THE SEED IN SUCH A FASHION AS TO PROVIDE AT LEAST 1/4 INCH OF SOIL COVERING. SEEDBED MUST BE FIRM AFTER PLANTING.
 b. WHERE PRACTICAL, SEED SHOULD BE APPLIED IN TWO DIRECTIONS PERPENDICULAR TO EACH OTHER. APPLY HALF THE SEEDING RATE IN EACH DIRECTION.

STORMWATER MANAGEMENT PLAN (EXEMPTION) NOTE:

POTOMAC ELECTRIC POWER CO. (PEPCO) IS PLANNING TO INSTALL AND MAINTAIN SEVERAL NEW WATER QUALITY TREATMENT BEST MANAGEMENT PRACTICES (BMPs) AT THEIR BENNING SERVICE CENTER LOCATED AT 3400 BENNING ROAD NE IN WASHINGTON, DC AS A RESULT OF AN ENVIRONMENTAL CONSENT DECREE ISSUED BY THE US ENVIRONMENTAL PROTECTION AGENCY (EPA). PEPCO IS SEEKING A BUILDING/CONSTRUCTION PERMIT FROM THE DISTRICT'S DEPARTMENT OF CONSUMER AND REGULATORY AFFAIRS (DCRA) AND AN EROSION AND SEDIMENT CONTROL (ESC) PERMIT FROM THE DISTRICT'S DEPARTMENT OF ENERGY & ENVIRONMENT (DOEE) TO CONSTRUCT THE NEW WATER QUALITY TREATMENT BMPS AND THE ASSOCIATED NEW STORM SEWER PIPING AND STRUCTURES DESCRIBED HEREIN. THE PROPOSED BMPs WILL REDUCE CONTAMINATION AND POLLUTANT LOADS IN SURFACE RUNOFF WATER WHICH IS CURRENTLY COLLECTED ON-SITE IN A PRIVATE, UNDERGROUND, SEPARATE STORM SEWER SYSTEM. STORMWATER RUNOFF LEAVES THE SITE THROUGH A SEPARATE STORM SEWER OUTFALL TO THE NORTH WHERE IT DISCHARGES DIRECTLY INTO THE ANACOSTIA RIVER.

THIS PROJECT IS CLASSIFIED AS EXEMPT FROM THE REQUIREMENTS OF SECTION 520 (STORMWATER MANAGEMENT: PERFORMANCE REQUIREMENTS FOR MAJOR LAND-DISTURBING ACTIVITY) OF THE DC MUNICIPAL REGULATIONS (DCMR) FOR TWO REASONS, AS FOLLOWS, PER DCMR SECTION 517 (STORMWATER MANAGEMENT: EXEMPTIONS):

1. SECTION 517.2(e): THE PROJECT IS BEING CONDUCTED FOR THE SOLE PURPOSE TO INSTALL BMPs IN COMPLIANCE WITH A COURT-APPROVED CONSENT DECREE OR IN COMPLIANCE WITH A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT; AND/OR
2. SECTION 517.3: THE PROJECT IS A LAND-DISTURBING ACTIVITY THAT CONSISTS SOLELY OF CUTTING A TRENCH FOR UTILITY WORK AND DOES NOT INVOLVE THE RECONSTRUCTION OF A DC DEPARTMENT OF TRANSPORTATION (DDOT) ROADWAY.

THE PROPOSED WATER QUALITY BMPS INCLUDE MEDIA FILTERS (E.G., CONTECH® STORMFILTER®), MEMBRANE FILTERS (E.G., CONTECH® JELLYFISH®), OR A COMBINATION OF THE TWO. THE MEDIA FILTERS (E.G., CONTECH® STORMFILTER®) WILL BE RECHARGEABLE, SELF-CLEANING CARTRIDGES THAT TRAP PARTICULATES AND ABSORB DISSOLVED METALS. THE MEMBRANE FILTERS (E.G., CONTECH® JELLYFISH®) WILL BE HIGH FLOW PRETREATMENT AND MEMBRANE FILTRATION TO REMOVE FLOATABLES, TRASH, OIL, DEBRIS, TOTAL SUSPENDED SOLIDS (TSS), FINE SILT-SIZED PARTICLES, AND A HIGH PERCENTAGE OF PARTICULATE-BOUND POLLUTANTS, INCLUDING METALS. EACH BMP OR BMP COMBINATION HAS BEEN DESIGNED TO REDUCE METAL CONCENTRATIONS IN COMPLIANCE WITH THE REQUIREMENTS OF THE CONSENT DECREE WITH THE EPA.

SITE NOTES:

THE LIMIT OF DISTURBANCE (LOD) IS LESS THAN ONE (1) ACRE; THEREFORE, COVERAGE UNDER A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) CONSTRUCTION GENERAL OR INDIVIDUAL PERMIT AND SUBMISSION OF A NOTICE OF INTENT (NOI) ARE NOT REQUIRED FOR STORMWATER MANAGEMENT.

THE LOD IS GREATER THAN 5,000 SF; THEREFORE, DEPARTMENT OF ENERGY & ENVIRONMENT (DOEE) STORMWATER MANAGEMENT PERFORMANCE REQUIREMENTS WOULD BE REQUIRED; HOWEVER, THE SITE IS EXEMPT AS DETERMINED BY DOEE (SEE STORMWATER MANAGEMENT PLAN (EXEMPTION) NOTE THIS SHEET FOR DESCRIPTION OF EXEMPTION).

PROJECT SITE INFORMATION:

PROPERTY ADDRESS: 3400 BENNING ROAD NE, WASHINGTON, DC 20019

SSL: PAR 01690114

PROPERTY OWNER:

FARIBA MAHVI, PEPCO HOLDINGS, INC.; 701 9TH STREET NW, WASHINGTON, DC 20001; OFFICE: (202) 331-6641; CELL: (202) 345-7647

CONTRACTOR:

(TBD AND SUBMITTED TO DCRA INSPECTION AND COMPLIANCE DIVISION)

DESIGNER OF RECORD:

SARAH J. NAPIER, PE; AECOM; 12420 MILESTONE CENTER DRIVE, SUITE 150, GERMANTOWN, MD 20876; OFFICE: (301) 820-3198; CELL: (301) 502-2657

SOIL TYPE: URBAN LAND (Ub)

PERMANENT STABILIZATION:

REPLACE EXISTING ASPHALT AND CONCRETE PAVEMENT IN LINE AND GRADE; REPLACE EXISTING COMPACTED COVER IN LINE AND GRADE AND USE DC/DOEE APPROVED SEED MIX

ENVIRONMENT:

NO WILDLIFE HABITAT OR WATER AREAS; ADJACENT TO ANACOSTIA RIVER; 100-YEAR FLOODPLAIN LOCATED AT WEST LIMIT OF PROPERTY OUTSIDE OF LIMITS OF DISTURBANCE (LOD)

PROFESSIONAL CERTIFICATION:
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE DISTRICT OF COLUMBIA.

NAME: SARAH J. NAPIER
LICENSE NO.: PE905830
EXPIRATION DATE: 08/31/2018

DESCRIPTION	CORR	CHKD	APPD	APPD	APPD	APPD

REVISIONS

PRELIMINARY:
ENVIRONMENTAL DESIGN FINAL SUBMITTAL
CIVIL DESIGN 65% SUBMITTAL
NOT FOR CONSTRUCTION

AECOM
8000 VIRGINIA MANOR ROAD
BELTSVILLE, MARYLAND 20705
(301) 289-3900

12420 MILESTONE CENTER DRIVE
SUITE 150
GERMANTOWN, MARYLAND 20876
(301) 820-3000

BENNING ROAD FACILITY
3400 BENNING ROAD NE
STORMWATER MEASURES

EROSION AND SEDIMENT CONTROL NOTES

POTOMAC ELECTRIC POWER CO.

CHKD	APPD	APPD	APPD	APPD	APPD	DR BY: EP	ENGR.: SJN	CLASS
						DATE: 01/27/17	SCALE: NTS	

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Technical Specification
for
STORMWATER MEASURES
BENNING ROAD FACILITY

Technical Specification
for
STORMWATER MEASURES
BENNING ROAD FACILITY

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<u>Appendix</u>

DRAWING LIST

The Contract Drawings are those numbered and titled as follows:

Drawing No.	Rev.	Title
C0001	-	Cover Sheet
C0002	-	Abbreviations and Legends
C0003	-	Existing Conditions Data
C0004	-	Overall Existing Conditions Plan
C0101	-	Existing Drainage Area Map
C0102	-	Existing Conditions and Demolition Plan 1 of 4
C0103	-	Existing Conditions and Demolition Plan 2 of 4
C0104	-	Existing Conditions and Demolition Plan 3 of 4
C0105	-	Existing Conditions and Demolition Plan 4 of 4
C0106	-	Storm Drain and Stormwater Management Plan 1 of 4
C0107	-	Storm Drain and Stormwater Management Plan 2 of 4
C0108	-	Storm Drain and Stormwater Management Plan 3 of 4
C0109	-	Storm Drain and Stormwater Management Plan 4 of 4
C0110	-	Grading and Paving Plan 1 of 4
C0111	-	Grading and Paving Plan 2 of 4
C0112	-	Erosion and Sediment Control Plan 1 of 4
C0113	-	Erosion and Sediment Control Plan 2 of 4
C0114	-	Erosion and Sediment Control Plan 3 of 4
C0115	-	Erosion and Sediment Control Plan 4 of 4
C0201	-	Storm Drain Profiles 1 of 3
C0202	-	Storm Drain Profiles 2 of 3

C0203	-	Storm Drain Profiles 3 of 3
C0501	-	Stormwater Management Details 1 of 3
C0502	-	Stormwater Management Details 2 of 3
C0503	-	Stormwater Management Details 3 of 3
C0504	-	Construction Details
C0505	-	Erosion and Sediment Control Details
C0506	-	Erosion and Sediment Control Notes

DIVISION 1 - GENERAL REQUIREMENTS

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Item	Page No.

DIVISION 1

SECTION 01100

SPECIAL CONDITIONS

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS

A. The provisions and requirements of Division 1 sections and the General Conditions apply to entire Work of Contract.

B. This specification has been arranged according to the Construction Specifications Institute format. Titles to the sections and paragraphs in these Contract Documents are introduced merely for convenience and shall not be taken as part of the Specification or as a correct or complete segregation of the several units of material and labor. No responsibility, either direct or implied, is assumed by the Company for omissions or duplication by the Contractor, or his subcontractors, due to real or alleged error in arrangement of these Contract Documents.

C. Should unanticipated work become necessary, the Contractor will be required to submit a detailed cost breakdown and obtain approval of the Company before such work is undertaken. This information shall be submitted to Fariba Mahvi, Facility Manager, 701 Ninth Street NW, Washington, DC 20001. A bill for extra work done shall be submitted within thirty (30) days of completion of said extra work. Failure to adhere to these instructions shall be sufficient reason for rejection of request for extra payment.

1.02 SUMMARY OF WORK

A. Work covered by Contract Documents

1. The Contract Documents provide for the clearing and grading, selective demolition, and installation of new stormwater quality measures at the Potomac Electric Power Company's Benning Road Facility, located at 3400 Benning Road, N.E., Washington, D.C. 20019.

2. Unless otherwise specified, this Specification provides for the furnishing by the Contractor of all labor, transportation, materials, apparatus, fuel, energy,

light, scaffolding and tools necessary for the entire and proper completion of the Work. The Contractor shall install, maintain, and remove all equipment used for the construction, and the Contractor shall construct in the best and most workmanlike manner foundations, utility structures and piping, and everything properly incidental thereto, as shown on the plans, stated in the Specification or reasonably implied therein, all in accordance with the Contract Documents.

B. Work Sequence

1. The Contractor shall adhere to the following construction sequence as specified herein. The schedule is designed to minimize erosion and siltation and to facilitate concurrent work with the Company's forces. To accomplish this, it is necessary to install the sedimentation controls in the initial stages of construction and to construct a stone construction entrance as soon as possible, in order to minimize the amount of soil deposited on the street by construction vehicles.

2. Construction Sequence:

   a. Provide the sediment and erosion control measures as shown on the drawings and as called for in Section 02270 "SEDIMENT AND EROSION CONTROL."

   b. Excavate for and selectively demolish asphalt, concrete pavement, curb and gutter, landscaped areas, existing underground obstructions, and abandoned utilities.

   c. Excavate for and install footings and foundations for large stormwater best management structures (BMPs).

   d. Excavate and trench for and install new underground structures and utilities.

   e. Test and inspect utilities and structures.

   f. Backfill excavations and trenches and grade to finish grade.

   g. Replace asphalt, concrete pavement, and curb and gutter in kind. Landscape site.

h. Remove the sediment and erosion control measures with approval from sediment and erosion control inspector.

3. The construction shall proceed according to normal construction practice. However, the Company reserves the right to make changes in the construction sequence.

1.03 COORDINATION

A. As stated in the General Conditions of the Contract, the Company or others will be doing work in the area concurrently with the Contractor.

B. The Contractor is cautioned that some portions of work under this Contract may be subject to delay while major equipment is being installed by others. The Contractor shall consult with the Superintendent at frequent intervals during the course of the work, so that work schedules for the various parties may be coordinated.

C. In some cases, conditions may dictate that work proceed in two or more independent operations.

1.04 FIELD ENGINEERING

A. Surveying Services

1. It shall be the Contractor's responsibility to have all grade stakes placed and maintained. Likewise the Contractor shall perform site layout to include trim lines, property lines, building layout, etc. as needed to properly and completely perform all work in the Contract Documents. The Contractor shall request the Superintendent to verify that all grades and critical elevations have been established. The Contractor must have the written approval of the Superintendent that all grades are as called for prior to commencing paving operations or spreading gravel.

B. Subsurface Conditions

Refer to Section 02010 – Subsurface Investigation. Additional tests, borings, and other exploratory operations shall be made by the Contractor at no cost to the Company and will be performed in accordance with requirements of the District of Columbia Department of Energy & Environment (DOEE) Stormwater Management Guidebook.

1.05 REGULATORY REQUIREMENTS

A. Safety Requirements

1. Except as specified otherwise by the local building code, all safety requirements for building construction shall be in accordance with the applicable requirements of the U.S.A. Standard Safety Code for Building Construction.

2. Where prevention of construction accidents is not regulated by code or ordinance, comply with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America.

3. Contractor's work forces will be permitted to work near energized equipment only while a Company representative is physically present. No exceptions shall be allowed.

B. All work in Public Space shall be in accordance with the requirements of the regulating jurisdiction.

C. Permits

1. Building Permit - The Company will obtain and pay for the building permit.

2. Sediment Control and Grading Permits - If required, the Company will obtain and pay for the necessary permits.

   However, any additional fees for permits or plans required to implement the grading and sediment control, required because of field construction procedure or required for off-site waste or borrow areas, will be obtained and paid for by the Contractor.

3. Other Permits - All other permits (including work in public spaces), inspections, notices, fees, and deposit shall be provided by the Contractor at his expense.

D. Workmanship and Material

The Contractor shall, without additional expense to the Company, comply with all state and municipal building ordinances, codes and regulations which govern all work procedures, workmanship, materials and equipment required to complete the Work.

1.06 REFERENCES

A. Work of Contract can be summarized by reference to the Contract, General Conditions, Specification sections as listed in the "Table of Contents" bound herewith, drawings, addenda and modifications to the Contract Documents issued subsequent to the initial printing of this Project Manual, and including but not necessarily limited to printed matter referenced by any of these.

B. Definitions

1. General Explanation: Certain terms used in Contract Documents are defined generally in this article. Definitions and explanations of this section are not necessarily complete or exclusive but are general for the Work to the extent not stated more explicitly in another provision of the Contract Documents.

2. Superintendent: Wherever used in these Technical Specifications, the term Superintendent means the Company's Superintendent or his/her designated representative.

1.07 PROJECT MEETINGS

A. Preconstruction

A preconstruction meeting will be held prior to Contractor mobilization with the Superintendent and DOEE Sediment and Erosion Control Inspector.

B. Progress Meetings

1. Monthly progress meetings will be held at the site.

2. The Contractor shall update the construction progress schedule to coincide with these meetings.

3. In addition to the monthly progress meetings, meetings will be held as necessary in order to rectify construction problems or scheduling discrepancies.

C. Installation Meetings

Meetings will be held prior to the installation of major building systems as requested by the Contractor or deemed appropriate by the Superintendent.

1.08 SUBMITTALS

A. The types of submittal requirements stipulated in this section include product data and miscellaneous work-related submittals.

B. Work-related submittals of this section are categorized for convenience as follows:

1. Product Data: Includes standard printed information on materials, products and systems including, but not limited to catalog cuts, descriptive brochures, performance charts, test reports, details, specifications and other printed literature or bulletins issued or provided by product manufacturers; not specially-prepared for this project, other than the designation of selections from available choices printed therein.

2. Miscellaneous submittals related directly to the work (non-administrative): Includes warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials and similar information, devices and materials applicable to the work and not processed as product data.

C. General Submittal Requirements as follows:

1. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Company's review with another.

2. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, Contractor, subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking and provide space for Company's "Action" marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through Contractor's office, or incomplete submittals, will be returned "without action".

3. Transmittal Form: Prepare a draft of special transmittal form for project, and submit to Company for acceptance. Provide places to indicate project, date, "To:"; "From:"; names of subcontractors, suppliers, manufacturers, required references, category and type of submittal, purpose, description, distribution record (for both transmittal and submittals), and signature of transmitter.

   a. Provide Contractor's certification of form, ready for execution, stating that information submitted complies with requirements of Contract Documents.

4. Company's Approval: Company's approval shall not be interpreted as a complete check, but will indicate only that the general method of construction and detailing is satisfactory and that errors and discrepancies observed when reviewed have been noted. Approval of a separate item shall not be interpreted as an approval of an assembly in which the item functions.

5. Submittals: Do not submit product data, or allow its use on the Project, until compliance with requirements of Contract Documents has been confirmed by Contractor. Submittal is for information and record, unless otherwise indicated. Submit a minimum of five copies and one copy of the Contractor's transmittal to the Company. Upon receipt, the Engineer will mark corrections, stamp copies and return three copies of the submittal to the Contractor. If resubmittal is necessary, the process shall be repeated until an approval is obtained.

6. Contractor's Responsibility: Engineer's review and approval shall not relieve the Contractor from responsibility for errors in shop drawings or for proper coordination and assembly of materials and equipment with other work, nor from the responsibility of furnishing materials and labor not indicated on approved show drawings, but required by the Contract Documents for completion of work.

D. Deviations: Approval of submittals by the Engineer shall not authorize deviations from the requirements of the Contract Documents, nor shall approval relieve the Contractor from responsibility for errors or omissions.

1. When submitting products for equivalency approval, it shall be the responsibility of the Contractors to justify that a product is equivalent to the item specified. As a

method of justification, the Contractor shall state differences between the items concerned on the transmittal sheet for that particular submittal. The engineer will not offer equivalency approval for submittals with insufficient product information. Should justification not appear on the transmittals, it will be assumed that the items submitted are not equivalent to those items specified and shall consequently be rejected.

2. Contractor's submittal of, and Engineer acceptance of, shop drawings, product data or samples which relate to work not complying with requirements of Contract Documents does not constitute an acceptable and valid request for a substitution, nor approval thereof.

1.09 CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

A. Temporary Office and Toilet - The Contractor shall, at the beginning of the work, provide on the site, at a location to be agreed upon by the Superintendent, a temporary office for his own use and a temporary toilet for the use of all workers on the job. A temporary office shall also be maintained for the use of the representative of the Superintendent. The office area, lighting, heating, air conditioning and furnishing shall satisfy the Superintendent.

The Contractor shall maintain the toilet in strict accordance with all regulations governing the area where the building is erected. The Contractor shall take all necessary precautions for maintaining sanitary conditions, in and around the building, as required by local health authorities and as directed by the Superintendent. Upon completion of the work, the Contractor shall remove the temporary offices and temporary toilet.

B. Safety Barriers, Lights - The Contractor shall erect around the site and in public areas where necessary, suitable safety barriers and shall maintain all necessary signs, lights, etc., for protection of workmen and the public, in accordance with all requirements of the jurisdiction in which work is being done, all police and fire regulations, and all ordinances in force.

C. Rodent Control - The Contractor shall take all necessary precautionary measures to keep the site free from rodents during construction operations. Food scraps and other debris attractive to rodents shall be put in containers and disposed of in an approved manner at the end of each working day.

D. Electrical Energy - The Company will provide a 120-208 volt, 400 ampere, three phase, 4 wire, temporary electrical service to one location selected by the Company on the construction site. Adequate and safe wiring, complying with the Washington, DC Electrical Code, shall be provided by the Contractor from the Company-provided service connection to convey electrical energy required for power and lights during building operations and for the temporary offices. The cost of installation, maintenance and removal of this wiring shall be borne by the Contractor.

E. Water - The Contractor shall provide for the water service and the necessary piping and connections to convey the water as required, at his own expense.

F. Telephone - The Contractor shall provide a telephone for his own use.

1.10 MATERIAL AND EQUIPMENT

A. Product Delivery - Storage - Handling

1. Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means which will prevent damage, deterioration, and loss including theft.

2. Control delivery schedules to preclude storage of products at site and overcrowding of construction spaces.

3. Provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

4. The Contractor shall be responsible for the safe storage and protection of all materials delivered to the site, including materials referred to herein as furnished by the Company. All material shall be stored in a location as specified by the Superintendent. No material will be stored near existing trees.

5. No public or private property shall be occupied for the purpose of storing materials and other purpose unless the Contractor has obtained the necessary permits and permissions.

B. Company Material

The Company will furnish at the site, and the Contractor shall unload and install all steel (electrical) conduit and all fiberglass conduit, PVC bends and fittings, unless otherwise shown or specified. The Contractor shall furnish and install,

as work progresses, all anchor bolts, inserts, etc., built into masonry or concrete, as shown on the Drawings.

1.11 WARRANTIES AND GUARANTEE

A. Guarantee

1. The Contractor guarantees by his acceptance of the Contract, that all work installed will be free from defects in workmanship and materials for a period of one year, or as otherwise specified from the date of certificate of completion and acceptance of Work. If defects in workmanship, material or performance appear, the Contractor shall, without cost to the Company, remedy defects within a reasonable time to be specified in notice from the Company. In default thereof, the Company may have such work done and charge the cost to the Contractor.

2. Prior to the Company's formal acceptance of the work, the Contractor shall certify to the effect that construction has been completed in accordance with the local Building Code and all other applicable local requirements.

B. Categories of Specific Warranties: Warranties on the Work are in several categories, including those of General Conditions, and including, but not necessarily limited to the following specific categories related to individual units of work specified in sections of Divisions 2 through 16 of these specifications:

1. Special Project Warranty: A warranty specifically written and signed by Contractor for a defined portion of the Work; and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor.

2. Specified Product Warranty: A warranty which is required by Contract Documents, to be provided for a manufactured product incorporated into the Work; regardless of whether manufacturer has published a similar warranty without regard for specific incorporation of product into the Work, or has written and executed a special Project

warranty as a direct result of Contract Document requirements.

3. Coincidental Product Warranty: A warranty which is not specifically required by Contract Documents (other than as specified in this Section); but which is available on a product incorporated into the Work, by virtue of the fact that manufacturer or product has published warranty in connection with purchases and uses of product without regard for specific applications except as otherwise limited by terms of warranty.

C. Refer to individual sections of Divisions 2 through 16 for the determination of units of Work which are required to be specially or individually warranted, and for the specific requirements and terms of those warranties.

D. General Limitations: It is recognized that specific warranties are intended primarily to protect the Company against failure of the Work to perform as required, and against deficient, defective and faulty materials and workmanship, regardless of sources. Except as otherwise indicated, specific warranties do not cover failures in the Work which result from: 1) Unusual and abnormal phenomena of the elements, 2) The Company's misuse, maltreatment or improper maintenance of the Work, 3) Vandalism after time of substantial completion, or 4) Insurrection or acts of aggression including war.

E. Related Damages and Losses: In connection with Contractor's correction of warranted work which has failed, remove and replace Work of Project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction or warranted work.

1. Consequential Damages: Except as otherwise indicated or required by governing regulations, special Project warranties and product warranties are not extended to cover damage to building contents (other than Work of Contract) which occurs as a result of failure of warranted work.

F. Reinstatement of Warranty Period: Except as otherwise indicated, when Work covered by a special Project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement for the following time period, starting on date of acceptance of replaced or restored work.

1. A period of time ending upon date original warranty would have expired if there had been no failure.

G. Replacement Cost, Obligations: Except as otherwise indicated, costs of replacing or restoring failing warranted units or products is Contractor's obligation, without regard for whether the Company has already benefitted from use through a portion of anticipated useful service lives.

H. Rejection of Warranties: The Company reserves the right, at time of substantial completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of the Company tend to detract from or confuse interpretation of requirements of Contract Documents.

I. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or sub-subcontract for materials or units of work for Project where a special Project warranty, specified product warranty, certification or similar commitment is required, until it has been determined that entities required to countersign such commitments are willing to do so.

J. Specific Warranty Forms: Where a special Project warranty (guarantee) or specified product warranty is required, prepare a written document to contain terms and appropriate identification, ready for execution by required parties. Submit draft to the Company (through Engineer) for approval prior to final executions.

1.12 FINAL INSPECTION AND FINAL PAYMENT

Prior to final payment, upon substantial completion of the Work and prior to acceptance by the Company, a single final inspection will be made by the Engineer, in which a list of all deficiencies will be prepared. Final payment to the Contractor shall not become due until all deficient items have been corrected by the Contractor, and approved by the Company and As-Built Drawings have been submitted by the Contractor. The inspection is to be commenced after formal notification in writing from the Contractor that the Work is complete and that he or his authorized representative has checked the Work for proper completion.

PART 2 PRODUCTS

2.01 GENERAL PRODUCTS COMPLIANCES

A. General: The compliance requirements, for individual products as indicated in Contract Documents, are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliance with codes, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with.

B. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Documents requirements, and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects. Required procedures include, but not necessarily limited to, the following for various indicated methods of specifying:

1. Product/Manufacturer Name(s): Provide product indicated. Where more than one product is named, provide one of the named products at Contractor's option. Advise the Company before proceeding where known that named product(s) is not a feasible or acceptable selection.

2. "Named", except as otherwise indicated, is defined to mean manufacturer's name for product, as recorded in published product literature, of latest issue as of date on Contract Documents. Refer requests to use products of a later model to Company for acceptance before proceeding.

3. Standards, Codes, and Regulations: Where only compliance with an imposed standard, code or regulation is required, selection from among products which comply with requirements including those standards, codes and regulations is Contractor's option.

4. Performance Requirements: Provide products which comply with specific performances indicated, and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated. Overall performance of a product is implied where product is specified with only certain specific performances requirements.

5. Visual Matching: Where matching with an established sample is required, final judgement or whether a product

proposed by Contractor matches sample satisfactorily is Engineer's judgement. Where no product within specified cost category is available, which matches sample satisfactorily and complies with requirements, comply with Contract Document provisions concerning, "substitutions" and "change orders" for selection of a matching product outside established cost category or, of a product not complying with requirements.

6. Visual Selection: Except as otherwise indicated, where specified product requirements include "... as selected from manufacturer's standard colors, patterns, textures.." or words of similar effect, the selection of manufacturer and basic product (complying with requirements) is Contractor's option, and subsequent selection of color, pattern and texture is Engineer's selection. Where specified product requirements include "... as selected from standard colors, patterns, textures available with the industry...", or words to that effect, selection of product (complying with requirements, and within established cost category) is Engineer's selection, including designation of manufacturer where necessary to obtain desired color, pattern or texture.

2.02 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for intended use and effect.

1. Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar applications.

2. Continued Availability: Where additional amounts of a product, by nature of its application, are likely to be needed by the Company at a later date for maintenance and repair or replacement work, provide a standard, domestically produced product which is likely to be available to the Company at such later date.

2.03 DESCRIPTION OF REQUIREMENTS

A. Definitions: "Products" is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for Project or taken from Contractor's stock of previously purchased products. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of Work. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," "special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Substitutions: The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to Contract Documents, where requested by the Company are "changes" not "substitutions." Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions;" and do not constitute a basis for change orders. Otherwise, Contractor's requests for changes in products, materials and methods of construction required by Contract Documents are considered requests for "substitutions," and are subject to requirements hereof.

2.04 REQUESTS FOR SUBSTITUTIONS

Submit 3 copies, fully identified for product or method being replaced by substitution, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Include product data, drawings, description of methods, samples where applicable, Contractor's detailed comparison of significant qualities between specified item and proposed substitution, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitution will result in overall work equal-to-or-better-than work originally indicated.

2.05 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible, for each unit of Work provide products, materials or equipment of a singular generic kind and from a single source.

B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product or material, select an option which is compatible with other products and materials already selected (which may have been from among options for those other products and materials). Total compatibility among options is not assured by limitations within Contract Documents, but must be provided by Contractor. Compatibility is basic general requirement of product selections and material selections.

C. Contractor shall employ specified materials and methods unless they are contrary to manufacturer's directions or recommended trade practices, or unless he believes they will not produce results which he will warrant as required. In which case, he shall notify the Company in writing and request a determination. Deviation from materials and procedures specified will be permitted only upon the Company's approval and providing the Work is warranted by the Contractor and related manufacturers.

PART 3 EXECUTION

3.01 EXAMINATION

The Contractor admits that, before submitting his proposal, he has the visited the site and familiarized himself with the existing conditions and the conditions under which the Work must be performed.

3.02 WORKMANSHIP STANDARDS

The Contractor shall instigate and maintain procedures to ensure that persons performing Work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality-levels for workmanship in completed Work. Remove and replace Work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other Work damaged or deteriorated by faulty workmanship or its replacement. All workmanship shall be first class and in accordance with modern practice.

3.03 CLEANING

All rubbish existing on the site at the beginning of construction shall be promptly removed. The Work site shall be kept clean at all times during the operations. Rubbish, debris, discarded or condemned materials shall be removed daily. Burning trash on the site is forbidden. Upon completion of the work, the surroundings shall be thoroughly cleaned and left in a condition satisfactory to the Superintendent.

3.04 DANGEROUS CONDITIONS

It shall be the Contractor's responsibility to immediately stop operations which could be considered as eminently dangerous to persons in the immediate vicinity or to operations on the Project Site. The Contractor shall immediately advise the Company of the situation which caused the Work to be stopped, or any portion thereof, so that administrative steps can be taken by the Company to prevent recurrence of the situation.

3.05 ACCIDENT PREVENTION AND SAFETY

A. All employees of the Contractor and employees of his subcontractors shall wear hard hats at all times on all portions of the site.

B. Erect and maintain, as required by conditions and progress of the Work, all safeguards for safety and protection, including fences, railings, barricades, lighting, posting of danger signs and other warnings against hazards.

C. The Contractor shall be solely responsible for initiating, maintaining and supervising safety precautions and programs in connection with the Project.

D. Build scaffolds in accordance with requirements of local and federal laws and regulations.

END OF SECTION 01100

DIVISION 2 - SITEWORK

Table of Contents

DIVISION 2

SECTION 02010

SUBSURFACE INVESTIGATION

PART 1 GENERAL

1.01 SUMMARY

Section describes soils investigation at the site, and use of data resulting from that investigation.

1.02 SUBSURFACE INVESTIGATION REPORT

A. General:

1. A report shall be prepared for the Company.

2. The report may be inspected at the office of the Engineer.

B. Use of data:

1. This report was obtained for the Engineer's use and is not a part of the Contract Documents.

2. The report is available to bidders for information only, and is not a warranty of subsurface conditions.

3. Prior to bidding, bidders may make their own subsurface investigations. Investigations shall be arranged in advance through the Superintendent.

1.03 QUALITY ASSURANCE

A. A construction materials testing engineer will be retained by the Company to observe performance of work in connection with excavating, trenching, filling, backfilling, and grading and to perform compaction tests.

B. All the excavated material shall be sampled for petroleum hydrocarbons, metal, PAHs and PCB at a minimum. Any soil that cannot be reused as backfill shall be containerized in containers provided by Pepco for disposal by Pepco.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 02010

DIVISION 2

SECTION 02070

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes providing the labor, materials, equipment services and supervision necessary for and reasonably incidental to complete the demolition work including, but not limited to, the following:

1. Saw-cut openings in concrete pavements and pads.

2. Saw-cut openings in flexible pavements.

3. Removal of portions of exterior wall to provide for removable masonry panel.

4. Saw-cut concrete curb and gutter.

5. Removal of existing storm drain pipes.

6. Selective removal of miscellaneous debris.

B. Related Sections

1. Section 03730, Concrete Rehabilitation

2. Section 04520, Masonry Restoration

1.02 SYSTEM DESCRIPTION

A. Provide excavations and trenches for installation of underground storm drain pipes and structures and stormwater management facilities.

1.03 SUBMITTALS

A. Submit schedule of operations for selective demolition work to Superintendent for review and approval.

1. Provide detailed sequence of demolition and removal work to ensure uninterrupted progress of on-site operations.

2. Coordinate with Superintendent for occupancy of building by Company personnel.

1.04 SITE CONDITIONS

A. The Work will be carried out at a facility housing sensitive electrical equipment. Minimize vibrations which could disturb this equipment.

B. Company personnel will occupy the building(s) immediately adjacent to areas of selective demolition.

1. Conduct selective demolition work in manner that will minimize need for disruption of normal operations.

2. Provide minimum of 72 hours advance notice of demolition activities that will affect normal operations.

C. Condition of Structures: Company assumes no responsibility for actual condition of items or structures to be demolished.

D. Damages: Promptly repair damages caused to adjacent facilities by demolition work.

E. Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

F. Flame Cutting:

1. Do not use cutting torches for removal until work area is cleared of flammable materials.

2. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations.

3. Maintain portable fire suppression devices during flame-cutting operations.

G. Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

H. Environmental Controls: Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

PART 2 PRODUCTS

A. Equipment:

1. Equipment capable of saw-cutting flexible pavement and concrete in true straight lines.

2. Equipment capable of breaking up and removing flexible pavement and concrete.

3. Equipment capable of excavating deep trenches for new storm drain pipes and large footprints for new storm drain structures and stormwater facilities.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

1. Correct conditions detrimental to timely and proper completion of the Work.

2. Do not proceed until unsatisfactory conditions are corrected.

B. Verify the extent and location of selective demolition required.

1. Carefully identify limits of selective demolition.

2. Mark interface surfaces to identify items to be removed and items to be left in place.

3.02 PREPARATION

A. Provide temporary barricades and other forms of protection prior to commencement of selective demolition work.

1. Provide protective measures to provide free and safe passage of Company personnel to occupied portions of building.

2. Protect existing finish work that is to remain in place and becomes exposed during demolition operation.

3. Construct temporary insulated dustproof partitions to isolate areas where noisy or extensive, dirty or dusty operations are performed. Equip partitions with dustproof doors and security locks.

4. Provide temporary weather protection during interval between demolition and new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

5. Remove temporary devices at completion of Work.

B. Provide bracing or support to prevent movement, settlement, or collapse of work to be demolished and adjacent facilities to remain.

C. Cover and protect equipment and fixtures from soilage or damage when demolition work is performed in areas where such items have not been removed.

3.03 DEMOLITION

A. General:

1. Demolish concrete and flexible pavement in small sections. Cut concrete and flexible pavement at junctures with construction to remain using power-driven saw or hand tool; do not use power-driven impact tools.

2. Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

B. If unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure both nature and extent of the conflict. Submit report to Superintendent in written, accurate detail. Prearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose of demolished material off site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

2. Burning materials is not permitted on project site.

3.05 CLEANUP AND REPAIR

A. General:

1. Repair demolition performed in excess of that required.

2. Return elements of construction and surfaces to remain to condition existing prior to start of operations.

3. Repair adjacent construction or surfaces soiled or damaged by selective demolition Work.

4. Leave areas stabilized and/or broom clean.

END OF SECTION 02070

DIVISION 2

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes providing the labor, materials, equipment, services, and supervision necessary for and reasonably incidental to complete the site preparation work including, but not limited to the following:

B. Products Installed but not Furnished Under this Section:

1. Section 03300, Cast-in-Place Concrete
2. Section 02235, Granular Base Course

C. Related Sections

1. Section 02200, Earthwork
2. Section 02270, Sediment and Erosion Control
3. Section 02900, Landscaping

1.02 SYSTEM DESCRIPTION

1.03 SUBMITTALS

Submit written notification to public utility companies.

1.04 SITE CONDITIONS

PART 2 PRODUCTS

2.01 EQUIPMENT

A. Equipment capable of saw-cutting masonry, concrete and slate in true, straight lines.

B. Equipment capable of breaking up and removing concrete slabs and foundations and asphalt paving.

C. Equipment capable of removing trees and shrubs to a depth of one foot below grade.

D. Equipment capable of excavating for and removing abandoned underground utilities, structures and tree stumps and roots.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions.

B. Submit plan for protecting, bracing and shoring existing structures and utilities.

3.02 PREPARATION

Install "Tree Protection Detail" prior to start-up activities including equipment and facilities move-in.

3.03 INSTALLATION

END OF SECTION 02100

DIVISION 2

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section includes providing the necessary labor, materials, equipment, services, and supervision for clearing, grubbing, excavating, pumping, filling, backfilling, mucking, rough and fine grading to elevations shown, complete as required for the building and incidental construction.

B. Products Installed but not Furnished Under this Section:

1. Cast-in-Place Concrete, Section 03300

2. Granular Base Course, Section 02235

C. Related Sections

1. Section 02100, Site Preparation

2. Section 02270, Sediment and Erosion Control

3. Section 02500, Paving and Surfacing

4. Section 02700, Sewerage and Drainage

5. Section 02900, Landscaping

D. Unit Prices:

1. Additional labor and material required to rectify unsuitable soil conditions not described in the "Geotechnical Engineering Study" will be paid for on the basis of unit prices.

2. Material declared unsuitable for backfill by the Geotechnical Engineer (not so identified in the "Geotechnical Engineering Study") and which cannot be corrected by ordinary methods such as spreading and drying, shall be removed from the site and replaced with suitable controlled fill.

3. Subgrade under slabs and pavements declared unsuitable by the Geotechnical Engineer (not so identified in the Geotechnical Engineering Study") shall be over-excavated, removed and replaced with suitable controlled fill.

4. All the excavated material shall be sampled for petroleum hydrocarbons, metal, PAHs and PCB at a minimum. Any soil that cannot be reused as backfill shall be containerized in containers provided by Pepco for disposal by Pepco.

5. Work Covered by Unit Prices

    a. Load, remove and dispose of unsuitable material.

    b. Provide No. 57 stone.

    c. Provide CR-6 stone.

    d. Provide suitable natural material.

    e. Provide No. 2 stone.

6. Work included in base contract amount and not subject to additional compensation.

    a. Place and compact backfill material in trenches.

    b. Stockpile and handle fill material.

7. Method to be used for measuring the quantities:

    The amount of imported material in cubic yards is equivalent to the amount of unsuitable material removed from the site, verified by delivery tickets.

1.02 REFERENCES

A. American Society of Testing and Materials Standard Specifications (ASTM)

1. D698-YY - Moisture - Density Relations

2. D1556-YY - Density of Soil in Place

3. C144-YY - Aggregate for Masonry Mortar

4. D2940-YY - Graded Aggregate Material

5. D448-YY - Aggregate for Road and Bridge Construction

B. Unified Soil Classification System

C. District of Columbia Department of Transportation (DDOT)

1. Standard Specifications for Highways and Structures

D. District of Columbia Department of Energy & Environment (DOEE)

1. 2003 Sediment and Erosion Control Handbook

1.03 QUALITY ASSURANCE

A. Perform earthwork in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service:

1. Testing and inspection of fill material and compaction shall be performed by a qualified Geotechnical Engineer.

2. The Company will select and pay for geotechnical engineering services.

3. The Contractor shall notify the Superintendent at least 24 hours in advance of activities requiring geotechnical engineering services.

C. Quality Control Testing During Construction: Testing service shall inspect and approve all subgrades and fill layers before further construction work is performed thereon. Tests of subgrades and fill layers will be taken as follows:

1. Foundation excavations to determine suitability for proposed foundations and loads.

2. Controlled backfill material for compliance with specification under footings, slabs and pavement.

3. Tests will be made in locations as directed by the Geotechnical Engineer.

D. If, based on reports of testing service and inspection, subgrade or fills which have been placed are below specified density, the Contractor shall provide additional compaction at no additional expense to the Company.

1.04 SITE CONDITIONS

A. No clearing of trees will be permitted except as shown on the Drawings.

B. Earthwork operations near listed trees shall be performed so as not to disturb the root systems.

C. Grass shall not be stripped or destroyed except in those areas where the building, driveway, duct lines or pipe lines are to be constructed, or in areas designated for storage or construction sheds. Maintain and protect vegetation to control erosion.

D. Existing Utilities: Locate existing underground utilities in the areas of work. Protect remaining utilities during earthwork operations.

E. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions.

1. Cooperate with the Company and utility companies in keeping respective services and facilities in operation.

2. Repair damaged utilities to satisfaction of utility owner.

F. Protection of Listed Trees:

1. No material is to be stockpiled, stored or placed within the limits of the "Tree Protection Detail".

2. No construction activity is to take place within the limits of the "Tree Protection Detail".

3. No waste liquid is to be disposed of anywhere on the site.

4. The "Tree Protection Detail" is to be in place prior to the start of construction activities, maintained throughout the construction period, and removed only upon the Superintendent's notification.

5. The Contractor shall be responsible for all types of damage or disturbance which he or his Subcontractors cause to any listed tree.

6. The Contractor shall report, in writing, to the Superintendent any damage or disturbance to or

unauthorized activity within the "Tree Protection Detail".

G. Protection of Persons and Property:

1. Post warning lights and barricade open excavations.

2. Maintain lights and barricades throughout open excavation period.

3. Remove when excavation is backfilled.

H. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Soil Materials:

1. Satisfactory soil materials for fill are defined as those described in the Unified Soil Classification System as GW, GP, GM, SW, SP, and SM; and relatively clean, granular material containing less than 10% passing the No. 200 sieve.

2. Unsatisfactory soil materials for fill are defined as those described as the Unified Soil Classification Systems as, CH, ML, CL, MH, OL, OH and PT or the following:

   a. Any deleterious, soft or yielding material encountered in cuts or in fills as a result of trapping water.

   b. Materials containing high silt content.

   c. Frozen material.

   d. Earth containing more than 4% by weight of organic material.

   e. Earth weighing less than 100 1b/cu ft. (maximum laboratory dry weight).

3. Structural fill material shall be approved by the Geotechnical Engineer.

4. Backfill and Fill Materials: Satisfactory soil consists of granular material free of clay, rock, or gravel larger than 2" in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.

   a. Soils must have moisture factor not to exceed 40 and a plasticity index not to exceed 20 unless noted otherwise in the Soils Report.

   b. The top 18" of subgrade fill under lawn areas shall contain no more than 10% rock or gravel.

   c. Existing site material may be used as fill or backfill upon approval of the Geotechnical Engineer.

2.02 EQUIPMENT

Provide hoist or other suitable equipment as required to facilitate testing. Remove such equipment after its function has been served.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which excavating, filling and grading are to be performed.

B. Notify the Engineer, in writing, of conditions detrimental to the proper and timely completion of the work.

C. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

Section 02100, Site Preparation

3.03 EXCAVATION

A. Excavation is unclassified and includes the removal of materials encountered in the depth and extent indicated.

   1. Extra charges for excavation in material described by the soil report will not be honored.

   2. This includes excavation in clay and excessively wet soils.

3. Excess material and objectionable material resulting from excavation work shall become the property of the Contractor and shall be removed from the site and legally deposited at the Contractor's expense in an area approved by the appropriate jurisdiction.

4. All the excavated material shall be sampled for petroleum hydrocarbons, metal, PAHs and PCB at a minimum. Any soil that cannot be reused as backfill shall be containerized in containers provided by Pepco for disposal by Pepco.

B. After stripping has been completed, the exposed subgrade soils within the building lines shall be inspected by the Geotechnical Engineer.

1. Proof-roll with a fully loaded 10-wheel dump truck to locate any pockets of soft or loose soils.

2. One complete coverage with overlap should be made. Any loose on soft zones detected shall be overexcavated and replaced with suitable controlled fill.

C. Because of limitations within the construction area, all excavated material shall be removed from the site, or used only in fill or backfill areas where specifically approved by the Engineer.

1. Stockpile satisfactory excavated material at the direction of the Superintendent until required for fill or backfill.

D. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be at the Contractor's expense.

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending the indicated bottom elevation of the footing or base to the excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

2. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

E. Soils exposed in the bases of all satisfactory foundation excavations shall be protected against any detrimental change in condition such as disturbance from rain or frost.

1. Surface run-off water shall be drained away from the excavations and not be allowed to pond.

2. Footing concrete should be poured the same day the excavation is made.

3. If this is not possible, the footing excavations shall be adequately protected by placing a 2 to 4 inch thick "mud-mat" of lean (2000 psi) concrete on bearing soils. Maintain indicated bottom elevation of the footing.

F. All soils unsuitable for foundations shall be removed from the site and replaced with an acceptable fill material at no additional expense to the Company.

1. All the excavated material shall be sampled for petroleum hydrocarbons, metal, PAHs and PCB at a minimum. Any soil that cannot be reused as backfill shall be containerized in containers provided by Pepco for disposal by Pepco.

G. Excavation for Structures: Conform to elevations and dimensions shown extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.

1. In excavating for footings and foundations, take care not to disturb bottom of excavation.

   a. Hand excavate to final grade just before concrete reinforcement is placed.

   b. Trim bottom required lines and grades to leave solid base to receive concrete.

2. Level and clean excavations of all loose rock, dirt and debris and standing water prior to pouring concrete.

H. Excavation for Trenches: Dig trenches to the uniform width required for the particular item to be installed, sufficiently wide to provide ample working room.

1. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations.

2. Excavate for exterior waterbearing piping so top of piping is not less than 3'-6" below finished grade.

3. Backfill trenches with concrete where trench excavations pass within 18" of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.

4. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

5. For piping or conduit less than 2'-6" below surface of roadways, provide 4" thick reinforced concrete base slab support. After installation and testing of piping or conduit, provide minimum 4" thick encasement (sides and top) of reinforced concrete prior to backfilling or placement of roadway subbase.

I. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.04 SHORING, BRACING AND PUMPING

A. Maintain stability of excavations.

1. Slope sides of excavations to comply with local codes and authorities having jurisdiction.

2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

3. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.

B. Shore and brace excavations with members of suitable sizes effectively placed to limit the extent of the excavation.

1. Safely remove shoring members as backfilling progresses.

2. Establish requirements for shoring and bracing to comply with local codes and authorities having jurisdiction.

C. Excavations shall be kept free from surface and ground water by pumping or other appropriate measures. Insure that excessive fine-grained soil material is not removed by pumping operations.

3.05 BACKFILL

A. Place fill in six-inch layers, thoroughly compacted to 95% of maximum density, at optimum moisture content, in accordance with ASTM D1557. Frozen soil or soil containing snow, ice or ice particles shall not be used for backfill. The Contractor shall not attempt to compact frozen soil.

B. Place backfill around the foundation as the construction work progresses. Do not place backfill against concrete foundation walls until the concrete has attained at least 70% of its design strength, unless otherwise directed by the Superintendent. Backfilling of trenches for duct and utility lines shall progress as rapidly as the construction and testing of the work will permit.

C. Compact porous fill under floor slabs with at least three passes of a vibrating roller having a static weight of at least one ton. Obtain approval of the Geotechnical Engineer prior to pouring the slab.

D. During the placement of backfill along a wall, do not overload the wall due to heavy compaction equipment. Only lightweight (a maximum of one ton total weight) equipment is allowed within five feet of a wall.

E. Compact porous base and sub-base under walkways to 95% of maximum density with a vibratory compactor.

3.06 GRADING

A. Uniformly grade disturbed areas including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding.

Finish surfaces free from irregular surface changes and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil or sod to within not more than 0.10' above or below the required subgrade elevations.

2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10' above or below the required subgrade elevation.

3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2" above or below the required subgrade elevation.

C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified and to required elevations. Provide final grades within a tolerance of 1/2" when tested with a 10' straight edge.

D. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density specified.

E. Top Soil Preparation

1. Before applying permanent sod, establish a bed using existing soil mixed with lime and fertilizer. Work lime and fertilizer uniformly and thoroughly into the soil using a disc harrow or other appropriate tool.

2. Pulverized dolomitic limestone (lime) shall have a pH valve between 6.0 and 6.5 and shall be applied at a rate of 2,000 Lbs. per acre.

3. Apply fertilizer as follows:

   a) 0-20-0, superphosphate, or its equivalent at 500 to l,000 lbs. per acre, plus,

   b) l0-l0-l0, or its equivalent, at l,000 lbs. per acre.

3.07 PAVEMENT SUBBASE COURSE:

Subbase course consists of placing subbase material, in layers of specified thickness, over subgrade surface to support a pavement base course. Perform work in accordance with District of Columbia Department of Transportation (DDOT) Standard Specifications for Highways and Structures.

3.08 TESTS

A. Prior to fill operations, collect and test samples of the proposed fill. Determine the maximum dry density, optimum moisture content, gradation and plasticity characteristics of the samples. These tests are necessary for quality control of the compacted fill and to verify that the fill material is acceptable.

B. The Geotechnical Engineer will inspect the footing excavation to verify that the bearing soils are similar to those encountered in the soil test borings and are capable of supporting the proposed loads. Portable dynamic cone penetrometer tests will be conducted in questionable footing excavations to verify the density or consistency of the bearing soil.

C. The fill shall be well-drained to prevent water from accumulating. Halt fill operation if the surface soils become excessively wet or frozen and consult the Geotechnical Engineer. Testing and inspection of fill material and compaction under the supervision of a qualified Geotechnical Engineer is essential for the successful completion of the fill operations. At least one field density test per 2,500 square feet of fill per layer will be conducted to verify compaction compliance.

END OF SECTION 02200

DIVISION 2

SECTION 02235

GRANULAR BASE COURSE

PART I GENERAL

1.01 SUMMARY

A. Section includes providing the necessary labor, materials, equipment, services and supervision for and reasonably incidental to complete the following:

1. Stone fill for transformer foundations.

2. Yard stone.

3. Porous fill under footings, slabs and pavements.

4. Pipe bedding material.

5. Stone riprap.

B. Related Sections

1. Section 02100, Site Preparation

2. Section 02200, Earthwork

3. Section 02500, Paving and Surfacing

4. Section 02700, Sewerage and Drainage

5. Section 03300, Cast-in-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D448-YY: Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

2. D2940-YY: Standard Specification Graded Aggregate Materials for Basis or Subbases for Highways or Airports.

B. American Association of State Highway and Transportation Officials (AASHTO)

1. M43: Specifications for Materials

C. District of Columbia Department of Transportation (DDOT)

1. Standard Specifications for Highways and Structures

2. Manual for Design and Engineering

3. Standard Drawings

D. District of Columbia Water and Sewer Authority

1. Project Design Manual

1.03 SUBMITTALS

Submit a written certification from the materials supplier that the stone delivered to the site is as specified herein.

1.04 QUALITY ASSURANCE

A. Testing and Inspection Service:

1. Testing and inspection of stone fill material and compaction will be performed by a qualified Geotechnical Engineer, selected and paid for by the Company.

2. Notify the Superintendent at least 24 hours in advance of activities requiring geotechnical engineering services.

3. The testing service will inspect and approve stone fill as required.

4. Provide hoist or other suitable equipment as required to facilitate testing. Remove such equipment after its function has been served.

B. Provide Work in compliance with applicable requirements of governing authorities having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle material in a manner which will preserve grading characteristics.

B. Store materials to permit free drainage and to avoid contamination with deleterious matter or other aggregates.

C. When material is stockpiled on ground, discard bottom 6 inches of pile.

1.06 PROJECT CONDITIONS

Material containing asbestos shall not be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. Transformer foundations:

1. ASTM D448 Size No. 3 - Washed bluestone.

B. Yard stone:

1. ASTM D448 Size No. 57 - Washed bluestone.

C. Porous fill under concrete slabs:

1. ASTM D448 Size No. 57 - Washed bluestone.

D. Pipe bedding material:

1. ASTM D448 Size No. 8 - Washed bluestone.

E. Riprap:

1. M.S.H.A. Class I, reasonably well graded from the smallest to the largest size.

F. Fill under brick pavers:

1. Well compacted stone screenings, well graded with particle sizes ranging from 3/16 inch diameter to zero.

G. Driveway Base and Subbase Material:

1. ASTM D2940 - Bases (DGAB)

2. ASTM D2942 - Subbases (CR-6)

H. Engineered Backfill: (Section 02200)

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are ready to receive the Work of this Section. B. Do not proceed with stone fill operations until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Fine grade all disturbed areas prior to the spreading of the yard bluestone.

B. Finish grade shall be as shown on the drawings.

C. Vegetation within the area to be covered by yard bluestone shall be thoroughly destroyed and removed from the site.

D. Do not spread yard bluestone until completion of foundations, grounding, and storm water management construction.

3.03 INSTALLATION

A. Fill transformer foundations with stone to the required level prior to the transformer installation.

B. Cover areas inside the fence line with a minimum of 4 inches of yard stone.

C. Install porous fill to a minimum depth of 6 inches under all concrete slabs.

D. Install pipe bedding material in accordance with the standard practice of the governing agency or jurisdiction.

E. Hand place riprap at culverts and endwalls so that finished surface forms a plane surface with no large void areas.

END OF SECTION 02235

DIVISION 2

SECTION 02270

SEDIMENT AND EROSION CONTROL

PART l GENERAL

1.01 SCOPE

A. Section includes providing the materials, labor, equipment services and supervision necessary for and reasonably incidental to the construction of the sediment and erosion control devices and appurtenances, complete.

B. Related Sections

1. Section 02100, Site Preparation
2. Section 02200, Earthwork
3. Section 02700, Sewerage and Drainage
4. Section 02900, Landscaping

1.02 REFERENCES

2003 District of Columbia Standards and Specifications for Soil Erosion and Sediment Control

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS): National Conservation Practice Standards.

1.03 SUBMITTALS

Sediment Control Plans must be submitted, as required by the governing agencies and jurisdictions for all off-site waste or borrow areas prior to the import or export of waste to or from the site.

1.04 REGULATORY REQUIREMENTS

Comply with 2003 District of Columbia Standards and Specifications for Soil Erosion and Sediment Control and DOEE Inspector. Refer to Appendix A for standard Specifications and Details.

Install Soil Erosion and Sediment Controls in compliance with Soil Erosion and Sediment Control Plans, Details, and Notes contained in the Contract Documents.

PART 2 PRODUCTS

Materials and equipment required to complete the Work of this section.

PART 3 EXCECUTION

3.01 EXAMINATION

The Contractor shall periodically inspect the site and alter construction procedures that are contributing to siltation of neighboring areas.

3.02 INSTALLATION

A. Excavation

1. Limit excavation to that area necessary to construct the building, driveway, and appurtenances.

2. If, after clearing or grading, the site is left unworked for such a time that erosion may take place, the site shall be stabilized to prevent erosion.

3. Fill material stored on the site shall be suitably protected to prevent erosion.

B. Grading

1. Grading of the site shall be carried out in such a fashion as to follow the contours of the site.

2. If grading is halted before the entire site had been graded, a windrow shall be constructed between the graded and ungraded sections of the site.

C. Sediment and erosion control devices shall be installed prior to commencing excavation.

D. Remove sediment and erosion control devices when final site stabilization has been completed.

END OF SECTION 02270

DIVISION 2

SECTION 02500

PAVING AND SURFACING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes materials, labor, equipment, services and supervision necessary for and reasonably incidental to the completion of the paving and surfacing work including, but not limited to the following:

1. Asphaltic Concrete Paving

2. Brick Pavers

3. Concrete Paving

4. Precast Concrete Curbs

B. Products Installed but not Furnished Under this section:

1. Cast-in-Place Concrete, Section 03300

2. Granular Base Course, Section 02235

3. Structural Precast Concrete, Section 03410

C. Related Sections

1. Section 02200, Earthwork

2. Section 02700, Sewerage and Drainage

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. D1752-YY - Preformed Expansion Joint Filler

B. American Association of State Highway and Transportation Officials (AASHTO)

C. District of Columbia Department of Transportation (DDOT)

1. Standard Specifications for Highways and Structures
2. Manual for Design and Engineering
3. Standard Drawings

D. District of Columbia Water and Sewer Authority

1. Project Design Manual

1.03 SYSTEM DESCRIPTION

The driveway entrance, public space work and asphalt driveway shall be installed to conform to the materials, geometry and workmanship requirements of the District of Columbia Department of Transportation (DDOT) Standard Specifications for Highways and Structures.

1.04 SUBMITTALS

Submit a written certification from the supplier that the asphaltic concrete paving is as specified herein.

1.05 Warranty

The Contractor shall guarantee to maintain the replaced asphalt and concrete pavement and curb and gutter for a period of two years from date of placing the material.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bituminous Paving

1. Base and Sub-base material - Section 02200.
2. Binder course - 4 inch thick.
3. Surface course - 2 inch thick.

B. Concrete Paving

1. Driveway Apron - DCDOT Standard Pavement, 8 inch slab.
2. See Section 03300 for concrete mix.
3. Expansion joint filler-Cork, ASTM Dl752, Type III.

a. Base - Stone Screenings, Section 02235

b. Thickness - 2 inches

2. Brick Pavers - ASTM C902, Class SX, Type II.

3. Size - Nominal dimension units: 3-5/8 in. by 7-5/8 in. by 2-1/4 in. thick

4. Pattern - [Herringbone]

5. Joints - Stone screenings filled, 3/8 inch.

D. Precast Concrete Curb

1. Section 03410

2. Precast concrete curb may be substituted for poured-in-place curb adjacent to asphalt pavement.

PART 3 EXECUTION

3.01 EXAMINATION

A. The Contractor shall provide all drainage ditches, gutters, and side drains necessary to carry off storm water during the construction work and to maintain the subgrade free from standing water.

B. The Contractor shall insure that proper grades and sections are obtained prior to any paving operations. Hauling on the subgrade after checking will be the minimum practicable and all damage to the subgrade shall be repaired as directed by the Superintendent.

3.02 PREPARATION

After preparation of subgrade as specified in Section 02200, thoroughly scarify and sprinkle the entire area to be paved, and then compact to a smooth, hard, even surface of 90% compaction to receive the aggregates.

3.03 INSTALLATION

A. Placement of Base Courses

1. Sub-base:

a. Spread the specified subbase material to a thickness providing the compacted thickness shown on the Drawings.

b. Compact to 95%.

2. Base:

a. Spread the specified base material to a thicknesses providing the compacted thickness shown on the Drawings.

b. Compact to 95%.

3. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0" to plus 0.5".

4. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 3/8" in ten feet.

a. Deviations: Correct by removing materials, replacing with new materials, and reworking or recompacting as required.

5. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

6. Remove all loose materials from the compacted base.

B. Asphaltic Concrete Paving

1. Install the specified headers and stakes to achieve the arrangement of paving shown on the Drawings.

2. Apply the specified prime coat, and tack coat where required, and allow to dry, in accordance with the manufacturer's recommendations.

3. Adjust frames and covers, if so required, to meet final grades.

4. Receipt of asphaltic concrete materials:

a. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 280 degrees F.

b. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 50 degrees F, nor during fog, rain, or other unsuitable conditions.

5. Spreading:

a. Spread material in a manner which requires the least handling.

6. Rolling:

a. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the Drawings.

b. Roll in at least two directions until no roller marks are visible.

c. Finished paving smoothness tolerance:

1. Free from birdbaths.

2. No deviations greater than 1/8" in six feet.

7. Flood Test

a. Prior to application of seal coat, perform a flood test in the presence of the Superintendent.

b. Method:

1. Flood by the entire asphaltic concrete paved area with water by use of a tank truck or hoses.

2. If a depression is found where water ponds to a depth of more than 1/8", fill or otherwise correct to provide proper drainage.

3. Feather and smooth the edges of fill so that the joint between fill and original surface is invisible.

8. Seal Coat

a. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer's recommendations as approved by the Engineer.

b. Apply one coat of the specified sealer.

c. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

C. Concrete Paving

1. Place concrete paving in such a manner as to require as little re-handling as possible, and distributed to such depth, above grade, that when consolidated and finished, the slab thickness required will be obtained at all points.

2. After completion of floating, and while the concrete is still plastic, test the surface with a 10 foot straightedge. Correct surface variations exceeding 1/8 inch except at grade changes. Finish with a fine-hair boom drawn over the surface transverse to line of traffic.

3. Form tooled contraction joints in fresh concrete pavement by cutting a groove in the top portion of the slab by means of a cutting blade. Finish all edges with a jointer.

4. The completed surface shall be uniform in color and free of surface blemishes and tool marks.

D. Brick Pavers

1. Install Pavers with joints approximately 3/8 in.

2. Where required, cut paving stones with an approved cutter to fit accurately, neatly and without damaged edges.

3. Tamp paving stones with a mechanical vibrator uniformly level, true to grade and free of movement.

4. Fill voids in joints by sweeping in stone

screenings.

E. Expansion Joint

1. Install cork expansion joint filler at all intersections of pavements and wherever pavement abuts structures, steps or stoops. Hold filler strip in place by means of appropriate installing device.

2. Install specified joint sealer. (Section 07900)

3.04 PROTECTION

A. Protect the paved areas from traffic until cured.

END OF SECTION 02500

DIVISION 2

SECTION 02700

SEWERAGE AND DRAINAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes materials, labor, equipment, services, and supervision necessary for and reasonably incidental to complete the Work of this Section, including but not limited to the following:

1. Storm drainage piping, fittings, and accessories.

2. Catch basins, paved area drainage, manhole access, site surface drainage as indicated.

B. Products Installed but not Furnished under this Section.

1. Granular Base Course - Section 02235

2. Cast-in-Place Concrete - Section 03300

C. Related Sections

1. Section 02200 - Earthwork

2. Section 02500 - Paving and Surfacing

3. Section 15400 - Plumbing

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. C76; Reinforced Concrete Pipe

2. C443; Joints Using Rubber Gaskets

3. D2729; Polyvinyl Chloride Pipe

B. American Association of State Highway and Transportation Officials (AASHTO)

1. M 170-02: Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

2. M 315-03: Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe

3. M 199-99: Standard Specification for Precast Reinforced Concrete Manhole Sections

4. M 91: Standard Specification for Sewer and Manhole Brick

C. District of Columbia Department of Transportation (DDOT)

1. Standard Specifications for Highways and Structures

2. Manual for Design and Engineering

3. Standard Drawings

D. District of Columbia Water and Sewer Authority (DC Water)

1. Project Design Manual

2. Design Guideline and Sewer Details.

E. District of Columbia Department of Energy & Environment (DOEE) Stormwater Management Guidebook

1.03 SUBMITTALS

A. Submit layout drawings indicating dimensions, layout of piping, gradient of slope, locations and elevations of manholes, catch basins, and appurtenances.

B. Submit manufacturer's shop drawings.

C. Submit manufacturer's installation instructions.

D. Project Record Documents:

1. Submit documents to accurately record location of pipe runs, connections, catch basins, manholes, and invert elevations.

2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.04 REGULATORY REQUIREMENTS

Conform to requirements of the governing agencies and jurisdiction for materials and installation of the Work of this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforced Concrete Pipe

1. Reinforced Concrete Pipe shall conform to ASTM C76, Table V, Wall Type A; mesh reinforcement; inside nominal diameter of sizes as indicated; bell and spigot end joints.

2. Concrete Pipe Joint Device shall conform to ASTM C443, rubber compression gasket joint.

B. Polyvinyl Chloride Pipe

1. ASTM D2729 Schedule 40 Perforated and/or Unperforated per drawings

C. Filter Fabric: Water pervious type

D. Drainage Structures:

1. Grate: Ductile Iron Grade 65-45-12.

2. Frame: Gray Iron Class 35.

3. Construction:

a. Heavy Duty

b. Reinforced Concrete, precast/cast in place per drawings.

c. Set top and grate flush with finished grade.

E. Prefabricated Drain Structures and Best Management Practices

1. Contech®

a. Jellyfish® Filter

b. StormFilter®

2. Approved substitute

H. Pipe Bedding Material - Section 02235 Granular Base Course

PART 3 EXECUTION

3.01 EXAMINATION:

A. Verify that trench cut, excavation base is ready to receive Work, and excavations, dimensions, and elevations are as indicated on Drawings.

B. Make necessary measurements in the field to ensure precise fit of items in accordance with the approved design.

C. Do not begin installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION:

A. Hand trim excavations to required elevations. Correct over excavation with fill material of coarse aggregate, or lean concrete.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.03 INSTALLATION

A. Pipe

1. Install pipe, fittings, and accessories in accordance with referenced standards. Seal joints watertight.

2. Place pipe on minimum 12" deep bed of pipe bedding material.

3. Lay pipe to slope gradients noted on layout drawings, with maximum variation from true slope of 1/8" in 10'0".

4. Install bedding material at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12".

5. Place pipe bedding material in maximum 6" lifts, consolidating each lift.

6. Increase compaction of each successive lift. Refer to Section 02220 for compaction requirements. Do not displace or damage pipe when compacting.

7. Connect to building collection, sump pits, municipal sewer system.

B. Structures and Cleanouts:

1. Form bottom of excavation clean and smooth to correct elevation.

2. Form and place cast-in-place concrete with provision for storm sewer pipe end sections.

3. Establish elevations and pipe inverts for inlets and outlets as indicated.

4. Install riser pipe.

5. Mount lid and frame level in grout, slope as necessary to meet elevation indicated.

C. Prefabricated Drain Structures

1. Install in accordance with manufacturer's instructions.

3.04 CONNECTION TO EXISTING PIPE

Make pipe connections to existing pipe by the use of Standard sewer pipe fittings.

3.05 FIELD QUALITY CONTROL:

A. Perform required tests and inspections including inspections by jurisdictional authority.

B. Backfill only after successful completion such of tests and inspections.

3.06 PROTECTION:

A. Protect finished installation from damage.

B. Protect pipe and pipe bedding material from damage or displacement until backfilling operation is in progress.

END OF SECTION 02700

DIVISION 2

SECTION 02900

LANDSCAPING

PART I GENERAL

1.01 SUMMARY

A. Section includes labor, materials, tools, equipment supervision and services necessary for and reasonably incidental to complete the landscaping Work.

B. Related Sections

1. Section 02100, Site Preparation

2. Section 02200, Earthwork

3. Section 02270, Sediment and Erosion Control

1.02 REFERENCES

FS 0-F-241 - Fertilizer, Mixed, Commercial

1.03 SUBMITTALS

A. Complete materials list of items proposed to be provided under this Section.

B. Complete data on source, size, and quality.

C. Sufficient data to demonstrate compliance with the specified requirements.

1.04 QUALITY ASSURANCE

Perform work with personnel experienced in the work required of this Section under direction of a skilled foreman.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver plant materials immediately prior to placement. Keep plant materials moist.

B. Reject plants when root system does not appear healthy. Reject damaged plants.

1.06 WARRANTY

A. Provide one year warranty from Date of Substantial Completion.

B. Replace plant materials found dead or not in a healthy growing condition.

C. Replacements: Plant materials of same size an species, with a new warranty commencing on date of replacement.

1.07 MAINTENANCE SERVICE

A. Begin maintenance of plant materials immediately after planting and continue until termination of warranty period.

1. Notify Superintendent at least 48 hours in advance of plant maintenance personnel's visit to site.

B. Include measures necessary to establish and maintain plants in a vigorous and healthy growing condition. Include the following:

1. Cultivation and weeding plant beds and tree pits.

a. When herbicides are used for weed control, apply in accordance with manufacturer's instructions.

b. Remedy damage resulting from use of herbicides.

2. Watering sufficient to saturate root system.

3. Disease and insect control.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sod

1. District of Columbia Approved Sod (Class of turfgrass sod shall be Maryland or Virginia State Certified or Approved per Department of Energy & Environment (DOEE) 2003 Sediment and Erosion Control Handbook), composed of 70% Kentucky Bluegrass and 30% Creeping Red Fescue.

2. Provide sod in rolls not less than l'-0"x4'-6".

3. The grass shall have been cut at least 5 days prior to lifting the sod.

4. At root level sod shall be minimum of l" thick.

B. Graded Topsoil

1. Natural, fertile, friable soil, representative of local soils unmixed with the subsoils.

2. 90% free of clay lumps or foreign matter.

3. Acidity range PH6 to 6.5.

C. Fertilizer

1. Non burning plant food with not less than 50% organic matter.

2. Delivered to the site in bags labeled with the manufacturer's guaranteed analysis.

D. Peat Moss

1. Type I shredded sphagnum moss, 95% pure, commercially prepared for planting purposes.

E. Mulch

1. Tanbark, pinebark, medium grade, free of matter injurious to plant growth, 1/4' to 1" in size.

F. Lime

1. Ground dolomitic limestone with not less than 85% total carbonates.

G. Planting Mixture

1. 4 parts screened topsoil and 1 part peat moss organic matter, add 5 lbs. bone meal cu. yd.

H. Bone Meal

1. Finely ground with minimum 2.3% nitrogen and 2.3%

phosphoric acid.

I. Herbicide

1. Granulated Calcium cyamine, Vanpan or approved substitute, commercially prepared to destroy weed seeds.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to timely and proper completion of the Work.

C. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Finish grading performed under Section 02220.

B. Upon completion of finish grading, perform fine grading required in planting areas.

3.03 SODDING

A. Installation

1. All disturbed areas shall receive permanent sod according to this Specification and the Drawings.

2. All sod shall be properly staked on not over three foot centers.

3. Irregular or broken pieces of sod shall not be used except for filling in small residual areas.

B. Maintenance

1. Mow sodded areas to a height of 3 to 4 inches and the cuttings removed if they are heavy enough to smother vegetation.

2. Re-sod areas torn up by the construction equipment.

3. Steep banks shall not be mowed too often or during extremely wet or dry periods, since this may cause vegetation to fail from mechanical scouring and wheel slippage.

4. Repair failures of the sodded areas at sixty day intervals.

3.04 PLANTING

A. Place plant materials for review and final orientation by Superintendent prior to installation.

B. Excavate for plant materials as indicated.

C. Set plant materials relative to grade as originally grown, after settlement.

D. Set plants in pits or beds partly filled with prepared topsoil mixture, at a minimum depth of at least 6" under each plant. Pull away burlap, ropes, wires, etc. from the top of the ball.

E. Place bare root plant materials so roots lie in a natural position. Backfill soil mixture in 6" layers. Maintain plant materials in vertical position.

F. Thoroughly water soil when the hole is half full and again when full. Water plant materials as indicated.

3.05 LISTED TREE FERTILIZATION

A. Fertilizer shall be l0-6-4 applied at the rate of two (2) pounds per inch of trunk diameter.

B. Fertilizer shall be applied to the tree root system by drilling or punching holes in the soil of one and a half (l l/2) to two (2) inches in diameter.

1. Those holes shall be approximately twelve inches deep and shall be located at the drip line of the tree.

2. They shall be in sufficient quantity to assure that the above rate of the application will be obtained.

C. Water trees at the rate of one (l) inch per week.

1. Make all necessary provision to assure that the rate of absorption will be maintained.

    a. Construct a temporary dike around the tree to prevent run-off.

    b. Construct dike on the outside of the tree drip lines except when excavation or construction work may require otherwise.

END OF SECTION 02900

DIVISION 3 – CONCRETE

Table of Contents

DIVISION 3

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Concrete formwork.
2. Concrete accessories.
3. Steel reinforcing.
4. Cast-in-place concrete.
5. Concrete curing.

B. Products Installed but not Furnished under this section:

1. Anchor Bolts and Imbedments, Sections 05120 and 05500

C. Related Sections:

1. Section 02200, Earthwork
2. Section 02500, Paving and Surfacing
3. Section 03600, Grout
4. Section 04200, Unit Masonry
5. Section 05120, Structural Steel

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM A82; Std. Specification for Steel Wire, Plain, for Concrete Reinforcement
2. ASTM A185; Std. Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

3. ASTM A615; Std. Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

4. ASTM C31; Methods for Making and Curing Concrete Test Specimens in the Field

5. ASTM C33; Specification for Concrete Aggregates

6. ASTM C42; Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

7. ASTM C94; Specification for Ready-Mixed Concrete

8. ASTM C143; Standard Test Method for Slump of Portland Cement Concrete

9. ASTM C150; Specification for Portland Cement

10. ASTM C171; Specification for Sheet Materials for Curing Concrete

11. ASTM C172; Standard Method of Sampling Freshly Mixed Concrete

12. ASTM C231; Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

13. ASTM C260; Specification for Air-Entraining Admixtures for Concrete

14. ASTM C309; Specification for Liquid Membrane-Forming Compounds for Curing Concrete

15. ASTM C330; Specification for Lightweight Aggregates for Structural Concrete

16. ASTM C494; Specification for Chemical Admixtures for Concrete

17. ASTM C685; Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing

18. ASTM C1059; Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete

19. ASTM D448; Specification for Standard Sizes of Coarse Aggregate for Highway Construction

20. ASTM E154; Standard Methods of Testing Materials for Use as Vapor Barriers under Concrete Slabs.

21. ASTM E329; Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction

B. American Concrete Institute

1. ACI 211.1; Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

2. ACI 211.2; Standard Practice for Selecting Proportions for Structural Lightweight Concrete.

3. ACI 301; Specifications for Structural Concrete for Buildings

4. ACI 302.1; Guide for Floor and Slab Construction

5. ACI 304R; Guide for Measuring, Mixing, Transporting, and Placing Concrete

6. ACI 305R; Hot Weather Concreting

7. ACI 306R; Cold Weather Concrete

8. ACE 309R; Guide for Consolidation of Concrete

9. ACI 315; Details and Detailing of Concrete Reinforcement

10. ACI 318; Building Code Requirements for Reinforced

Concrete

11. ACI 347; Formwork for Concrete

12. ACI SP4; Formwork for Concrete

13. ACI SP66; ACI Detailing Manual

C. U.S. Army Corps of Engineers

1. CRD-C572; Specification for Polyvinylchloride Waterstop

D. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice

E. U.S. Department of Commerce

1. PS-1; Construction and Industrial Plywood

2. PS-20; American Softwood Lumber

3. CS-236; Mat-Formed Wood Particle - Board

1.03 SYSTEM DESCRIPTION

A. 28-day design compressive strength.

<u>Concrete Type Strength Use</u>

Normal weight 4000 psi Structural Concrete

Light weight 3000 psi Roof fill and duct banks

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for the following:

1. Formwork accessories.

2. Concrete admixtures.

3. Waterstops.

4. Surface Hardener.

5. Nonslip aggregate finish.

6. Curing Compound.

7. Bonding compound.

B. Shop Drawings: Submit shop drawings for fabrication and placement of the following:

1. Reinforcement: Comply with ACI SP-66. Include bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement, and splices. Include details of reinforcement at openings through concrete structures.

C. Quality Control Submittals: Submit the following information related to quality assurance requirements specified herein:

1. Mix designs:

    a. Sieve analysis for fine and coarse aggregate

    b. Test for aggregate organic impurities

    c. Proportions of all materials

    d. Mill certificates for cement

    e. Slump, during laboratory tests

    f. Air content, during laboratory tests

    g. 7-day and 28-day laboratory compression test results (Minimum 3 cylinders for the 7-day and 3 cylinders for the 28-day tests)

2. Certifications: Submit affidavits from an independent testing laboratory certifying that all materials furnished under this section conform to specifications.

3. Placement schedule: Submit concrete placement schedule at the beginning of the project and update bi-weekly. Include location of all joints indicated on drawings, plus anticipated construction joints.

4. Submit batch tickets to the Superintendent complying with ASTM C 685 or delivery tickets complying with ASTM C 94, as applicable, for each load of concrete used in the Work.

    a. Tickets shall contain the additional information specified in the ASTM document.

5. Cold weather concreting: Submit description of planned protective measures.

6. Hot weather concreting: Submit description of planned protective measures.

D. Formwork

1. Working drawings showing details of form types including methods of form construction, erection and removal, design computations, and location of form joints and form ties.

2. Certificates from manufacturers stating that materials meet specified requirements.

3. Early form removal calculations in advance of any early form removal.

1.05 QUALITY ASSURANCE

A. Codes and Standards: Comply with the following documents, except where requirements of the Contract Documents or of governing codes and authorities having jurisdiction are more stringent (Maintain copies of these documents in Construction Trailer):

1. ACI 301-Specifications for Structural Concrete for Buildings

2. ACI 318-Building Code Requirements for Reinforced Concrete

3. CRSI Manual of Standard Practice.

B. Testing Laboratory Services:

1. Company will engage testing laboratory to conduct tests and perform other services specified for quality control during construction.

C. Source of Materials:

1. Approved by the Engineer.

2. Provide materials from same source for the entire project.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site bundled and tagged with metal tags indicating bar size, lengths, and other data corresponding to information shown on placement drawings.

1. Use necessary precautions to maintain identification after bundles are opened.

2. Store concrete reinforcement materials at the site off the ground. Prevent damage and accumulation of dirt or rust.

B. Store cementitious materials in a dry, weathertight location. Maintain accurate records of shipment and use.

C. Store aggregates to permit free drainage and to avoid contamination with deleterious matter or other aggregates. When stockpiled on ground, discard bottom 6 inches of pile.

D. Handle aggregates to avoid segregation.

1.07 PROJECT CONDITIONS

A. Cold-Weather Concreting: Comply fully with the recommendations of ACI 306R.

B. Hot-Weather Concreting: Comply fully with the recommendations of ACI 305R.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Facing Materials:

1. Unexposed finish concrete: Any standard form materials that produce structurally sound concrete. Provide lumber dressed on at least two edges and one side for tight fit.

2. Exposed finish concrete: Materials selected to offer optimum smooth, stainfree final appearance and minimum number of joints.

3. Provide materials with sufficient strength to resist hydrostatic head without bow or deflection in excess of allowable tolerances, and as follows:

a. Lumber: PS-20l, Stress-graded, dressed on contact side.

b. Plywood: PS-1, B-B (Concrete Form) Plywood," Class I, Exterior Grade, mill-oiled and edge-sealed.

c. Hardboard: CS-236, Tempered, Smooth one-side not less than 3/16 inch thick.

B. Formwork Accessories:

1. Form release agent: Commercial formulation form-coating compound that will not bond with, stain, or otherwise adversely affect concrete surfaces, and which will not impair subsequent coating of concrete surfaces.

2. Metal ties: Commercially manufactured types; cone snap ties, taper removable bolt, or other type which will leave no metal closer than 1-1/2 inches from surface of concrete when forms are removed, leaving not more than a 1-inch-diameter hole in concrete surface.

3. Fillets: Wood or plastic fillets for chamfered corners, in maximum lengths possible.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars:

1. ASTM A 615, Grade 60.

2. Fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with the CRSI Manual.

3. In the case of fabricating errors, do not straighten or rebend reinforcement in a manner that will weaken or injure the material.

4. Reinforcement with any of the following defects will be rejected:

a. Bar lengths, depths, and/or bends exceeding the specified fabrication tolerances.

b. Bends or kinks not shown on the Drawings.

c. Bars with reduced cross-section due to excessive rusting or other cause.

B. Welded Wire Fabric: ASTM A 185, plain cold-drawn steel.

C. Reinforcing Accessories:

1. Tie wire: ASTM A82, Black annealed type, 16-1/2 gage or heavier.

2. Supports: Bar supports conforming to specifications of CRSI Manual of Standard Practice.

a. Class 1 (plastic protected) at all formed surfaces which will be exposed to weather.

b. Class 1 (plastic protected) or Class 2 (stainless steel protected) at all formed surfaces which will be exposed to view but not to weather.

c. Precast concrete blocks of strength equal to or greater than specified strength of concrete or Class 3 supports equipped with sand plates, where concrete will be cast against earth. Wood, brick, or other non-complying material will not be accepted.

2.03 CONCRETE MATERIALS

A. Portland Cement, ASTM C150, Type I, II

B. Aggregates:

1. Normal weight concrete: ASTM C33, sand, gravel or crushed stone, free from soft, thin elongated pieces, disintegrated stone, dirt, organic, or other injurious materials occurring either free or as a coating.

2. Light weight concrete: ASTM C330, composed predominately of lightweight-cellular and granular inorganic material.

C. Water: Potable, clean and free of injurious quantities of substances known to be harmful to Portland Cement.

D. Admixtures: The following types of admixtures may be used when approved by the Engineer certified by manufacturer to be compatible with other required admixtures.

1. Air-Entraining Admixture: ASTM C 260

a. "Air Mix"; the Euclid Chemical Company.

b. "Sika-Aer"; Sika Corporation.

c. "Micro-Air"; Master Builders, Inc.

d. "Darex AEA" W. R. Grace & Co.

e. "Pro Tex AES" - Procrete Industries

2. Water-Reducing Admixture: ASTM C 494, Type A.

a. "Eucon WR-75"; The Euclid Chemical Company.

b. "Plastocrete 161"; Sika Corporation.

c. "Pozzolith Normal"; Master Builders, Inc.

d. "WRDA Hycol"; W. R. Grace & Co.

e. "Prokrete N"; Prokrete Industries.

3. Water-Reducing, Retarding Admixture: ASTM C 494, Type D.

    a. "Eucon Retarder 75"; The Euclid Chemical Company.

    b. "Plastiment"; Sika Corporation.

    c. "Pozzolith Retarder"; Master Builder, Inc.

    d. "Daratard-17"; W. R. Grace & Co.

    e. "Protard"; Prokrete Industries.

4. Water-Reducing and Accelerating Admixtures: ASTM C 494, Type E.

    a. "Accelguard 80"; The Euclid Chemical Company.

    b. "Pozzutec 20"; Master Builders, Inc.

    c. "Gilco Accelerator"; Gifford-Hill & Company, Inc.

5. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or G.

    a. "Eucon 37"; The Euclid Chemical Company.

    b. "Sikament"; Sika Corporation.

    c. "Rheobuild"; Master Builders, Inc.

    d. "WRDA 19" or "Daracem-100"; W. R. Grace & Co.

    e. "PSP Superplasticizer"; Prokrete Industries.

6. Calcium chloride shall not be permitted in the concrete as an intentional additive.

2.04 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Reglets:

1. Not less than 26 gage galvanized steel sheet at locations indicated.

B. Waterstops:

1. Polyvinyl chloride; Corps of Engineers CRD-C 572.

   a. Manufacturers:

      1. The Burke Company.

      2. Greenstreak Plastic Products Company.

      3. W. R. Meadows, Inc.

      4. Vinylex Corporation.

C. Vapor Barrier: Underslab

1. Polyethylene sheet, minimum 10 mils thick, black or clear.

2. Waterproof, reinforced Kratt paper.

   a. Moistop-Fortifiber Corp.

D. Nonshrink Grout: Section 03600

E. Surface Hardener: Graded, iron aggregate base compound in a cementitious binder for dry-shake application and trowel embedment in fresh concrete floor surface:

1. Products:

   a. "Euco-Plate"; The Euclid Chemical Company

   b. "Ferrolith H"; Sonneborn Building Products Division/ChemRex, Inc.

   c. "Masterplate 200"; Master Builders, Inc.

F. Nonslip Aggregate Finish: Fused aluminum oxide grits or crushed emery abrasive aggregate for nonslip finish, certified by manufacturer to be rustproof, nonglazing, and unaffected by freezing, moisture, and cleaning materials. Provide material which has been factory-graded and packaged.

G. Moisture-Retaining Cover: ASTM C 171:

1. Waterproof paper.

2. Polyethylene film.

3. Polyethylene-coated burlap.

H. Liquid Membrane-Forming Curing Compounds: ASTM C309, Type 1, clear, non-yellowing, free of waxes, rosins, or oils and compatible with subsequent finishes, coatings, or coverings, and subject to approval of the Engineer.

1. Products:

a. "Masterkure"; Master Builders, Inc.

b. "Aqua-Cure"; The Euclid Chemical Company.

c. "Kure-n-Seal WB"; Sonneborn Building Products Division/ChemRex, Inc.

I. Bonding Compound: Non-reemulsifiable acrylic bonding admixture, ASTM C 1059, Type II.

1. Products:

a. "Everbond"; L & M Construction Chemicals, Inc.

b. "Flex-Con"; The Euclid Chemical Company.

c. "Proweld Acrylic"; Prokrete Industries.

d. "Weld Crete"; Larsen Co.

J. Expansion Joint Filler:

1. Cork type: ASTM D 1752, Type II.

2. Neoprene Type: ASTM D1056, Grade RE41.

K. Water proofing Mortar: Mixture of pulverized iron and cement.

1. Products:

a. "Iron Water-peller"; Euclid Chemical Company

2.05 CONCRETE MIXING EQUIPMENT

A. On-Site Equipment: Drum type batch machine mixer ASTM C 685.

B. Transit Mixers: ASTM C 94.

2.06 CONCRETE MIX DESIGN

A. Design mix to meet or exceed each requirement specified. Where more than one criterion is specified, the most stringent shall apply. For example, a minimum cement content or maximum water-cement ratio might result in strengths greater than the minimum specified; likewise, a greater cement content or lower water-cement ratio may be required in order to achieve the required strength.

1. Maximum water-cementitious materials ratio by weight: 0.40.

2. Minimum cement content per cubic yard: 7 bag mix

3. Maximum slump: 5 inches

4. Coarse aggregate gradation: Number 57; Number 67; Number 8

5. Total air content (ASTM C 173 or ASTM C 231): 5 percent.

B. Review: Do not begin concrete operations until proposed mix has been approved by the Engineer.

C. Proportioning of Normal Weight Concrete: Comply with recommendations of ACI 211.1.

D. Proportioning of Light Weight Concrete; Comply with recommendations of ACI 211.2.

E. Required Average Strength: Establish the required average strength f'c of the design mix on the basis of trial mixtures as specified in ACI 301, and proportion mixes accordingly. Employ an independent testing facility acceptable to the Engineer for preparing and reporting proposed mix design.

F. Admixtures: Incorporate into the mix in amounts and manner recommended by the manufacturer and approved by the Engineer.

1. Air-entraining admixture: Add at rate to achieve specified air content.

   a. Do not use in slabs scheduled to receive surface hardener.

2. Water-reducing admixture: Add as required for placement and workability.

3. Water-reducing and retarding admixture: Add as required in concrete mixes to be placed at ambient temperatures above 90 degrees F.

4. Water-reducing and accelerating admixture: Add as required in concrete mixes to be placed at ambient temperatures below 50 degrees F.

5. High-range water-reducing admixture (superplasticizer): Add as required for placement and workability.

6. Do not use admixtures not specified or approved.

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, provided no additional expense to the Company results. Submit laboratory test data for revised mix design to the Engineer for approval before using in the work.

2.07 BATCHING AND MIXING

A. Ready-mix concrete shall be batched, mixed and transported in accordance with applicable provisions of ASTM C94.

1. Batch plants shall comply with standards set forth by Plant Manufacturers Bureau of National Ready-Mix Concrete Association.

2. Truck mixers shall comply with Standards of Truck Mixers Manufacturers Bureau of National Ready-Mix Concrete Association.

3. Ready-mixed concrete production facilities shall be currently certified by National Ready-Mixed Concrete Association.

4. Concrete shall be delivered to site and discharged within 90 minutes after introduction of mixing water; Where ambient temperature is above 35°F, concrete shall be discharged within one hour. Concrete which exceeds the above specified time limitation will be rejected.

5. Indiscriminate addition of a water or a "super" water reducing admixture to increase the slump is prohibited.

6. When a "super" water reducing admixture is added, it shall be incorporated at the site by additional mixing as specified by the manufacturer.

B. Small amounts of concrete may be mixed at the job site. Batching may be by volume provided that every twelfth batch is checked by weight. Protect from contaminants and moisture. Do not use damaged bags of cement.

C. Admixtures: Dispense either manually with the use of calibrated containers or measuring tanks, or by means of an approved automatic dispenser designed by the manufacturer of the specific admixture.

1. Admixture dispenser shall be capable of control to 3.0 percent accuracy.

2. Each admixture shall be added separately and with a different portion of the batch loading sequence.

PART 3 EXECUTION

3.01 FORMWORK INSTALLATION

A. The Contractor is responsible for design, engineering, and construction of formwork, and for its timely removal.

B. Forms may be removed when field-cured cylinders achieve 75 percent of the specified 28-day compressive strength. It shall be the responsibility of the Contractor to make and pay for the costs of these supplemental strength tests.

C. Forms not actually supporting weight of concrete or weight of soffit forms may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard that it will not be damaged by form removal operations, and further provided that curing and protections are maintained.

D. Earth Forms: Hand-trim bottoms and sides of earth forms to profiles indicated on the Drawings. Remove loose material before placing concrete.

E. Design: Design and Fabricate forms for easy removal, without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials. Design to support all applied loads until concrete is adequately cured, within allowable tolerances and deflection limits.

F. Construction: Construct forms to sizes, shapes, lines, and dimensions shown and to achieve accurate final alignment, locations, and grades, with work level and plumb. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in the work.

1. Thoroughly clean the insides of forms prior to concreting so they are free from dirt, debris, and foreign material.

2. Joints: Minimize form joints and make watertight to prevent leakage of concrete.

    a. Align joints symmetrically at exposed conditions.

3. Chamfers: Provide chamfered edges and corners at exposed locations.

4. Permanent openings: Provide openings in concrete formwork to accommodate work of other trades, sized and located accurately. Securely support items built into forms; provide additional bracing at openings and discontinuities in formwork.

5. Temporary openings: Provide temporary openings for cleaning and inspection in most inconspicuous locations at base of forms, closed with tight-fitting panels designed to minimize appearance of joints in finished concrete work.

G. Tolerances: Comply with minimum tolerances established in ACI 347, unless more stringent requirements are indicated on the Drawings.

H. Release Agent: Provide either form materials with factory-applied nonabsorptive liner or field-applied form coating. Do not allow release agent to come into contact with reinforcing steel.

3.02 CONNECTION TO EXISTING CONCRETE

A. Preparation: At locations where new concrete is to join existing concrete, prepare existing surface by cleaning with wire brush and applying bonding compound in accordance with manufacturer's instructions, or wet the existing surface for 1 hour prior to placement but do not allow puddles to form, then coat the existing surfaces with a grout of equal parts of sand and cement.

3.03 VAPOR RETARDER INSTALLATION

A. General: Place vapor retarder sheet over prepared base and under fill material, aligning longer dimension parallel to direction of pour and lapped 6 inches. Seal joints securely with appropriate tape.

B. Take care not to damage membrane during construction.

C. Repair cuts or accidental tears with appropriate repair material to maintain integrity of the barrier.

3.04 REINFORCING PLACEMENT

A. General: Comply with requirements of ACI 301, ACI 315, and as herein specified.

B. Preparation: Clean reinforcement, removing loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Placement: Place reinforcement to obtain at least minimum coverages for concrete protection. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with metal chairs, runners, bolsters, spacers, and hangers, as required.

2. Provide sufficient numbers of supports, and of strength to carry the reinforcement. Set wire ties so ends are directed into concrete and not toward exposed concrete surfaces.

3. Wire fabric: Install in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with tie wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

D. Welding: Welding of reinforcement is not permitted without prior written approval from the Engineer.

3.05 CONCRETE PLACEMENT

A. Preparation:

1. Materials necessary to ensure adequate protection of concrete shall be present on the site before concreting operations are begun.

2. Before placing concrete, all equipment for mixing and transporting concrete shall be cleaned, vibrators shall be checked for workability, all frost, ice, mud, debris, and water shall be removed from concrete surfaces and forms.

3. Forms shall be thoroughly wetted or oiled.

4. Anchors, Sleeves and other embedments shall be securely tied in place and thoroughly cleaned of ice and other coatings which may destroy or reduce bonding with concrete.

B. Inspection:

1. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded.

2. No concrete shall be placed until the Engineer has approved the reinforcement.

C. On-Site Mixing:

Mix each batch a minimum of 1-1/2 minutes and a maximum of 5 minutes before discharging concrete. Clean thoroughly at end of day and before changing concrete type.

D. Placement - General: Comply with requirements of ACI 304 and as herein specified.

1. Deposit concrete continuously, or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness.

2. If a section cannot be placed continuously, provide construction joints as specified herein.

3. Deposit concrete as nearly as possible to its final location, in order to avoid segregation due to rehandling or flowing.

4. Conveying the concrete from the mixer to the place of deposit shall not cause separation or loss of materials.

E. Placement in Forms: Deposit concrete in forms in horizontal layers not deeper than 24 inches and in a manner to avoid inclined construction joints.

1. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically through freshly placed layer and at least 6 inches into preceding layer, at uniform spacing not exceeding visibly effective range of machine.

3. Limit duration of vibration in each instance to time necessary to achieve consolidation without causing segregation of mix.

4. Placing shall be at such a rate that at all times concrete shall be plastic and flow readily into corners of forms and into spaces between rebars.

5. No concrete that has partially hardened or has been contaminated by foreign materials shall be deposited.

6. When concreting is commenced, it shall be carried on as a continuous operation until the panel or section is completed.

7. When being deposited, concrete shall not be allowed to fall a vertical distance greater than 4 feet from point of discharge to point of deposit.

F. Placement of Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until panel or section is completed.

1. Consolidate concrete during placement so that concrete is thoroughly worked around reinforcement and embedded items and into corners without displacing floor drains, reinforcement or other items.

2. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats, or derbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

G. Consolidate newly placed concrete by means of vibration. Keep extra vibrators at the project site to be used in case a vibrator does not work. Vibrators shall be as narrow as necessary for shallow work.

H. Cold Weather Placement: Comply with recommendations of ACI 306R when air temperatures are expected to drop below 40 degrees F either during concrete placement operations or before concrete has cured.

1. Do not use frozen materials or materials containing ice or snow.

2. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

I. Hot Weather Placement: Comply with recommendations of ACI 305 when ambient temperature before, during, or after concrete placement is expected to exceed 90 degrees F or when combinations of high air temperature, low relative humidity, and wind speed are such that the rate of evaporation from freshly poured concrete would be excessive.

1. Do not add water to approved concrete mixes under hot weather conditions.

2. Provide mixing water at lowest feasible temperature, and provide adequate protection of poured concrete to reduce rate of evaporation.

3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature does not exceed air temperature at time of concrete placement.

4. Fog-spray forms and reinforcing steel just before concrete is placed.

3.06 JOINT CONSTRUCTION

A. Construction Joints: Locate and install construction joints in a manner which will not impair strength and will have least impact on appearance, as acceptable to the Engineer.

1. Keyways: Provide keyways at least 1-1/2 inches deep in construction joints.

2. Reinforcement: Continue reinforcement across and perpendicular to construction joints, unless details specifically indicate otherwise.

3. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous, watertight diaphragm, with field joints fabricated in strict accordance with manufacturer's instructions for watertight closure.

B. Isolation Joints: Construct isolation joints in slabs poured on grade at points of contact with vertical components, such as column pedestals, foundation walls, and grade beams. Install expansion joint filler to full concrete depth.

C. Expansion Joints: Construct expansion joints where indicated. Install expansion joint filler to full depth of concrete. Recess edge of filler to depth indicated to receive joint sealant and backer rod where necessary. (See Section 07900).

D. Control Joints: Construct contraction joints in slabs poured on grade to form panels of sizes indicated on drawings, but not more than 15 feet apart in either direction.

1. Saw cuts: Form control joints by means of saw cuts of a thickness one-fourth that of the slab, performed as soon as possible after slab finishing without dislodging aggregate.

3.07 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete, using setting drawings and instructions from suppliers of items to be embedded.

1. Install reglets to receive top edge of flashings and other membrane materials at locations indicated, in accordance with manufacturer's recommendations. Temporarily fill reglets or cover openings to prevent intrusion of concrete or debris during installation.

2. Edge Forms and Screed Strips: Set edge forms or bulkheads and intermediate screed strips for slabs, to obtain required elevations and contours in finished slab surface.

3.08 FINISHING FORMED SURFACES

A. Repairs - General: Repair and patch defective areas with cement mortar immediately after removal of forms.

1. Cut out honeycomb, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts, down to solid concrete but in no case to a depth of less than 1 inch.

2. Make edges of cuts perpendicular to concrete surface. Thoroughly clean, dampen with water, and brush-coat the area with bonding compound. Place patching mortar while bonding compound is still active.

B. Unexposed Form Finish: Repair tie holes and patch defective areas. Rub down or chip off fins or other raised areas exceeding 1/4 inch height.

C. Exposed Form Finish: Repair and patch defective areas, with fins or other projections completely removed and smoothed.

1. Smooth rubbed finish: Provide smooth rubbed finish to concrete surfaces indicated not later than 1 day after form removal.

   a. Use blend of white and standard portland cement for patching mortar, so that completed patches will match surrounding areas when dry.

   b. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture are produced.

2. Grout cleaned finish: Provide grout cleaned finish to concrete surfaces indicated.

   a. Combine one part Portland cement to 1-1/2 parts fine sand by volume, and mix with 50:50 mixture of water and bonding admixture to consistency of thick paint. Blend standard Portland cement and white Portland cement so that final color of dry grout will match adjacent surfaces.

   b. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

3. Related unformed surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces.

3.09 FINISHING SLABS

A. Finishing Operations - General:

1. Do not directly apply water to slab surface or dust with cement.

2. Use hand or powered equipment only as recommended in ACI 302.1R

3. Screeding: Strike off to required grade and within surface tolerances indicated.

4. Bull Floating: Immediately following screeding, bull float or darby before bleed water appears.

5. Do not perform subsequent finishing until excess moisture or bleed water has disappeared and concrete will support either foot pressure with less than 1/4-inch indentation or weight of power floats without damaging flatness.

6. Final floating: Float to embed coarse aggregate, to eliminate ridges, to compact concrete, to consolidate mortar at surface, and to achieve uniform, sandy texture.

7. Troweling: Trowel immediately following final floating. Wait between trowelings to allow concrete to harden. Do not overtrowel. Begin final troweling when surface produces a ringing sound as trowel is moved over it. Completed surface shall be free of trowel marks, uniform in texture and appearance, and within surface tolerance specified.

B. Scratch Finish: After screeding and leveling to tolerance, roughen surface before final set with stiff brushes, brooms, or rakes.

C. Float Finish: After edging and jointing operations, float finish the slab with a disc type float or a troweling machine with floats attached

D. Broomed Float Finish: After floating and when water sheen has practically disappeared, apply uniform transverse corrugations approximately 1/16 inch deep, without tearing surface.

E. Nonslip Aggregate Finish:

1. After completion of float finishing and before starting trowel finish, uniformly spread dampened aggregate at rate of 25 pounds per 100 square feet of surface.

2. Tamp aggregate flush with surface using a steel trowel. Upon completion of tamping, proceed with trowel finish.

3. After curing, lightly work surface with steel wire brush or an abrasive stone and water, to expose nonslip aggregate.

F. Surface Hardener Finish:

1. Request services of the local product representative for a pre-installation conference.

2. Apply surface hardener at a rate of 1.5 psf, in accordance with manufacturers printed application instructions, to interior floor surfaces.

3. Use only admixtures which are approved by the manufacturer of the surface hardener in the concrete. Do not use air-entraining admixtures.

4. Use only curing compounds which are approved by the manufacturer of the surface hardener.

5. Do not install slabs requiring surface hardener until area is protected from rain.

G. Slab Surface Tolerances:

1. Achieve flat, level planes except where grades are indicated. Slope uniformly to drains.

2. Scratched finishes: After placing slabs, plane surface to tolerances of at least F(F) 15 for flatness and F(L) 13 for levelness per ASTM E 1155.

3. Floated finishes: Check and level surface plane to tolerances of at least F(F) 20 for flatness and F(L) 15 for levelness per ASTM E 1155.

H. Slab Finish Schedule: Apply finishes in the following typical locations and as otherwise shown on the drawings:

1. Scratch finish:

    a. Surfaces to receive bonded cementitious toppings, unless indicated otherwise.

2. Float finish:

    a. All interior horizontal surfaces.

3. Broomed float:

    a. Exterior slabs not otherwise scheduled.

4. Nonslip aggregate finish:

    a. Stairs and landings.

5. Surface hardener finish:

    a. Interior Concrete floors.

I. Repair of Slab Surfaces: Test slab surfaces for smoothness and to verify surface plane to tolerance specified. Repair defects as follows:

1. High areas: Correct by grinding after concrete has cured for not less than 14 days.

2. Low areas: Immediately after completion of surface finishing operations, cut out low areas and replace with fresh concrete. Finish repaired areas to blend with adjacent concrete. Proprietary patching compounds may be used when approved by the Engineer.

3. Crazed or cracked areas: Cut out defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with not less than 3/4 inch clearance. Dampen exposed concrete and apply bonding compound. Mix, place compact, and finish patching concrete to match adjacent concrete.

4. Isolated cracks and holes: Groove top of cracks and cut out holes not over 1 inch in diameter for repair by dry-pack

method. Dampen cleaned concrete surfaces and apply bonding compound; place dry pack while bonding compound is still active, as follows:

a. Dry-pack mix: One part portland cement to 2-1/2 parts fine aggregate passing No. 16 mesh sieve and enough water as required for handling and placing.

b. Compact dry-pack mix in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

3.10 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

2. Provide curing of concrete by a method appropriate to service conditions and finish type.

B. Curing Period:

1. Not less than 7 days for standard cements and mixes.

C. Formed Surfaces: Cure formed concrete surfaces by moist curing with forms in place for full curing period or until forms are removed.

1. Forms exposed to heat of the sun shall be kept moist.

2. If forms are removed during the curing period, complete curing by applicable method.

D. Surfaces Not in Contact with Forms:

1. Start curing as soon as free water has disappeared from concrete surface after placing and finishing, but before surface is dry. Do not apply curing compounds to the interfacing of channels to be caulked. Mask channels to avoid sealant adhesion problems.

a. Curing compound: Apply at rate stated by manufacturer. Reapply if damaged by rain.

b. Curing and hardening compound: Apply one or more applications as recommended by manufacturer.

c. Use curing compounds only in locations permitted or required, and where use will not interfere with other finishes, coatings, or coverings to be applied.

E. Avoid rapid drying at end of curing period.

F. Protect concrete from temperature changes in excess of 5 degrees F per hour and 50 degrees F per 24 hours. Adjust protective measures to provide uniform temperature changes over entire concrete surface.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Fill in holes and openings left in concrete structures for passage of work by other trades after such work is in place.

B. Provide machine and equipment bases and foundations, as indicated on Drawings. Set anchor bolts at correct elevations, complying with diagrams or templates of equipment manufacturer. Grout base plates and foundations as indicated (Section 03600).

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Screed, tamp, and finish concrete surfaces as scheduled.

D. Waterproofing Mortar: Apply in two 3/8 inch coats on all below grade exterior concrete and masonry building walls.

3.12 FIELD QUALITY CONTROL

A. Control of Mix in the Field

1. Slump: A tolerance of up to 1 inch above that specified will be permitted for 1 batch in 5 consecutive batches tested. Concrete of lower slump than that specified may be used, provided proper placing and consolidated is obtained.

a. If slump upon arrival at the site is lower than 1 inch below the value specified, one addition of water in accordance with ASTM C 94 will be permitted to bring slump within tolerance, provided that:

1. A positive means is available to measure the amount of water added at the site.

2. The specified (or approved) maximum water-cement ratio is not exceeded.

3. Not more than 45 minutes have elapsed since batching.

2. Total Air Content: A tolerance of plus or minus 1-1/2 percent of that specified will be allowed for field measurements.

3. Batches that exceed tolerances will be rejected.

B. Concrete Testing

1. A set of concrete field specimens consisting of four 4 in. X 8 in. cylinders shall be taken not less than once a day, nor less than once for each 40 cubic yards of concrete, nor less than once per truck, or for each 5000 square feet of surface area placed, whichever is smaller. These cylinders shall be obtained by the Company.

2. All cylinders shall be made and tested by a qualified approved testing laboratory which meets the requirements of ASTM E329, and their reports will be sent to the Engineer. These tests shall be obtained by the Company.

3. Two cylinder shall be tested at 7 days, the other two at 28 days, in accordance with ASTM C31.

4. For each set of cylinders made, a slump and air content test shall also be made. The temperature of concrete shall be taken at the same time cylinders are made Slump tests shall be made in accordance with ASTM C143. Air content tests shall be made in accordance with ASTM C231.

5. Tests specimens shall be molded immediately after the sample is taken and then placed in site storage. Storage shall be in a shed, box or other enclosure maintained at a temperature of between 60o F and 89o F. Specimens shall be stored not less than 16 hours prior to removal to the laboratory.

6. Testing of cylinders shall be in accordance with ASTM C39.

7. Cost of additional field-cured cylinders, if tests indicate non-compliance with the specifications at the required 28-day compressive strength, shall be paid by the Contractor.

8. Strength of concrete shall be considered satisfactory if the average of two 28-day tests in each set of cylinders equals or exceeds the specified 28-day strength, and neither of the 28-day tests is 500 psi or more below specified 28-day strength.

9. Should the results of cylinder tests not meet the preceding requirements, the Contractor shall submit revised mix design data for concrete which will conform to the specifications. Also, the Contractor, at the Contractor's expense, shall have sample cores cut from that portion of structure represented by the unsatisfactory test specimens. These cores shall be taken from each area in question according the ASTM C42. If the strength criteria are not met by the core tests, the Contractor shall remove and replace all questionable areas of concrete at the Contractor's expense.

C. Provide two insulated curing boxes on the site, each with 18 cylinder capacity.

END OF SECTION 03300

DIVISION 3

SECTION 03410

STRUCTURAL PRECAST CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes prestressed concrete slabs and related items.

B. Related Sections

1. Section 03300 - Cast-in-Place Concrete
2. Section 05500 - Metal Fabrications
3. Section 07500 - Membrane Roofing
4. Section 15400 - Plumbing
5. Section 15850 - Air Handling

1.02 REFERENCES

A. American Concrete Institute (ACI)

1. Building Code Requirements for Reinforced Concrete (ACI 318)

B. American Society for Testing and Materials (ASTM)

1. A416; Standard Specification for Uncoated Seven-Wire Stress-Relieved Steel Strand.
2. A615; Standard Specification for Deformed and Plain Billet-Steel Bars.
3. C33; Standard Specification for Concrete Aggregates.
4. C39; Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5. C150; Standard Specification for Portland Cement.

1.03 SYSTEM DESCRIPTION

A. Precast concrete units shall be the product of a company regularly engaged in the manufacture of same, and shall be standard and special shape, prestressed concrete units produced under a rigid factory inspected process approved by the Engineer, designed and reinforced for the superimposed loads as shown on the drawings.

B. The finished product shall be free of honeycombs or voids, with straight, true edges and surfaces. Handling and conveying before curing shall be reduced to a minimum by use of machinery designed to prevent bending or shock liable to produce incipient cracks or other deformities.

C. Provisions shall be made for any additional loads imposed on slabs to provide for openings or support the work of other trades.

D. In addition the slabs shall be adequately reinforced to resist all handling stresses.

E. Members shall be cast in steel forms and vibrated to assure maximum compaction and smooth surfaces; the top surfaces shall receive a finish suitable to receive concrete topping or roofing installation.

F. All units shall conform to the requirements of the ACI-3l8 Code.

1.04 SUBMITTALS

A. Prior to proceeding with the fabrication and erection of the precast concrete units, the Contractor shall submit for approval of the Engineer complete Shop Drawings and Setting Plans.

1. Shop drawings shall cover each type of precast prestressed concrete unit to be used and shall show the exact profile of each unit, steel reinforcement, sleeves and other pertinent details, including standard manufacturer's loading chart data for the specific span, as well as resisting moment, and manufacturer's specifications.

2. Setting plans shall be complete in every detail, including special conditions around the openings and anchorage details, and shall include manufacturer's printed erection instruction and sequence of operations.

3. All designs, fabrication and testing shall be under the direct supervision of a registered professional structural engineer with not less than three years of experience in design, manufacture and erection of precast - prestressed concrete units for similar and comparable work, and the shop drawings shall bear his seal.

4. Submit design data to verify structural adequacy of members and connections as required by criteria and loads shown on contract drawings.

B. Test Reports

Proportions for the concrete mix and its certified test shall be submitted for approval. Concrete shall have a minimum compressive strength of 3500 psi at time of initial prestress and 5000 psi at 28 days. Test shall conform to ASTM C39. Reports of tests on concrete taken by an approved testing agency from each mix used in the manufacture shall be submitted to the Engineer.

1.05 QUALITY ASSURANCE

A. Precast concrete elements shall be true to size and dimensions and within the following limits at the time of installation:

1. Overall length - plus or minus 1/8-inch per 10 feet.

2. Cross section dimension - for sections less than 18 inches, plus or minus 1/8-inch; and sections over 18-inches, plus or minus 1/4-inch.

3. Sweep in long members shall be not more than 1/4-inch in 20 feet.

B. Cracks

Precast concrete units containing hair cracks which are visible, but not measurable by ordinary means will be accepted. Cracks of widths measurable by ordinary means (0.01 inch wide and over) may be cause for rejection, depending on the location and magnitude of the cracks.

C. Curing

1. Curing of all precast concrete units shall be accomplished in a manner acceptable to the Superintendent and in accordance with the following provisions:

a. Surfaces not enclosed by forms shall be covered by tarps or an approved non-residual curing compound.

b. Curing by high-pressure steam, steam vapor, or other accepted processes may be employed to accelerate the hardening of the cement and to reduce the time of curing.

1.06 STORAGE AND PROTECTION

Precast members shall be stored above ground, properly protected from the weather and air borne dirt, separated by wood or other suitable non-staining material.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement

Cement shall be Portland Cement ASTM C150, Type III.

B. Aggregates

Fine and coarse aggregate shall conform to ASTM C33.

C. Reinforcing

1. Prestressing steel shall be uncoated seven wire stress relieved strand, conforming to ASTM A416.

2. Bar steel reinforcement shall conform to the applicable portion of ASTM A615.

D. Anchors and Inserts

Anchors, bolts, welding inserts, connecting plates and sleeves necessary for fabrication and installation of the precast concrete members shall be cast in the precast member.

PART 3 EXECUTION

3.01 ERECTION

A. Installation shall be in accordance with approved shop drawings. Workers used must be skilled in this type of work. Each unit shall be set in position assigned on the approved shop drawings, carefully plumbed and aligned and securely anchored.

B. Fastening between precast members shall be by grouting or welding plat inserts together at one third points. (See Section 03600-Grout).

C. Precast concrete units shall be secured to structure by welding and bolting as indicated. Provide steel struts, angles, clips, plates, and other members as indicated or required for support and attachment of precast work; secure to adjacent work as indicated. Set units plumb, level and true with joints kept open and units resting on temporary shims while connections are made. Remove shims as soon as possible to avoid staining. Joints shall be uniform and of width indicated. All welding shall be done by qualified operators as certified by the American Welding Society.

3.02 CLEANING

Clean thoroughly by scrubbing with fiber brushes and mild alkaline abrasive cleaner that contains no caustic or harsh fillers. The use of acids is prohibited.

END OF SECTION 03410

DIVISION 3

SECTION 03600

GROUT

PART 1 GENERAL

1.01 SUMMARY

A. Section includes Structural Grouting of column base plates, equipment base plates, bearing plates; and the grouting of cavities, voids and keyways with non-ferrous, non-shrink portland cement grout.

B. Related Sections

1. Section 03300 - Cast-in-Place Concrete
2. Section 03400 - Precast Concrete
3. Section 04200 - Unit Masonry
4. Section 05120 - Structural Steel
5. Section 05500 - Metal Fabrications
6. Section 07180 - Water Repellents

1.02 REFERENCES

A. American Society for Testing and Materials

1. ASTM C191; Test Method for Time of Setting of Hydraulic Cement.
2. ASTM C309; Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
3. ASTM C827; Test Method for Early Volume Change of Cementitious Mixtures.
4. ASTM C1107; Specification for Packaged Dry, Hydraulic Cement Grout (Non-shrinkable).

B. American Concrete Institute

1. ACI 305R; Hot Weather Concreting.

2. ACI 306R; Cold Weather Concreting.

1.03 DEFINITIONS

A. Grout is a ready-mixed pre-packaged mixture of portland cement, aggregate and proprietary admixtures, requiring only the addition of water.

B. Non-ferrous, non-shrink grout is free of iron aggregate, chlorides or corrosive-type materials, and contains additives to control shrinkage.

1.04 SYSTEM DESCRIPTION

A. The grout shall provide an effective load bearing surface, stable and capable of transferring loads.

B. The grout shall not discolor, corrode, ravel, spall or delaminate.

C. The grout shall not shrink below its original placement volume.

1.05 SUBMITTALS

A. Manufacturer's current printed literature including, but not limited to:

1. Design data.

2. Test reports

3. Manufacturer's instructions.

B. Quality Control Submittals

Provide a notarized certification stating that the non-ferrous, non-shrinking portland cement grout meets the requirements specified herein.

1.06 QUALITY ASSURANCE

A. Qualifications

1. The grout manufacturer shall have a program of training and technical support including on-site field technical support to assist the Contractor.

2. The Contractor shall have approval of the manufacturer of the specified products and the Contractor's foreman shall

have a mean of five years experience installing the specified products under similar project conditions.

B. Mock Ups

1. Prior to commencement of grouting work, the Contractor shall place grout in a unit of the project in the presence of the Superintendent.

2. Adjust until workmanship and methods are acceptable to the Superintendent.

3. The acceptable workmanship and methods used shall become the standard of work for the project.

C. Pre-Installation Conference

Hold pre-installation conference with grout manufacturer's representative.

1.07 DELIVERY, STORAGE, and HANDLING

A. Deliver the specified products to the job site in their original, unopened labeled containers with the manufacturer's name, address, product identifications and mixing instructions.

B. Accept only undamaged, unopened containers. Protect from damage, moisture, contamination and loss, including theft.

C. Store and condition the material as recommended by the manufacturer.

D. Schedule product delivery to minimize on-site storage and overcrowding of construction spaces.

E. Material shall be stored in a location specified by the Superintendent.

1.08 PROJECT/SITE CONDITIONS

A. Do not install material if it is raining or snowing or if foul weather is imminent.

B. Precautions shall be taken to avoid damage to any surface near the work zone due to the mixing and handling of the material.

1.09 SAFETY REQUIREMENTS

Inform and protect those using or coming in contact with the product. Provide first aid treatment capabilities for the potential risks of exposure to the material. Inform and protect workers against the following factors and that failure to heed these warnings can produce serious injury:

1. Product is alkaline on contact with water. Avoid splashing into eyes, contact with skin, or breathing dust.

2. Avoid inhaling the dry grout dust. Provide respiratory protection.

3. Protect eyes and mucous membranes form contact with the material. If contact should occur, flush the affected area repeatedly with liberal amounts of water for a minimum of 15 minutes and contact a physician immediately.

4. Wash skin areas that come into prolonged contact with wet or moist grout with fresh, clean water for 15 minutes. If irritation develops, contact a physician.

5. Immediately change any clothing that becomes soaked with the material.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland cement grout:

1. Non-metallic, non-shrink composition containing a blend of selected portland cement, plasticizing/water-reducing admixtures, and shrinkage compensating agents. The shrinkage agents shall compensate for shrinkage in both the plastic and hardened state.

2. Products

    a. "Masterflow 928"; Master Builders, Inc.

    b. "Euco N-S Grout"; Euclid Chemical Co.

    c. "Five Star Grout"; Five Star Products, Inc.

d. "Sika Grout 212"; Sika Corporation

e. "Crystex"; L&M Construction Chemicals, Inc.

B. Water: Clean and potable.

C. Properties of the mixed portland cement grout:

1. Time of set (ASTM C191)

a. Initial Set: 3 hours minimum.

b. Final Set: 6 hours maximum.

2. Color: Concrete gray.

3. The grout shall not exhibit bleeding.

4. The grout shall not segregate.

D. Properties of the cured portland cement grout:

1. Compressive Strength:

a. 1 day: 4000 psi minimum.

b. 28 day: 10,000 psi minimum.

2. The grout shall not produce a vapor barrier.

3. The grout shall exhibit positive expansion when tested in accordance to ASTM C827.

2.02 Equipment

A. Equipment capable of roughening concrete surfaces.

B. Paddle-type or shear type mortar mixer. Provide reserve mixer in the event of mechanical failure.

2.03 Mixes

A. Use "Plastic" mix consisting of approximately 3-3/4 quarts water per 50 lb. bag of grout, not to exceed manufacturer's recommendations.

B. Do not add cement, plasticizer or accelerator to the premixed grout.

PART 3 EXECUTION

3.01 EXAMINATION

A. Visually inspect all areas to be grouted to ensure they are clean and free of oil, grease, rust, scale, laitance, wax or other substances that will preclude adhesion of the grout, and to ensure that unsound substrates are repaired. Installation of grout shall be evidence of acceptance of the substrate.

B. Verify that the ambient and substrate temperature is between 50°F and 80°F at time of application.

3.02 PREPARATION

A. Set up sufficient and proper mixing equipment, tools and materials adjacent to the work area.

B. Thoroughly clean all contact surfaces down to sound concrete; remove rust from underside of plates; clean bolt holes and foundation area to be grouted.

C. Roughen surfaces to receive grout by mechanical means such as chipping, sandblasting, or high-pressure water blasting.

D. Saturate the prepared surfaces with clean water for at least four hours. Prior to grouting, bring surfaces to a saturated surface-dry condition.

E. If ambient temperature falls below 80°F, cool mixing water and grout in accordance with ACI 305R, "Hot Weather Concreting".

F. If ambient temperature falls below 50°F, warm mixing water and grout in accordance with ACI 306R, "Cool Weather Concreting".

G. Mix with paddle-type or shear-type mortar mixer.

H. Mix no more grout than can be placed in 15 minutes.

3.03 INSTALLATION

A. Forming:

1. Forms must be rigid and securely anchored in place to prevent movement and leakage during grout placement while leaving adequate clearance to allow grout to be placed.

2. Apply form release agent.

3. Install around three sides of a rectangular base plate or around approximately 3/4 of a non-rectangular base plate.

4. Maintain full contact of forms and remove only after initial set. Premature form removal will cause grout to sag and lose bearing between grout and base plate.

B. Mixing:

1. Add an appropriate amount of water to the mixer to achieve plastic grout consistency according to manufacturer's recommendations. Do not overwater.

2. While mixing, slowly add the dry grout to the mixer. Mix to a uniform consistency for a minimum of two minutes. Follow printed instructions on each package and do not mix any longer than is necessary to obtain uniform mixture.

3. Maintain mix temperature at 70°F - 75°F by using cold or warm water accordingly.

4. The addition of water for retempering purposes is prohibited.

C. Placing:

1. Place grout continuously and rapidly from the unformed side of the base plate by rodding or tamping to compact grout and eliminate voids. Mechanical vibration is prohibited.

2. Shut down all nearby equipment which may cause vibration during grouting and for a period of eight hours afterwards.

3. Complete placement within 15 minutes of mixing the grout.

4. Remove forms after initial set. Shape grout around the perimeter of the base plate at a 45 degree angle between bottom of base plate and top of concrete foundation. Do not disturb the grout beneath the base plate.

D. Curing:

1. Immediately after final set, wet cure exposed surfaces for a minimum of three days, or apply an approved curing compound which complies with ASTM C309.

2. Maintain the temperature of the grout and contact area at 50°F to 80°F for a minimum period of 24 hours.

3. After curing, seal exposed grout surfaces with a water repellent (Section 07000).

3.04 FIELD QUALITY CONTROL

A. Place a 1/2 inch steel plate with bolt holes immediately over a freshly screeded test cylinder. After three days lift the plate. If there is no bond between the grout and the plate, the grout is rejected.

B. Inspect all grouted areas to ensure absence of voids, shrinkage, and bleeding. Remove and replace as necessary.

3.05 CLEANING

A. Clean the uncured grout from tools and equipment with water. The cured grout can only be removed mechanically.

B. Leave finished work and work area in neat, clean condition without evidence of spillovers onto adjacent areas.

C. Dispose of discarded materials and construction debris on a daily basis and in accordance with the regulations of governing jurisdictions.

END OF SECTION 03600

DIVISION 3

SECTION 03730

CONCRETE REHABILITATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Removal of unsound and sound concrete, cleaning of newly exposed underlying sound concrete and reinforcing steel, preparation of existing surfaces and the routing of cracks.

2. Installation of proprietary cementitious mortar over prepared existing surfaces, coating of prepared existing and new reinforcing bars with epoxy, and replacement of reinforcing bars with loss of cross section greater than 25%.

1.02 REFERENCES

A. American Society for Testing and Materials

1. ASTM A615; Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

2. ASTM C33; Specification for Concrete Aggregates

3. ASTM C39; Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

4. ASTM C78; Standard Test Method for Flexural Strength of Concrete

5. ASTM C109; Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

6. ASTM C157; Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete

7. ASTM C496; Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

8. ASTM C596; Standard Test Method for Drying Shrinkage of Mortar Containing Portland Cement

9. ASTM C666; Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing

10. ASTM C882; Standard Test Method for Bond Strength of Epoxy- Resin Systems Used with Concrete

11. ASTM C1042; Test Method for Bond Strength of Latex Systems Used with Concrete

12. ASTM C1059; Specification for Latex Agents for Bonding Fresh to Hardened Concrete

B. American Concrete Institute

1. ACI 318; Building Code Requirements for Reinforced Concrete

C. Steel Structures Painting Council

1. Surface Preparation Specification

1.03 SYSTEM DESCRIPTION

A. Design Requirements

1. Provide a cementitious patching compound specifically destined for resurfacing and levelling concrete surfaces.

2. Product shall employ a polymer-modified portland cement mortar.

3. Product shall have high abrasion resistance, high bonding strength, and high thermal compatibility with concrete.

B. Performance Requirements

1. Properties of the mixed polymer-modified portland cement mortar:

   a. Working Time: 10-15 minutes

   b. Finishing Time: 20-60 minutes

   c. Color: concrete gray to match existing concrete

2. Properties of the cured polymer-modified portland cement mortar:

a. Compressive Strength (ASTM C-109 Modified)

1) 4 hour: 250 psi min.

2) 1 day: 1800 psi min.

3) 28 day: 7000 psi min.

b. Splitting Tensile Strength (ASTM C-496) at 28 days: 880 psi min.

c. Flexural Strength (Modulus of Rupture) (ASTM C-78) at 28 days: 1600 psi min.

d. Rapid Freeze/Thaw Durability (ASTM C-666; Procedure A): Relative Durability Factor at 300 cycles: 90 min.

e. Bond Strength (ASTM C-882 Modified) at 28 days: 2200 psi min.

f. Thermal Compatibility (ASTM C-884 Modified): passed test min.

g. Abrasion (Taber Abader) at 7 days: Weight Loss: 7.0 gm max. (H-22 wheel; 1000 gm load; 1000 cycles)

h. The polymer-modified portland cement mortar shall be approved by the United States Department of Agriculture.

i. The polymer-modified portland cement mortar shall not produce a vapor barrier.

3. Properties of the polymer-modified portland cement concrete (extended with ASTM C33 Aggregates):

a. Compressive Strength (ASTM C-39)

1. 4 hour: 300 psi min.

2. 1 day: 1500 psi min.

3. 28 day: 7000 psi min.

b. Splitting Tensile Strength (ASTM C-496) at 28 days: 500 psi min.

c. Flexural Strength (Modulus of Rupture) (ASTM C-78) at 28 days: 900 psi min.

d. Rapid Freeze/Thaw Durability (ASTM C-666; Procedure A): Relative Durability Factor at 300 cycles: 90 min.

1.04 SUBMITTALS

A. Manufacturer's data consisting of list of proposed materials, printed specifications, cleaning and protection recommendations, application instructions, and other pertinent details; and instructions for handling, storage, and in-place protection.

B. Certificate of compliance from an approved independent testing laboratory that the product meets or exceeds the specified performance criteria, tested in accordance with the specified test standards.

1.05 QUALITY ASSURANCE

A. Manufacturer qualifications: The manufacturer of the specified product shall have in existence, for a minimum of 10 years, a program of training, certifying, and technically, supporting a nationally organized Approved Contractor Program with annual re-certification of its participants.

B. Contractor qualifications: Contractors shall be an Approved Contractor of the manufacturer of the specified product, who has completed a program of instruction in the use of a polymer-modified portland cement mortar/concrete for patching or overlaying surfaces, and provide a notarized certification from the manufacturer attesting to their Approved Contractor status.

At the discretion of the Engineer, bids shall be accepted from a contractor other than an Approved Contractor of the manufacturer of the specified product. Said contractors shall provide the Engineer with five job references where they have successfully patched or overlayed a surface with the specified product.

C. Guarantee: The Approved Contractor of the manufacturer of the specified product and manufacturer shall provide the Company with a joint and several guarantee on the application and product covered in this specification.

D. Mockup

1. The Contractor shall restore a 3 foot x 3 foot wall panel in the presence of the Superintendent.

2. The acceptable panel and methods used shall become the standard of work for this Section of the Specification.

E. Pre-Installation Conference

A conference shall be held with the Contractor, the Superintendent nd the Engineer to coordinate materials and techniques, and to sequence the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver the specified product in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.

B. Store and condition the specified product as recommended by the manufacturer.

1.07 SITE CONDITIONS

A. Environmental Conditions: Do not apply material if it is raining or snowing or if these conditions appear to be imminent.

B. Protection: Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the polymer-modified portland cement mortar/concrete.

PART 2 PRODUCTS

2.01 MATERIALS

A. Polymer-modified Portland Cement Mortar:

1. Component A shall be a liquid polymer emulsion of an acrylic copolymer base and additives.

2. Component B shall be a blend of selected portland cements, specially graded aggregates, admixtures for controlling setting time, water reducers for workability, a corrosion inhibitor, and an organic accelerator.

3. The material shall not contain asbestos, chlorides, nitrates, added lime, or high aluminum cements.

4. The material shall be non-combustible, either before or after cure.

5. The polymer-modified portland cement mortar shall be supplied in a factory proportioned unit.

6. The polymer-modified Portland cement mortar must be placeable from 1/8 inch to 2 inches in depth and extendable in greater depths.

B. Products

1. Master Builders, Inc.

    a. MASTERPATCH 210

    b. MASTERPATCH 220

    c. MASTERPATCH 230 VP

2. Fosroc, Inc.

    a. RENDEROC SD

    b. RENDEROC HB

3. The Euclid Chemical Company

    a. EUCO Verticoat

4. SIkA Corporation

    a. Sika Top 122

C. Aggregate to extend the polymer-modified Portland cement mortar shall be a 3/8 inch clean, well-graded, saturated surface dry material, having low absorption and high density. Aggregate must be approved for use by the Engineer.

D. Epoxy coating for reinforcing bars:

1. As manufactured by the polymer-modified Portland cement mortar manufacturer.

2. As approved by the polymer-modified portland cement mortar manufacturer.

2.02 EQUIPMENT

A. Select the means and methods of concrete removal, cleaning and surface preparation so that the specified prepared surface and depth of cut are obtained, and the structural capacity is not exceeded or otherwise undermined.

B. Chipping hammers with a total weight not to exceed:

1. 30 lb. and equipped with flat, chisel-type points with a cutting edge not less than 3/4 inch or greater than 2 1/2 inch in width, or pointed to minimize fracturing the aggregate.

2. Chipping hammers of nominal 15 lb. class or less for removal of concrete from beneath reinforcing.

C. Sandblasting equipment capable of removing rust from the exposed reinforcement and surface contaminants and laitance from newly exposed concrete surfaces.

D. Compressed air equipment capable of the removal of dust and dirt from concrete repair areas.

E. Equipment capable of roughening sound concrete surfaces to accept fresh concrete.

F. Equipment capable of saw-cutting and routing concrete surfaces to required depths.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to any concrete removal work, submit a plan for confining, collecting and disposing of broken concrete and other waste materials as a result of removal operations.

B. Sound concrete surfaces for hollow areas using no more than a 2 lb. flat faced hammer.

C. Identify cracks and areas of unsound concrete and mark for review by the Superintendent.

3.02 PREPARATION

A. Concrete Removal

1. Remove all unsound, delaminated or cracked concrete until sound concrete is exposed.

2. Where possible, removal areas shall be rectangular in shape. Do not feather edges, but saw cut edges 1/2 inch below the concrete surfaces. Do not saw through reinforcement.

3. During the removal process, care shall be exercised to avoid cracking of the underlying sound concrete or punching through the section. All existing reinforcing bars shall remain in-place unless removal is directed by the Superintendent.

4. Remove the concrete below the rebar level around all corroding reinforcement steel until a sound substrate remains. All fully exposed reinforcing bars shall be no closer than 3/4 inch, measured radially, from existing concrete. Remove concrete minimum of 1 inch beyond corroded sections.

5. Roughen the newly exposed sound concrete by sandblasting and blow away loose material with a compressed air jet.

6. Determine that all unsound concrete has been removed by sounding the final prepared surfaces prior to the Superintendent's inspection.

B. Reinforcement Cleaning and Replacement

1. Thoroughly clean exposed reinforcement by sandblasting to remove all rust and concrete. Blast the bars to near white metal in accordance with the Steel Structures Painting Council.

2. Bars that are damaged, mislocated, fractured or that have lost more than 25 percent of their original cross sectional area at any point along the length shall be brought to the attention of the Superintendent. Remedial action will be at the direction of the Engineer.

3. If during removal of unsound concrete, the Contractor encounters existing reinforcing with less than 1/2 in. cover from the member surface, he shall notify the Superintendent.

4. Reinforcement shall be secured in position so as to be unaffected by concreting operations. Tying loose reinforcement to bonded reinforcement is incidental to surface preparation.

5. Supplement defective or damaged embedded reinforcement with the addition of reinforcement as directed by the Engineer with a mechanical connection or splice per ACI 318.

6. Bars that are fully exposed for their entire length may be removed and replaced with new epoxy-coated bars, at the Contractors option, rather than cleaning and coating the existing bars.

C. Crack Routing

1. Rout cracks to a 3/4 inch deep by 3/8 inch wide cross sectional profile.

2. Clean the routed crack with an air jet.

D. Soil Excavation and Backfill

Soil excavation may be necessary for certain repairs. Perform the following operations for excavation and backfill:

1. Excavations adjacent to foundations shall be hand dug.

2. Place excavated soil in an area as directed by the Superintendent. Cover excavated soil with a rainproof tarp.

3. Provide soil erosion control measures.

4. Compact backfill to 95 percent maximum density per ASTM D1558, or as directed by the Engineer.

5. For repair below grade, rake back or remove the existing bluestone as necessary.

   a. Place bluestone in an area designated by the Superintendent.

   b. Upon completion of the backfill operations replace bluestone to original locations and elevations.

3.03 INSTALLATION

A. Coat exposed reinforcing bars with epoxy immediately after cleaning.

B. Mechanically mix the polymer-modified Portland cement mortar/concrete in appropriately sized mortar mixer following manufacturer's instructions. Do not overmix. Do not retemper the mix.

C. Pre-wet substrate to a saturated surface damp (SSD) condition with no standing water.

D. Surface Preparation (refer to manufacturer's requirements)

1. Apply a scrub coat or bond coat of mortar slurry to the substrate with a stiff brush. Vigorously scrub it into the roughened surface. Do not allow the bond coat to dry out.

2. Apply proprietary bonding adhesive in accordance with manufacturer's recommendations.

E. Installation

1. Fill cavity with the mixed material, consolidate, then screed. Allow material to set to desired stiffness then finish with trowel to match the finish of existing concrete.

2. At Contractor's option, form and pour large patch areas.

F. Cure surfaces in accordance with manufacturer's recommendations.

G. Seal routed cracks (Section 07900).

3.04 CLEANING

A. Clean the uncured polymer-modified portland cement mortar from tools with water. The cured polymer- modified portland cement mortar can only be removed mechanically.

B. Leave finished work and work area in a neat, clean condition without evidence of spillovers onto adjacent areas.

3.05 PROTECTION

A. Temporary Supports:

Provide temporary supports for all partial and full repair to any foundation supporting a structure or as directed by the Superintendent. The Contractor shall submit his plan for temporary supports to the Engineer for his approval prior to construction.

B. Temporary Protection:

Provide temporary protection consisting of plastic sheeting or other approved methods against dust infiltration during sand blasting operations. Electrical equipment shall be protected as directed by the Superintendent.

C. Vibration Damage:

Avoid damage to fresh patches due to impact or vibration caused by surface preparation of adjacent deteriorated concrete. Schedule surface preparation at a safe distance from fresh patches to avoid damage.

END OF SECTION 03730

DIVISION 4 - MASONRY

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DIVISION 4

SECTION 04200

UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Brick

2. Mortar

B. Product Installed but not Furnished under this Section

1. Grout, Section 03600

C. Related Sections

1. Section 03300, Cast-in-Place Concrete

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A82; Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. A240; Standard specification for Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

3. A366; Standard Specification for Steel, Sheet, Carbon, Cold- Rolled, Commercial Quality.

4. A479; Standard Specification for Stainless and Heat Resisting Steel Bars and Shapes for use in Boilers and other Pressure Vessels.

5. A580; Standard Specification for Stainless and Heat Resisting Steel Wire.

6. A635; Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils Carbon, Hot-Rolled.

7. C33; Standard Specification for Concrete Aggregates.

8. C62; Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).

9. C67; Standard Methods of Sampling and Testing Brick and Structural Clay Tile.

10. C90; Standard Specification for Load-Bearing Masonry Units

11. C129; Standard Specification for Non-Load-Bearing Concrete Masonry Units.

12. C144; Standard Specification for Aggregate for Masonry Mortar.

13. C145; Standard Specification for Solid Load-Bearing Concrete Masonry Units.

14. C150; Standard Specification for Portland Cement

15. C207; Standard Specification for Hydrated Lime for Masonry Purposes.

16. C216; Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).

17. C270; Standard Specification for Mortar for Unit Masonry

18. D226; Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

19. D1056; Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

20. D2000; Standard Classification System for Rubber Products in Automotive Applications.

21. D2287; Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

22. E119; Standard Test Methods for Fire Tests of Building Construction and Materials.

23. E447; Standard Test Methods for Compressive Strength of Masonry Prisms.

C. National Concrete Masonry Association

1. NCMA-TEK 45 -- Removal of Stains from Concrete Masonry Walls.

D. American Society of Civil Engineers (ASCE)

American Concrete Institute (ACI)

1. Building Code Requirements for Masonry Structures (ACI 530-88/ASCE 5-88)

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Minimum ultimate compressive strength of engineered masonry: 2,000 psi

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

B. Verification Samples:

1. Minimum of four brick proposed for each use.

2. Two samples of each type anchor and joint reinforcement.

3. One sample of each concrete masonry unit.

C. Tests Reports

1. All tests specified herein and required by referenced specification shall be made at the expense of the Contractor.

2. A representative sample of the face and common brick shall be tested in accordance with requirements of the ASTM Specification C67. The results of all tests required for the brick shall be submitted to the Engineer for approval. Testing shall be done by an independent commercial laboratory. Test reports shall be furnished in triplicate. Brick for use in the work shall have been approved, including test reports, before brick work is started.

3. Test reports and certificates of compliance with the Specification requirements shall be submitted to the

Engineer for each lot of masonry units which are furnished, and shall include the following information:

a. Age at test.

b. Storage conditions.

c. Dimension (h/t).

d. Compressive strength of individual prisms.

e. Coefficient of variation (v).

f. Ultimate compressive strength of masonry, which has been corrected for the coefficient of variation and the h/t of the prisms tested.

1.05 QUALITY ASSURANCE

A. Fire Performance Characteristics: Where fire-rated masonry construction is indicated, provide materials and construction methods identical to those of assemblies tested in accordance with ASTM E 119 for hourly ratings required. Provide evidence acceptable to governing authority that proposed construction complies with fire performance requirements.

B. Source Control: Obtain exposed masonry units from one manufacturer, with texture and color uniform or of a uniform blend acceptable to the Engineer.

C. Mock-up: Prior to commencement of exposed masonry work, erect sample wall panel to serve as standard of appearance and workmanship throughout construction period.

1. Build at location and to design indicated on drawings, or as otherwise directed.

2. Adjust until mock-up appearance and workmanship are acceptable to the Engineer.

3. Upon completion of construction and at the direction of the Superintendent, demolish mock-up construction completely and remove from site.

D. Testing Service: The Company will employ a testing laboratory to perform types of masonry testing for compliance with specification. The Contractor will be responsible for the cost of retesting required because of test failures.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means which will prevent mechanical damage and deterioration due to moisture, temperature changes, and corrosion.

B. Deliver cementitious materials to the site in unbroken bags, barrels or other appropriate containers plainly marked and labeled with the manufacturer's names and brands. Store off the ground and protected from moisture and intrusion of foreign materials.

C. Store aggregates in a manner which will preserve grading characteristics.

D. Store masonry accessories to prevent corrosion, dirt accumulation, and other deterioration.

1.07 PROJECT CONDITIONS

A. Protection of Work: During construction, cover tops of exterior walls with waterproof sheet material at end of each day. Cover partially completed masonry construction when work is not in progress.

1. Extend cover a minimum of 24 inches down on both sides, securing firmly in place.

2. Immediately remove mortar, soil, and other such materials from exposed masonry faces to prevent staining.

3. Protect wall bases from rain-splashed mud and from mortar splatter by means of coverings spread on ground and over wall surfaces.

4. Protect sills, ledges, and projections from droppings of mortar.

B. Cold Weather Construction: Implement the following procedures when either the ambient temperature falls below 40°F or the temperature of masonry units is below 40°F.

1. Preparation:

a. Temperatures of masonry units shall not be less than 20°F when laid in the masonry. Masonry units containing frozen moisture, visible ice or snow on their surface shall not be laid.

b. Remove visible ice and snow from the top surface of existing foundations and masonry to receive new construction. Heat these surfaces to above freezing, using methods that do not result in damage.

2. Construction: Apply the following requirements to work in progress when ambient temperatures are within prescribed ranges.

a. Construction requirements for temperatures between 40°F and 32°F:

i. Glass unit masonry shall not be laid.

ii. Water and aggregates used in mortar and grout shall not be heated above 140°F.

iii. Heat mortar sand or mixing water to produce mortar temperatures between 40°F and 120°F at the time of mixing.

iv. Heat water and aggregates for grout when they are below 32°F.

b. Construction requirements for temperatures between 32°F and 25°F: Meet the requirements from subparagraph a. and the following construction requirements:

i. Maintain the mortar temperature above freezing until used in masonry.

ii Heat aggregates and mixing water for grout to produce grout temperature between 70°F and 120°F at the time of mixing. Maintain grout temperature above 70°F at the time of grout placement.

c. Construction requirements for temperatures between 25°F and 20°F: Meet the requirements from subparagraphs a. and b. and the following construction requirements:

i. Masonry surfaces under construction shall be heated to 40°F.

ii. Wind breaks or enclosures shall be provided when the wind velocity exceeds 15 miles per hour (mph).

iii. Prior to grouting, masonry shall be heated to a minimum of 40°F.

d. Construction requirements for temperatures below 20°F: Meet the requirements from subparagraphs a., b., and c. and the following construction requirement: Enclosures and auxiliary heat shall be provided to maintain air temperature within the enclosure to above 32°F

3. Protection: Apply the following requirements after the masonry is placed. Apply requirements for grouted masonry based on anticipated minimum daily temperature. Apply requirements for ungrouted masonry based on anticipated mean daily temperature.

a. Glass unit masonry: The temperature of glass unit masonry shall be maintained above 40°F. for 48 hours after construction.

b. When the temperature is between 40°F and 25°F, cover newly constructed masonry with a weather-resistive membrane for 24 hours after being completed.

c. When the temperature is between 25°F and 20°F, completely cover newly constructed masonry with weather-resistive insulating blankets, or equal protection, for 24 hours after being completed. The time period shall be extended to 48 hours for grouted masonry, unless the only cement in the grout is Type III Portland cement.

d. When the temperature is below 20°F, maintain newly constructed masonry at a temperature above 32°F for at least 24 hours after being completed by using heated enclosures, electric heating blankets, infrared lamps or other acceptable methods. The time period shall be extended to 48 hours for grouted masonry, unless the only cement in the grout is Type III Portland cement.

C. Hot-Weather Protection: Cover or shade masonry units and mortar materials and use cool water for mortar whenever ambient air temperature is 90 degrees F or greater. At air temperatures of 85 degrees F or above, if relative humidity is less than 30 percent or wind is in excess of 15 miles per hour, provide protection by immediately covering newly constructed walls, by providing wind-breaks, or by using fog spray to reduce rate of evaporation.

PART 2 PRODUCTS

2.01 BRICK MASONRY UNITS

A. Provide brick which has aged a minimum of 60 days from date of firing.

B. Facing Brick: ASTM C 216

1. Standard Industry Brick size and shape

    a. Comparable products of other manufacturers will be considered for acceptance under standard substitution request procedures.

2. Special shapes: Provide special molded shapes where indicated and as required to achieve configurations shown, except where sawing standard units will accomplish required effect. For sills, caps, and similar applications resulting in exposure of brick surfaces normally concealed from view, provide uncored or unfrogged units with all exposed surfaces finished.

3. Grade SW

4. Size: Standard Modular

C. Building (Common) Brick

1. Grade SW.

2. Size: Standard Modular

3. Color: Red.

2.02 MORTAR

A. Mortar Material

1. Portland Cement: ASTM C 150, Type I/II.

2. Hydrated Lime: ASTM C 207, Type S.

3. Aggregate for Mortar: ASTM C 144. Clean, sharp, well graded and free from dust, lumps, shale, alkalies, surface coating and organic matter

4. Water: Clean and potable.

5. Accelerating Admixture: Nonchloride admixture for use in mortar mixes during cold weather, proportioned and mixed to comply with directions of manufacturer.

   a. Products:

      (1) "Accelguard 80"; Euclid Chemical Company.

      (2) "Dur-O-Guard"; Dur-O-Wal, Inc.

6. Integral Water Repellent Admixture:

B. Mortar Mix

1. General: Do not use admixtures unless indicated as acceptable in the Contract Documents.

   a. Do not use calcium chloride in mortar or grout mixture.

2. Mixing: Combine and thoroughly mix ingredients in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

3. Mortar for Unit Masonry: Comply with the requirements of ASTM C 270, Proportion Specification.

   a. Limit cementitious materials in mortar to Portland cement and lime. Masonry cement shall not be used.

   b. Use Type S mortar composed by volume proportions as follows:

      Portland Cement - 1 part

      Hydrated Lime - 1/2 part

      Aggregate (measured in a damp, loose condition) - 4 parts

   c. For exterior exposures the mortar shall contain the recommended amount of DRY-BLOCK mortar admix for water-repellency and to assure proper bond strength. (The recommended amount is one quart of DRY-BLOCK mortar admix per bag of Portland cement when mixed at the job site with lime-with not more than 6 cubic feet of masonry sand.

4. The method of measuring materials for the mortar used in construction shall be such that the specified proportions of the mortar materials can be controlled and accurately maintained.

Mortar shall conform to ASTM Specification C 270.

2.03 REINFORCEMENT AND ANCHORAGE

A. Joint Reinforcement and Anchorage Materials:

1. Steel wire

    a. Stainless Steel; ASTM A479, Type 304.

        1) Application: Use for dovetail ties, ladder type joint reinforcement, and miscellaneous wire in masonry accessories.

2. Sheet Steel

    a. Stainless Steel; ASTM A240, Type 304

3. Application: Use for dovetail slots, corrugated metal ties, anchors and miscellaneous sheet metal in masonry accessories.

4. Manufacturers:

    a. AA Wire Products Company

    b. Dur-o-Wal, Inc.

    c. Heckman Building Products, Inc.

    d. Hohmann and Barnard, Inc.

    e. Masonry Reinforcing Corporation of America.

    f. National Wire Products Industries, Inc.

B. Joint Reinforcement: Provide welded-wire units prefabricated into straight lengths of not less than 10 feet, with deformed continuous side rods and plain cross rods, and as follows:

1. Width: Approximately two inches less than nominal wall width, providing not less than 5/8 inch mortar coverage on exterior exposures and 1/2 inch elsewhere.

2. Wire sizes:

   a. Side rod diameter: 0.1620 inch.

   b. Cross rod diameter: 0.1483 inch.

3. Configuration:

   a. Applications more than one unit in width: Ladder design, cross rods at not more than 16 inches on center and number of side rods as follows:

      1) One rod per face shell of concrete masonry.

      2) Not less than one rod per brick wythe.

   b. Corners: Provide prefabricated L-and T-shaped units.

C. Flexible Anchors: Where flexible anchors are required for connecting masonry to structural framework, provide 2-piece anchors permitting vertical or horizontal differential movement between masonry and frame but preventing lateral movement of masonry out of plane.

1. For anchorage to concrete, provide dovetail anchor sections formed from sheet metal 0.1046 inch thick (12 gage), and triangular-shaped wire tie section 0.25 inch thick and sized to extend within 1 inch of masonry face.

   a. Furnish dovetail slots of sizes indicated, with filler strips, fabricated from not less than 22 gage sheet metal, for installation under Division 3.

2. For anchorage to steel frame, provide crimped anchor section 0.25 inch thick for welding and triangular-shaped wire tie section 0.25 inch thick and sized to extend within 1 inch of masonry face.

2.04 MISCELLANEOUS MASONRY ACCESSORIES

A. Expansion Joint Strips: Premolded flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41, capable of compression up to 35 percent, and of width and thickness indicated.

B. Premolded Control Joint Strips: Joints designed to fit standard sash block and to maintain lateral stability in masonry wall, of size and configuration indicated or as required for conditions, and as follows:

1. Either styrene-butadiene rubber compound complying with ASTM D 2000, 2AA-805; or polyvinyl chloride complying with ASTM D 2287, Type PVC 654-4.

C. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Sealant and Backer Rod: (Division 7).

E. Steel Weepholes: 1/4 inch plastic.

F. Brick Vent: molded PVC by Williams Products, Troy MI.

2.05 MASONRY CLEANER

A. Acidic Cleaner: General-purpose cleaner designed for new masonry surfaces of type indicated, comprised of blended organic and inorganic acids combined with special wetting systems, and expressly approved for intended use by manufacturer of masonry units being cleaned.

1. Products: The following products, provided they comply with requirements of the Contract Documents, will be among those considered acceptable:

a. "Sure Klean No. 600 Detergent"; ProSoCo, Inc.

2.06 PRECONSTRUCTION TESTING

A. Prism Testing: The Company's testing agency will test masonry prisms per ASTM E 447, Method B, for wall types as follows:

1. All walls.

a. Procedures: Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

b. Fabricate brick prisms with height-to-thickness ratio of 5, unless otherwise indicated.

c. Fabricate concrete masonry prisms with height-to-thickness ratio of not less than 1.33 and not more than 3.0.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROCEDURES

A. Workmanship

1. Masonry walls shall be carried up level and plumb all around. One section of wall shall not be carried up in advance of another section, unless specifically approved.

2. Height of masonry shall be checked with an instrument at sills and heads of openings, to maintain the level of the walls.

3. Masonry units shall be handled with care to avoid chipping, cracking, and spalling of faces and edges.

4. Drilling, cutting, fitting, and patching, to accommodate the work of others, shall be performed by masonry mechanics.

5. Cover tops of exposed walls and partitions with watertight material while work thereon is not in progress and at the end of each day.

6. Partitions and interior walls shall be securely anchored or wedged to the construction above. Wedging shall be done with slate, metal, or clay tile shims, at least two days after the erection of the wall or partition, and the top joint shall be filled solidly with mortar.

7. Scaffolding shall be inspected regularly, and shall be amply strong, well braced, and securely tied in position. Overloading of scaffolding will not be permitted.

B. Mortar Mixing

1. Measure mortar materials by volume in approved containers, so that the specified proportions of materials will be controlled and accurately maintained during the progress of the work.

2. Mortar boxes, pans, and/or mixer drums shall be kept clean and free of debris or dried mortar.

3. The mortar shall be used before the initial setting of the cement has taken place; retempering of mortar in which cement has started to set will not be permitted.

4. Anti-freeze compounds, salts, or any other substance used to lower the freezing point of mortar, will not be permitted.

C. Brick: Wet clay or shale brick which has an initial rate of absorption (suction) per ASTM C 67 of more than 30 grams per 30 square inches per minute. Use wetting methods which will ensure that each masonry unit is nearly saturated but dry to the touch when laid.

D. Concrete Masonry Units: Do not wet concrete masonry units prior to laying.

E. Sound-block: Install units with slots facing the transformer areas; open sides of cavities placed downward. Keep slots free of mortar and debris.

F. Reinforcing: Before placing masonry reinforcing, remove loose rust, dirt, and other coatings.

G. Equipment Openings: Leave openings for equipment to be installed in masonry. After installation of equipment, complete masonry work to match work immediately adjacent to opening.

H. Cutting Masonry Units: Use motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work.

3.02 CONSTRUCTION TOLERANCES

A. Variation from Plumb: Do not exceed the following construction tolerances in vertical elements, including surfaces of walls, columns, and arrises:

1. 1/4 inch in 10 feet.

2. 3/8 inch in one story height, or 20 feet, whichever is less, except 1/4 inch for external corners, expansion joints, and other highly conspicuous vertical elements.

3. 1/2 inch in 40 feet or more.

4. Plus or minus 1/4 inch in 10 feet, 1/2 inch maximum, for vertical alignment of head joints.

B. Variation from level: Do not exceed the following construction tolerances for bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal elements:

1. 1/4 inch in one bay or in 20 feet maximum.

2. 1/2 inch in 40 feet or more.

C. Variation from Plan Lines: Do not exceed the following horizontal construction tolerances for related portions of columns, walls, and partitions:

1. 1/2 inch in any bay or in 20 feet maximum.

2. 3/4 inch in 40 feet or more.

D. Variation in Cross Section: Do not exceed the following construction tolerances for thickness of walls and other masonry elements:

1. Minus 1/4 inch.

2. Plus 1/2 inch.

E. Variation in Mortar Joint Thickness: Do not exceed the following construction tolerances for thickness of mortar joints:

1. Bed joints: Plus or minus 1/8 inch.

2. Head joints: Plus or minus 1/8 inch.

3.03 MASONRY CONSTRUCTION - GENERAL

A. Layout: Lay out masonry for accurate pattern bond, for uniform joint widths, and for accurate location of specific features before beginning actual construction. Avoid use of masonry units of less than 1/2 size. Do not use units with less than nominal 4 inch horizontal face dimensions at corners and jambs.

B. Pattern Bond: Lay exposed masonry in running bond except where other bonds are indicated at special features.

1. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches.

2. Bond and interlock each course of each wythe at corners.

C. Stopping and Resuming Work: Lay masonry in proper sequence to avoid toothing. Rack walls back in each course at end of each work day. Before resuming, clean exposed surfaces and remove loose masonry units and mortar.

1. Lightly wet previously laid brick masonry units which have rate of absorption (suction) of more than 30 grams, per ASTM C 67, before laying fresh masonry.

D. Built-in Work: As work progresses, build in items indicated for installation in masonry, filling around built-in items solidly with masonry.

1. Fill spaces between metal frames and masonry elements solidly with mortar, unless otherwise indicated.

2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in mortar joint below location of items; rod mortar or grout into cores.

3. Fill cores in hollow concrete masonry units with grout 3 courses (24 inches) under bearing plates, beams, lintels, posts, and similar items, except as otherwise indicated.

E. Control and Expansion Joints: Provide vertical and horizontal expansion, control, and isolation joints in masonry where shown. Build in items related to such joints as masonry work progresses.

1. Install factory-fabricated elastic expansion joints as specified in Division 7.

2. Build in nonmetallic joint fillers where indicated.

F. Lintels: Install lintels of types indicated at all openings.

1. Bearing: Provide not less than 8 inches of bearing at each jamb unless otherwise indicated.

2. Reinforcement: At masonry openings greater than one foot in width, install horizontal joint reinforcement in 2 horizontal joints approximately 8 inches apart immediately above lintel and immediately below sill. Extend reinforcement which is in addition to required continuous joint reinforcement not less than 24 inches beyond jambs of the opening, except at control joints.

G. Provide weep holes on 2 foot horizontal centers at the base of interior and exterior concrete masonry unit walls.

H. Brick Vents: Provide brick vents on 2 foot horizontal centers at the base of exterior brick walls and imbed joints to receive flashing.

3.04 MORTAR BEDDING AND JOINTING

A. Lay solid masonry units with completely filled bed and head joints. Butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

B. Lay hollow masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be grouted or filled with concrete.

C. Maintain joint widths indicated, except for minor variations required to maintain bond alignment.

1. Except as otherwise indicated, maintain mortar joint widths of 3/8 inch.

D. Cut joints flush for masonry walls which are concealed or covered by other materials, unless otherwise indicated.

E. Tool exposed joints, using a V-shaped jointer larger than joint thickness unless otherwise indicated.

F. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

3.05 STRUCTURAL BONDING OF MULTIWYTHE MASONRY

A. Use continuous horizontal joint reinforcement installed in horizontal mortar joints for bond tie between wythes. Install at not more than 16 inches on center vertically. Lap reinforcing at least 6 inches. Cut or interrupt joint reinforcement at control and expansion joints.

B. Space reinforcement at parapets at 8 inches on center vertically.

C. Provide interlocking masonry unit bond in each course at corners and intersections with other walls, unless otherwise shown.

1. For horizontally reinforced masonry, provide continuity at corners with prefabricated L-shaped units, in addition to masonry bonding. Except at junctures detailed for vertical expansion or control joints, provide continuity at intersecting and abutting walls with prefabricated T-shaped units.

D. Anchor masonry to structural members where masonry abuts or faces structural members, and to comply with the following:

1. Providing an open space not less than 1 inch in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar and other rigid materials.

2. Anchor masonry to structural members, with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but at not more than the following:

a. 16 inches on center vertically.

b. 3 foot on center horizontal spacing.

3.06 CONCEALED MASONRY FLASHING

A. General: Provide concealed flashing in masonry work, whether or not specifically indicated, at or above shelf angles, lintels, ledges, and other obstructions to the downward flow of water within the masonry so as to divert such water to the exterior. Extend flashing the full length of such obstructions and a minimum of 4 inches into masonry at each end, or turned up at least 4 inches to form a pan at materials other than masonry. Prepare masonry surfaces smooth and free of projections which could puncture flashings. Place flashing on sloped mortar bed; seal lapped ends of flashing sheets and penetrations through flashing before covering with mortar.

1. Extend metal flashing through exterior face of masonry and turn down to form drip.

B. Through-Wall Flashings: Turn flashings up not less than 4 inches behind outer wythe and through the inner wythe to within 1/2 inch of the interior face of the wall in exposed work. Where interior surface is covered by furring or other material, carry flashing completely through inner wythe and turn up approximately 2 inches.

C. Heads and Sills: Turn up ends of flashing at least 2 inches at heads and sills to form a pan, and seal joints.

D. Sealing: Seal all joints in flashing to assure watertight integrity.

1. Lap end joints on metal flashings at least 4 inches; seal laps with elastic sealant or mastic.

E. Reglets and Nailers: Install reglets and nailers for flashing and other related work where shown to be built into masonry work.

3.07 FIELD QUALITY CONTROL

A. Compression Tests: Test masonry prisms for each wall type indicated, conducting sampling and testing per ASTM E 447, Method B, and as follows:

1. Prepare one set of prisms for testing at 7 days and one set at 28 days. Testing at 28 days will not be required if 7-day tests indicate that 28-day strength will be equal to or greater than required minimum ultimate compressive strength.

2. For brick masonry prisms, provide same height-to-thickness ratio (h/t) as provided under preconstruction testing.

3. For concrete unit masonry prisms, provide same height-to-thickness ratio (h/t) as provided under preconstruction testing.

4. Conduct tests no less frequently than is required to provide sets of prisms from each 5000 square feet of wall area installed.

B. Report test results in writing, and in the form specified under applicable test method, to both the Engineer and the Contractor not later than the day after the test is conducted.

3.08 REPAIR AND POINTING

A. Repair: Remove and replace masonry units which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units, and install in fresh mortar or grout pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of mortar joints, enlarge any holes or voids except weep holes and completely fill with mortar. Point up all joints, including corners, openings, and adjacent work, to provide a neat and uniform appearance.

3.09 CLEANING AND PROTECTION

A. Clean masonry as follows after mortar is thoroughly set and cured:

1. Remove large mortar particles by hand, using wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on sample wall panel, leaving half of panel uncleaned for comparison.

3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.

5. Use bucket and brush hand-cleaning method described in BIA "Technical Note No. 20 Revised" for brick masonry, using acidic cleaner applied in accordance with manufacturer's instructions.

6. Clean concrete unit masonry to comply with directions of masonry manufacturer and as recommended by NCMA in "Tek Bulletin No. 45".

B. Protection: Institute protective measures as required to ensure that unit masonry work will be clean and undamaged at date of substantial completion.

3.10 REMOVABLE MASONRY PANELS

Do not install removable masonry panels until the Company has installed its electrical equipment and the Superintendent has given authorization.

END OF SECTION 04200

DIVISION 4

SECTION 04520

MASONRY RESTORATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Masonry restoration.

2 Expansion joints.

3. Reinforcement, anchorage and accessories.

4. Crack and joint repair.

B. Related Sections

1. Section 04200, Unit Masonry

C. Unit prices

Provide unit prices for masonry restoration and repair as follows:

1. Re-pointing, per square foot.

2. Replacing defective brick, per square foot.

3. Installing expansion joints, per lineal foot.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A82; Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

2. A153; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

3. A366; Standard Specification for Steel, Sheet, Carbon, Cold- Rolled, Commercial Quality.

4. A525; Standard Specification for General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process.

5. A635; Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot-Rolled.

6. C62; Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).

7. C67; Standard Methods of Sampling and Testing Brick and Structural Clay Tile.

8. C144; Standard Specification for Aggregate for Masonry Mortar.

9. C150; Standard Specification for Portland Cement

10. C207; Standard Specification for Hydrated Lime for Masonry Purposes.

11. C270; Standard Specification for Mortar for Unit Masonry

12. D226; Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

13. D1056; Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.

14. D2287; Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.

15. E447; Standard Test Methods for Compressive Strength of Masonry Prisms.

B. Brick Institute of America (BIA);

1. Cleaning Brick Masonry; Technical Notes on Brick Construction, No. 20 Revised.

C. National Concrete Masonry Association;

1. NCMA-TEK 45 -- Removal of Stains from Concrete Masonry Walls.

1.03 DEFINITIONS

A. Defective masonry shall be defined as cracked, spalled or delaminated, not presenting a uniform appearance and capable of leaking rainwater.

B. Re-pointing shall be defined as the cutting-out of defective mortar joints and the filling of joint with new mortar.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements.

B. Verification Samples:

1. Minimum of four brick proposed for each use.

2. One sample of each type anchor and joint reinforcement.

C. Tests Reports

1. All tests specified herein and required by referenced specification shall be made at the expense of the Contractor.

2. A representative sample of the brick shall be tested in accordance with requirements of the ASTM Specification C67. The results of all tests required for the brick shall be submitted to the Engineer for approval. Testing shall be done by an independent commercial laboratory. Test reports shall be furnished in triplicate. Brick for use in the work shall have been approved, including test reports, before brick work is started.

3. Test reports and certificates of compliance with the Specification requirements shall be submitted to the Engineer for each lot of masonry units which are furnished, and shall include the following information:

   a. Age at test.

   b. Storage conditions.

   c. Dimension (h/t).

d. Compressive strength of individual prisms.

e. Coefficient of variation (v).

f. Ultimate compressive strength of masonry, which has been corrected for the coefficient of variation and the h/t of the prisms tested.

1.05 QUALITY ASSURANCE

A. Source Control: Obtain exposed masonry units from one manufacturer, with texture and color uniform or of a uniform blend acceptable to the Engineer.

B. Mockup

1. The Contractor shall restore a 3 foot x 3 foot wall panel in the presence of the Superintendent.

2. The acceptable panel and methods used shall become the standard of work for this Section of the Specification.

C. Pre-Installation Conference

A conference shall be held with the Contractor, the Superintendent and the Engineer to coordinate materials and techniques, and to sequence the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means which will prevent mechanical damage and deterioration due to moisture, temperature changes, and corrosion.

1. Provide protection which will limit moisture absorption of concrete masonry units to the maximum percentage specified for Type I units for the average relative humidity at the project site, as reported by the nearest National Weather Service station.

B. Deliver cementitious materials to the site in unbroken bags, barrels or other appropriate containers plainly marked and labeled with the manufacturer's names and brands. Store off the ground and protected from moisture and intrusion of foreign materials.

C. Store aggregates in a manner which will preserve grading characteristics.

D. Store masonry accessories to prevent corrosion, dirt accumulation, and other deterioration.

1.07 PROJECT CONDITIONS

A. Environmental Requirements

1. Do not lay bricks, repoint, caulk, wash down or wet surface when temperature may drop below 40 degrees F (4 degrees C) within 24 hours.

2. Do not use dust creating processes when wind is over 10 mph.

B. Existing Conditions

1. Match existing exterior work in size, color and texture.

C. Protection of Work:

1. Cover partially completed masonry construction when work is not in progress.

2. Immediately remove mortar, soil, and other such materials from exposed masonry faces to prevent staining.

3. Protect walls from rain-splashed mud and from mortar splatter.

4. Protect sills, ledges, and projections from droppings of mortar.

D. Cold-Weather Protection: Do not lay masonry units which have wet surfaces or units which are below freezing. Remove ice or snow from masonry bed by careful application of heat until dry to the touch. Remove masonry damaged by freezing.

1. General: Comply with the following construction procedures for masonry construction, based on air temperatures at time of installation:

a. 40 degrees F to 32 degrees F: Heat mixing water or sand to produce mortar temperature between 40 degrees F and 120 degrees F. Protect masonry from rain or snow for at least 24 hours by covering with weather-resistive membrane.

(1) Do not lay masonry units when air temperatures are below 32 degrees F.

2. Bricks: Comply with the following requirements for clay masonry units which must be wetted before laying because of initial rate of absorption (suction) greater than 30 grams, per ASTM C 67:

   a. Surface temperatures above 32 degrees F: Sprinkle water heated to 70 degrees F or above, just before laying.

   b. Surface temperatures below 32 degrees F: Sprinkle with water heated to 130 degrees F or above, just before laying.

3. Water: Do not heat water for mortar or grout to more than 160 degrees F.

E. Hot-Weather Protection: Cover or shade masonry units and mortar materials and use cool water for mortar whenever ambient air temperature is 90 degrees F or greater. At air temperatures of 85 degrees F or above, if relative humidity is less than 30 percent or wind is in excess of 15 miles per hour, provide protection by immediately covering newly constructed walls, by providing windbreaks, or by using fog spray to reduce rate of evaporation.

F. Existing Conditions

1. The work is located at a facility containing electrical equipment. Electrical equipment is located immediately adjacent to the work area and must be worked around and over. This equipment shall be protected while performing the work. Dust and debris shall not be permitted to fall on this equipment.

2. Due to the electrical equipment, the Contractor will be delayed while the Company is making arrangements for outages. The Contractor will be required to work in phases.

PART 2 PRODUCTS

2.01 BRICK MASONRY UNITS

A. Provide brick which has aged a minimum of 60 days from date of firing.

B. Face Brick: ASTM C216

1. To match original building masonry specification.

2. Grade SW

3. Size: To match existing.

C. Building (Common) Brick ASTM C 62

1. Grade SW.

2. Size: Standard Modular:

   a. Field verify brick dimensions.

3. Solid, with no cored holes.

4. Color: Red.

2.02 MORTAR

A. Mortar Material

1. Portland Cement: ASTM C 150, Type I/II.

2. Hydrated Lime: ASTM C 207, Type S.

3. Aggregate for Mortar: ASTM C 144. Clean, sharp, well graded and free from dust, lumps, shale, alkalies, surface coating and organic matter

4. Water: Clean and potable.

5. Accelerating Admixture: Nonchloride admixture for use in mortar mixes during cold weather, proportioned and mixed to comply with directions of manufacturer.

   a. Products:

      (1) "Accelguard 80"; Euclid Chemical Company.

      (2) "Dur-O-Guard"; Dur-O-Wal, Inc.

6. Integral Water Repellent Admixture:

7. Color of mortar shall match existing in exterior walls.

B. Mortar Mix

1. General: Do not use admixtures unless indicated as acceptable in the Contract Documents.

   a. Do not use calcium chloride in mortar mixture.

2. Mixing: Combine and thoroughly mix ingredients in a mechanical batch mixer; comply with referenced ASTM standards for mixing time and water content.

3. Mortar for Masonry Restoration: Comply with the requirements of ASTM C 270, Proportion Specification.

   a. Limit cementitious materials in mortar to Portland cement and lime. Masonry cement shall not be used.

   b. Use Type S mortar composed by volume proportions as follows:

      Portland Cement - 1 part

      Hydrated Lime - 1/2 part

      Aggregate (measured in a damp, loose condition) - 4 parts

   c. Use Type N mortar for tuck pointing, composed by volume proportions as follows:

      Portland Cement - 1 part

      Hydrated Lime - 1 part

      Aggregate (measured in a damp, loose condition) - 5 parts

4. The method of measuring materials for the mortar used in construction shall be such that the specified proportions of the mortar materials can be controlled and accurately maintained.

5. Mortar mix shall be colored to match existing adjacent mortar joints.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcement and Anchorage Materials:

1. Steel wire: ASTM A 82.

   a. Hot-dip galvanizing (after fabrication): ASTM A 153, Class B-2.

1) Application: Use for masonry exposed to exterior or in contact with earth.

2. Zinc-coated steel sheet: ASTM A 525 carbon steel, with G90 zinc coating.

   a. Application: Dovetail slots and where otherwise indicated.

3. Stainless Steel: Type 304

   a. Application: Dovetail Ties

4. Hot-dip galvanized steel sheet: ASTM A 366, Class 2, or ASTM A 635; hot-dip galvanized after fabrication to comply with ASTM A 153, Class B.

   a. Application: Wall reinforcing bars, anchors and miscellaneous sheet metal in masonry accessories.

5. Manufacturers:

   a. Dur-o-Wal, Inc.

   b. Heckman Building Products, Inc.

   c. Masonry Reinforcing Corporation of America.

   d. National Wire Products Industries, Inc.

B. Joint Reinforcement: Provide welded-wire units prefabricated into straight lengths of not less than 10 feet, with deformed continuous side rods and plain cross rods, and as follows:

1. Width: Approximately two inches less than nominal wall width, providing not less than 5/8 inch mortar coverage on exterior exposures and 1/2 inch elsewhere.

2. Wire sizes:

   a. Side rod diameter: 0.1875 inch.

   b. Cross rod diameter: 0.1483 inch.

3. Configuration:

a. Applications more than one unit in width: Ladder design, cross rods at not more than 16 inches on center and number of side rods as follows:

1) One rod per face shell of concrete masonry.

2) Not less than one rod per brick wythe.

b. Corners: Provide prefabricated L-and T-shaped units.

C. Flexible Anchors: 2-piece anchors permitting vertical or horizontal differential movement between masonry and frame but preventing lateral movement of masonry out of plane.

1. For anchorage to concrete, provide dovetail anchor sections formed from sheet metal 0.1046 inch thick (12 gage), and triangular-shaped wire tie section 0.25 inch thick and sized to extend within 1 inch of masonry face.

a. Furnish dovetail slots with filler strips: 22 gage sheet metal.

2. For anchorage to steel frame, provide crimped anchor section 0.25 inch thick for welding and triangular-shaped wire tie section 0.25 inch thick and sized to extend within 1 inch of masonry face.

2.04 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Joint Filler: Premolded flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE41, capable of compression up to 50 percent, and of width and thickness indicated.

B. Bond Breaker Strips: Asphalt-saturated organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

C. Sealant and Backer Rod: As specified in Division 7.

2.05 MASONRY CLEANER

A. Acidic Cleaner: General-purpose cleaner designed for new and existing masonry surfaces.

1. Products:

a. "Sure Klean No. 600 Detergent"; ProSoCo, Inc.

b. "Sure Klean Restoration Cleaner", ProSoCo, Inc.

2.06 EQUIPMENT

A. The Contractor shall select the means and methods of masonry restoration.

B. Use paddle type or shear type mortar mixer. Provide reserve mixer in the event of mechanical failure.

PART 3 EXECUTION

3.01 EXAMINATION

Area of defective masonry shall be identified and marked by the Contractor and reviewed by the Superintendent.

3.02 PREPARATION

A. Scaffolding shall be inspected regularly, and shall be amply strong, well braced, and securely tied in position. Overloading of scaffolding will not be permitted.

B. Mortar Mixing

1. Measure mortar materials by volume in approved containers so that the specified proportions of materials will be controlled and accurately maintained during the progress of the work.

2. Mortar boxes, pans, and/or mixer drums shall be kept clean and free of debris or dried mortar.

3. The mortar shall be used before the initial setting of the cement has taken place; retempering of mortar in which cement has started to set will not be permitted.

4. Anti-freeze compounds, salts, or any other substance used to lower the freezing point of mortar, will not be permitted.

C. Brick: Wet clay or shale brick which has an initial rate of absorption (suction) per ASTM C 67 of more than 30 grams per 30 square inches per minute. Use wetting methods which will ensure that each masonry unit is nearly saturated but dry to the touch when laid.

D. Reinforcing: Before placing masonry reinforcing, remove loose rust, dirt, and other coatings.

E. Cutting Masonry Units: Use motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining work.

3.03 INSTALLATION

A. Layout: Lay out masonry for accurate pattern bond, for uniform joint widths, and for accurate location of specific features before beginning actual construction. Avoid use of masonry units of less than 1/2 size. Do not use units with less than nominal 4 inch horizontal face dimensions at corners and jambs.

B. Pattern Bond: (To match existing)

C. Stopping and Resuming Work: Before resuming, clean exposed surfaces and remove loose masonry units and mortar.

1. Lightly wet previously laid brick masonry units which have rate of absorption (suction) of more than 30 grams, per ASTM C67, before laying fresh masonry.

D. Control and Expansion Joints: Provide vertical and horizontal expansion, control, and isolation joints in masonry where shown. Build in items related to such joints as masonry work progresses. Isolate steel truss chords from brick masonry.

E. Cut out damaged and deteriorated bricks with care in a manner to prevent damage to adjacent remaining materials.

F. Needle, shore and underpin any brick as necessary in advance of cutting out units.

G. Cut away loose or unsound brick and mortar to provide a firm and solid bearing for new work.

H. Ensure that anchors and ties are correctly located and built-in.

I. Build-in brick work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build-in all openings, accessories, and fittings.

3.04 MORTAR BEDDING AND JOINTING

A. Lay solid masonry units with completely filled bed and head joints. Butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.

B. Maintain joint widths indicated, except for minor variations required to maintain bond alignment.

   1. Except as otherwise indicated, maintain mortar joint widths of 3/8 inch.

C. Cut joints flush for masonry walls which are concealed or covered by other materials, unless otherwise indicated.

D. Tool exposed joints, using a V-shaped jointer larger than joint thickness unless otherwise indicated.

E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners or jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar, and reset in fresh mortar.

F. Fill collar joints between wythes solidly with mortar as each course is laid.

3.05 STRUCTURAL BONDING

A. Install continuous horizontal joint reinforcement at not more than 16 inches on center vertically. Lap reinforcing at least 6 inches. Cut or interrupt joint reinforcement at expansion joints.

   1. Provide continuity at corners with prefabricated L-shaped units.

   2. Provide continuity at intersecting and abutting walls with prefabricated T-shaped units.

B. Anchor new masonry to backup wall with anchors embedded in masonry joints and attached to structure.

   1. Space anchors as indicated, but at not more than the following:

      a. 16 inches on center vertically.

b. 3 foot on center horizontal spacing.

3.06 REPAIR AND POINTING

A. Repair: Remove and replace masonry units which are loose, chipped, broken, stained, or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units, and install in fresh mortar or grout pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of mortar joints, enlarge any holes or voids except weep holes and completely fill with mortar. Point up all joints, including corners, openings, and adjacent work, to provide a neat and uniform appearance.

3.07 CLEANING

A. Promptly as work proceeds and upon completion, remove excess mortar, smears and droppings. All ground surfaces splattered with mortar droppings shall be thoroughly cleaned daily.

1. Test cleaning methods on sample wall panel, leaving half of panel uncleaned for comparison.

2. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

3. Ensure that new mortar is thoroughly set and cured prior to cleaning.

4. Saturate masonry with clean water and flush off all loose mortar and dirt.

5. Scrub masonry with a detergent or acid solution using stiff brush. Before solution dries, thoroughly rinse and wash off using clean, pressurized water. B. Institute protective measures as required to ensure that unit masonry work will be clean and undamaged at date of substantial completion.

END OF SECTION 04520

DIVISION 5 - METALS

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DIVISION 5

SECTION 05120

STRUCTURAL STEEL

PART I GENERAL

1.01 SUMMARY

A. Section includes fabrication and installation of structural steel.

B. Related Sections

1. Section 03300, Cast-in-Place Concrete

2. Section 03600, Grout

3. Section 04200, Unit Masonry

4. Section 05500, Metal Fabrications

1.02 REFERENCES

A. American Institute of Steel Construction (AISC)

1. "Manual of Steel Construction" (Ninth Edition)

2. "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings", with Commentary

3. "Code of Standard Practice for Steel Buildings and Bridges"

4. "Specifications for Structural Joints using ASTM A325 or A490 Bolts"

B. American Welding Society (AWS) "Structural Welding Code"

C. American Society for Testing and Materials (ASTM)

1. A6; General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use.

2. A36; Standard Specification for Structural Steel.

3. A53; Standard Specification for Steel Pipe.

4. A123; Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

5. A153; Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

6. A307; Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

7. A325; Standard Specification for High-Strength Bolts for Structural Steel Joints.

8. A501; Standard Specification for Steel Tube.

D. Structural Steel Painting Council (SSPC).

1.03 DESIGN REQUIREMENTS

A. Beam to column connections shall be moment connections unless detailed differently on the Drawings.

B. Connections that are not detailed on the Drawings shall be designed to develop the full strength of the beam plus 25 percent.

C. Electrodes for welded shop connections shall be E70XX.

D. Field connections shall be bolted unless detailed otherwise on the drawings. Bolted connections shall be made in accordance with the latest edition of "Specification for Structural Joints Using A325 Bolts", Research Council on Riveted and Bolted Structural Joints of the American Institute of Steel Construction, Inc.

1.04 SUBMITTALS

A. Manufacturer's Data: Submit producer's or manufacturer's specifications and installation instructions for the following products, include laboratory test reports and other data to show compliance with specified standards:

1. Structural steel, including certified copies of mill reports covering chemical and physical properties.

2. High-strength bolts, including nuts and washers and direct tension indicator washers.

3. Unfinished bolts and nuts.

4. Structural steel primer paint. (Shop primer)

B. Shop Drawings: Submit shop drawings prepared under supervision of a professional engineer registered in the jurisdiction of the work, including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

1. Include details of cuts, connections, holes, and other pertinent data.

2. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.

3. Provide setting drawings, templates and directions for installation of anchor bolts and other anchorages to be installed by other trades.

4. Identify details by reference to sheet and detail number of the Drawings.

5. Structural design drawings shall not be reproduced for use as base sheet for shop drawings, erection plans or details.

C. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include date, type(s), and results.

D. No structural steel sections shall be substituted for the sizes shown on the drawings, unless approved by the Engineer.

1.05 QUALITY ASSURANCE

A. Provide documentation that the structured steel fabricating plant is a participant in the AISC Quality Certification Program.

B. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure" prior to start of the Work.

C. Provide certification that welders to be employed in the Work have satisfactorily passed AWS qualification tests.

1. If recertification of welders is required, retesting will be Contractor's responsibility.

2. Each bolting crew and welder shall be assigned an identifying symbol or mark and shop and field connections shall be so identified that the inspector can refer back to the crew or person making the connection.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site properly marked, and at such intervals to insure uninterrupted progress of work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay the Work.

B. Store materials in a manner to maintain identification and to prevent damage.

1. Store materials off the ground using pallets, platforms or other supports.

2. Protect steel members and packaged materials from corrosion, deterioration, distortion and damage.

3. Repair or replace all damaged materials as directed.

PART 2 PRODUCTS

2.01 MATERIALS:

A. Structural Steel Shapes: ASTM A36.

1. Hot-dip galvanized, ASTM A123, for locations indicated.

B. Steel pipe: ASTM A53, type E or S, grade B and, where applicable, API-5L, grade B.

1. Hot-dip galvanized, ASTM A123, for locations indicated.

C. Steel tube: ASTM A501.

1. Hot-dip galvanized, ASTM A123 for locations indicated.

D. Anchor Bolts: ASTM A307, non-headed type unless otherwise indicated.

E. Unfinished Threaded Fasteners: ASTM A307, Grade A, hexhead bolts and nuts, Hot-dip galvanized per ASTM A153.

F. High-Strength Threaded Fasteners: ASTM A325, Type 1 Heavy hexagonal structural bolts, heavy hexagonal nuts, and hardened washers, Hot-dip galvanize per ASTM A153.

G. Electrodes for Welding: Comply with AWS Code. Use E70XX electrodes.

H. Structural Steel Primer Paint:

1. "10-99 Tnemec Primer".
2. Rustoleum No. 5769 Primer.
3. Approved substitute.

2.02 FABRICATION

A. Shop Fabrication and Assembly

1. Fabricate and assemble structural assemblies in shop to greatest extent possible.
2. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.
3. Provide camber in structural member where indicated.
4. Use markings corresponding to the approved shop drawings. Mark and match-mark materials for field assembly.
5. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
6. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects. Complete the assembly, including welding of units, before start of finishing operations.

B. Connections:

1. Bolt field connections, except where welded connections or other connections are indicated.

   a. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

b. Provide unfinished threaded fasteners only for bolted connections of secondary framing members to primary members (including purlins, girts, and other framing members taking only nominal stresses) and for temporary bracing to facilitate erection.

2. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".

3. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work. Stress relief welded assemblies.

a. Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS.

b. Welded connections shall be detailed and designed to minimize the accumulation and concentration of thru-thickness strains due to weld shrinkage.

c. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedure to prevent brittle and premature fracture during fabrication and erection.

C. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on approved shop drawings.

1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

D. Bases and bearing plates: Shop weld to columns and members attached to concrete or masonry.

2.03 SHOP PAINTING

A. Shop paint structural non-galvanized steel, except those members or portions of members to be embedded in concrete or mortar.

Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.

1. Do not paint surfaces which are to be welded or high-strength bolted with friction-type connections.

2. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from the first.

B. Surface Preparation: Clean steel in accordance with Steel Structures Painting Council (SSPC) P-3 "Power Tool Cleaning".

C. Painting:

1. Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide a dry film thickness of not less than 1.5 mils.

2. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces.

3. Apply second coat when first coat has sufficiently cured.

2.04 GALVANIZING

A. Structural steel members not fireproofed with concrete or brick shall be hot-dip galvanized. Hot-dip galvanizing shall be in accordance with ASTM A123 or A153 as applicable.

B. Galvanized steel members accidentally damaged during construction or damaged by authorized field welds shall be repaired with 2 coats of an approved galvanizing repair compound.

2.05 SOURCE QUALITY CONTROL

A. Provide access for Company's testing and inspection agency to places where structural steel work is being fabricated so that required inspection and testing can be accomplished.

B. Structural steel may be inspected at the plant before shipment; however, Engineer reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

C. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any noncompliance of original work, and as may be necessary to show compliance of corrected work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Surveys:

1. Establish permanent benchmarks necessary for accurate erection of structural steel.

2. Check elevations of concrete surfaces, and locations of anchor bolts, levelling plates, and similar items, before erection proceeds.

3. Do not proceed with erection until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Temporary Shoring and Bracing:

1. Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads.

2. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

3. Remove temporary members and connections when permanent members are in place and final connections are made.

B. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the Work.

C. Anchor Bolts:

1. Preset anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

2. Furnish templates and other devices as necessary for accurate locations.

3. Refer to Section 03300 for anchor bolt installation requirements in concrete, and Section 04200 for masonry installation.

D. Leveling Plates:

1. Pre-install 1/4 inch thick leveling plates sheared to the same size as the base plates.

2. Grout leveling plates in place in advance of the column erection. (See Section 03600).

3.03 ERECTION

A. General:

1. Structures shall not be set on foundations until at least seven (7) days after the concrete has been placed.

2. The methods of assembling and erecting the structures shall be such that during erection no member shall be subjected to any stress in excess of that for which it was designed.

3. Misalignment or misfit of adjacent sections or members attributable to the method of erection shall be corrected by adjusting erection methods as necessary to eliminate the trouble. 4. Members shall be clean at the joints when bolted.

5. Structures assembled on the ground shall be blocked off the ground so as to be free of dirt, mud and other foreign materials that tend to adhere to the structure.

6. If erected by assembling in sections, initial bolting shall be adequate for dead load and live loads, but shall not be so tight as to prevent aligning and fitting adjacent sections of members.

7. The use of any wrench which may deform the nut, or cut or flake the metal or galvanizing will not be permitted.

B. Tighten anchor bolts after supported members have been positioned and plumbed.

C. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.

2. Align and adjust various members forming a part of a complete frame or structure before permanently fastening.

3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.

4. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

5. Level and plumb individual members of structure within specified AISC tolerances.

6. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

7. All measurements relating to field assembly shall be on the theoretical centerline of the columns.

8. No welding or bolting shall be done until as much of the structure as will be stiffened by the welding or bolting has been aligned.

9. Bolting shall be in compliance with AISC specifications.

3.04 TOUCH-UP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint.

   1. Apply paint to exposed areas using same materials as used for shop painting.

   2. Use zinc-rich type paint to touch up damage to galvanized steel.

B. Apply two coats by brush or spray to provide minimum dry film thickness of 1.5 mils each coat.

3.05 FIELD QUALITY CONTROL

A. The Company will engage a testing and inspection agency to inspect high-strength bolted connections and welded connections. The Contractor shall provide labor, equipment, and facilities needed to move and handle the materials to be inspected.

B. Erection inspection:

1. The Company's testing and inspecting agency will inspect high strength bolted connections, and will perform such additional tests and inspections of field work as are required by the Engineer's review.

2. The testing agency will conduct and interpret the tests, and will state in each report whether the inspected work complies with the requirements, specifically stating all deviations therefrom.

C. Welding inspection:

1. Perform welding under observation of a qualified inspector from a testing laboratory approved by the Engineer.

2. Inspect every layer of weld for quality, penetration, and conformity with design requirements.

3. The welding inspector will submit a signed report to the Engineer verifying that:

   a. The welding is adequate and was performed in conformity with the specified requirements;

   b. And adequate methods have been used to determine the quality of the welding.

4. The welding inspector may use gamma ray, magnaflux, trepanning, or any other aid to visual inspection considered necessary to assure adequacy of welding, or may use ultrasonic testing performed in accordance with pertinent requirements of governmental agencies having jurisdiction.

D. Corrections:

1. Correct deficiencies in structural steel work which inspections and test reports indicate to be not in compliance with the specified requirements.

2. Perform additional tests required to reconfirm non-compliance of corrected work, all at no additional cost to the Company.

3.06 ADJUSTING

A. A reasonable amount of drifting will be allowed in assembly, but punching, reaming, or drilling for correction of mismatched holes due to shop errors shall not be permitted without the authorization of the Superintendent. If any shop errors are discovered, the Contractor shall notify the Superintendent who will decide whether the error shall be corrected in the field or the members returned to the fabricator for correction or replacement.

B. Gas Cutting:

1. Do not use cutting torches for correcting fabricating errors in the structural framing.

2. Cutting will be permitted only in secondary members as acceptable to the Engineer.

3. When gas cutting is permitted, finish the gas cut section to a sheared appearance acceptable to the Superintendent.

C. When authorized by the Superintendent in writing, the Contractor shall correct members for misaligned holes or interferences.

END OF SECTION 05120

DIVISION 5

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes providing the labor materials, tools, equipment, services and supervision for and reasonably incidental to complete metal fabrications work as shown on the Drawings and herein specified, including but not limited to the following:

1. Rough hardware

2. Clip angles, bent plates, rods, backing plates, anchor bolts

3. Loose steel lintels

4. Miscellaneous framing and supports

5. Miscellaneous angles, braces, struts and kickers

B. Products Furnished but not Installed under this Section.

1. Loose steel lintels, Section 04200

2. Miscellaneous framing and supports, Section 04200

C. Products Installed but not furnished under this Section

1. Paint, Section 09900

D. Related Sections

1. Section 04200, Unit Masonry

2. Section 05120, Structural Steel

1.02 REFERENCES

A. American Institute of Steel Construction (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", including commentary of the AISC Specifications.

B. American Iron and Steel Institute (AISI) "Specifications for the Design of Cold-Formed Steel Structural Members"

C. American Welding Society (AWS) "Structural Welding Code".

D. American Society for Testing and Materials (ASTM).

1. General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use (A6).

2. Standard Specification for Structural Steel (A36)

3. Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware (A153)

4. Standard Specification for High-Strength Bolts for Structural Steel Joints (A325)

5. Standard Specification for Steel Plate (A283)

E. Industrial Fasteners Institute "Handbook on Bolt, Nut and Rivet Standards".

F. American National Standards Institute (ANSI) A14.3, A12.1, A58.1 and Part 1910 of the Occupational Safety and Health Standards, OSHA, as applicable to stairs, ladders, railings and protection of openings in floors.

1.03 SUBMITTALS

A. Submit shop drawings for fabrication and erection of miscellaneous metal fabrications. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

B. Submit manufacturer's product data for grout.

1.04 QUALITY ASSURANCE

Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.

1.05 DELIVERY STORAGE AND HANDLING

Provide special protection during shipping and installation for items finished in the shop with finish paints.

1.06 SITE CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Conditions of Substrates: Examine the conditions under which the work will be done. Do not proceed until unsatisfactory conditions have been corrected.

1.07 COORDINATION

Furnish inserts and anchoring devices which must be set in concrete or built into masonry for the installation of miscellaneous metal fabrications. Refer to concrete and masonry Sections for installation of inserts and anchoring devices.

PART 2 PRODUCTS

2.01 MATERIALS

A. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names, rust and roughness.

B. Steel shall be free from defects that impair strength, durability or appearance, and shall be of best commercial quality for the purpose specified, and made with structural properties to safely withstand strains and stresses to which they will be subjected. Miscellaneous steel not otherwise specified shall meet the requirements of ASTM Specification A36.

C. Grout: Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining non-corrosive, non-gaseous grout complying with U.S. Army Corps of Engineers CRD-C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section. Provide "Masterflow 928" by Master Builder, Inc. or approved substitutes.

D. Fasteners: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required.

1. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A

2. Lag Bolts: Square head type, FS FF-B-561

3. Machine Screws: Cadmium plated steel, FS FF-S-92

4. Wood Screws: Flat head carbon steel, FS FF-S-111

5. Plain Washers: Round, carbon steel, FS FF-W-92

6. Masonry Anchorage Devices: Expansion shields, FS FF-S-325

2.02 COMPONENTS

Steel components are indicated on the Drawings. All anchors, bolts, angles, hangers, supports, and any other accessory needed for a completed assembly and installation shall be furnished as required.

2.03 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness indicated or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

1. Preassemble work in the shop to greatest extent possible. Minimize field splicing and assembly of units. Disassemble units only to extent necessary for shipping.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts.

E. Provide for anchorage, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

G. Galvanizing: Provide a zinc coating for all exterior steel fabrication items and those items shown or specified to be galvanized, as follows:

1. ASTM A153 for galvanizing iron and steel hardware.

2. ASTM A123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8" thick and heavier.

H. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

I. Shop paint miscellaneous metal work, except surfaces and edges to be field welded, and galvanized surfaces, unless otherwise indicated. (See Section 09900, Painting)

2.04 MISCELLANEOUS METAL FABRICATIONS:

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing, supporting, bracing, strutting and anchoring fabricated items to concrete or other structures.

B. Fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

C. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

D. Provide loose structural steel lintels for openings and recesses in masonry walls and partitions as shown or as required to complete the work. Weld adjoining members together to form a single unit where indicated. Provide not less than 8" bearing at each side of openings.

E. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work including, but not limited to the following:

1. Miscellaneous plates and angles for the support, bracing, stiffening, and strutting of masonry connections to the structure.

F. Fabricate miscellaneous units to sizes, shapes and profiles shown or, if not shown, of required dimensions to receive other adjacent work to be retained by framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.02 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, screws and other connectors as required.

B. Cutting, Fitting and Placement: Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications. Set work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

C. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

D. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

1. Grind all welds smooth.

E. Setting Loose Plates: Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

F. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut-off flush with the edge of the bearing plate before packing with grout.

G. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.03 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces: Clean field welds, bolted connections and abraded areas and apply 2 coats of galvanizing repair paint.

END OF SECTION 05500

DIVISION 15 - MECHANICAL

Table of Contents

DIVISION 15

SECTION 15400

PLUMBING

PART 1 GENERAL

01.1 Scope

A. Section includes all material, labor, equipment, services and operations necessary for and reasonably incidental to the complete installation of drains as indicated on the Drawings and herein specified.

B. Related Sections

1. Section 02700 Sewerage and Drainage

1.02 REGULATORY REQUIREMENT

A. All materials and workmanship shall be in accordance with The BOCA Plumbing Code.

B. Permits and Charges

The Company shall obtain and pay for all necessary permits and pay all required connection charges.

PART 2 PRODUCTS

2.01 Water Lines

A. Leaders

Rain water leaders shall be 4 inch diameter stainless steel, type 302 or 304, dead soft temper, .0l5 inch thick 2D mill finish. Leader straps shall be 2 l/2 inch wide, .0l8 inch thick. Roof Scupper drains and downspout elbow shall be Josam type 24900, complete with galvanized nipple.

B. Roof Drains

Roof drains shall be Josam Type 4954-B cast iron scupper drain, with 4-inch diameter elbow connected to a 4-inch rainwater leader. Overflow scupper shall be Josam Type 25002.

PART 3 EXECUTION

3.01 INSTALLATION

A. Storm and Sanitary Sewer

Storm and sanitary sewer shall be installed and tested in accordance with WSSC requirements (Section 02700).

B. Rainwater Leaders

Leaders shall be held clear from wall for the required distance with 3/4 x l/2 inch ears punched from straps. Provide shoulders on each side of leaders to support their weight.

3.02 TESTING

Fill all drainage systems with water and drain these systems before they are placed in operation to assure complete removal of foreign materials left or deposited in the piping system during its installation.

END OF SECTION 15400

APPENDIX A

2003 District of Columbia Standards and Specifications for Soil Erosion and Sediment Control (applicable portions thereof)

4.0 STANDARDS AND SPECIFICATIONS

FOR

STRAW BALE DIKE

Definition

Straw bale dikes are temporary barriers of straw or similar material used to intercept and direct surface runoff.

Purpose

The straw bale dike intercepts sediment laden runoff so that deposition of transported sediment can occur.

1. The use of straw bale dikes is not recommended as a primary sediment control device. Straw bale dikes clog and deteriorate rapidly and require frequent maintenance.

2. Straw bale dikes can be used to intercept sheet flow only. They cannot be used as velocity checks in swales, or placed where they will intercept concentrated flow.

3. Straw bale dikes can be used only on projects that will be completed within three months.

4. Straw bale dikes shall not be used on slopes exceeding 5:1.

5. The length of straw bale dikes must conform to the following limitations:

Table 1 Straw Bale Design Criteria

Slope	Slope Steepness	Slope Length	Dike Length
0% to <2%	Flatter than 50:1	300 feet	500 feet
2% to <10%	50:1 to <10:1	125 feet	500 feet
10% to <20%	10:1 to <5:1	100 feet	500 feet

Construction Specifications

1. Bales shall be placed in a row on the contour with the ends of each bale tightly abutting the adjacent bales.

2. Each bale shall be entrenched 4" min. in the soil and placed so the bindings are horizontal.

3. Bales shall be securely anchored in place by either two stakes or re-bars driven through the bale 12" to 18" into the ground. The first stake in each bale shall be driven toward the previously laid bale at an angle to force the bales together. Stakes shall be driven flush with the top of the bale.

4. All bales shall be removed when the site has been stabilized. The trench where the bales were located shall be graded flush and stabilized.

<u>Maintenance</u>

1. Straw bale barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall events. The anchoring stakes must be re-driven if they become exposed

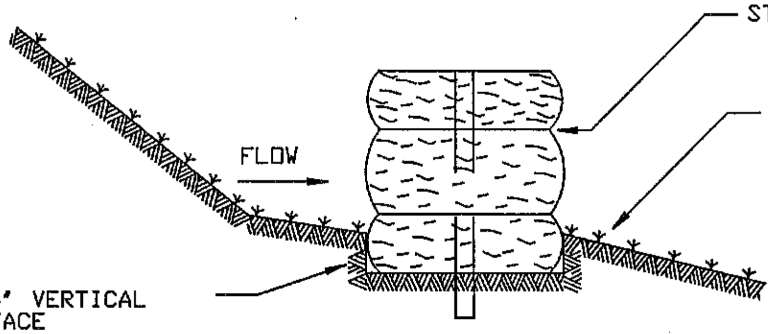
2. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales.

3. Necessary repairs to barriers or replacement of bales shall be accomplished promptly.

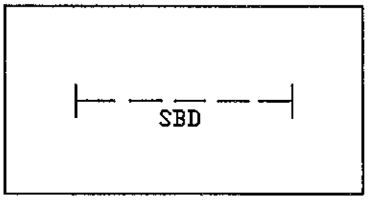
4. Sediment deposists should be removed after each rainfall. They must be removed when the level of depostion reaches approximately one-half the height of the barrier.

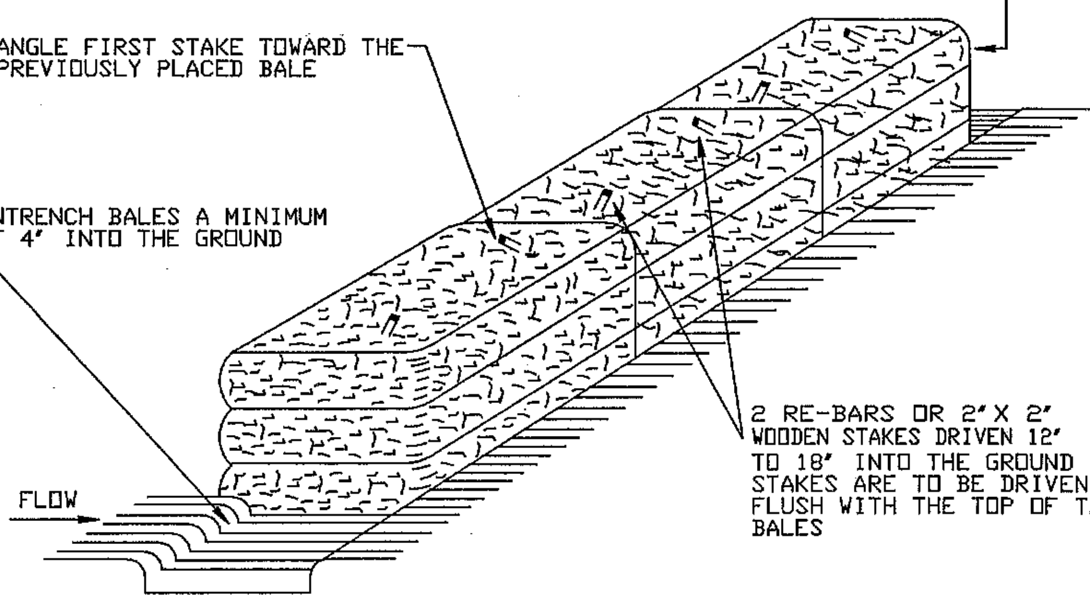
5. Any sediment deposits remaining in place after the straw bale barrier is no longer required shall be dressed to conform to the existing grade, prepared and seeded.

DETAIL 3 - STRAW BALE DIKE



BEDDING DETAIL





ANCHORING DETAIL

STRAW BALE DIKE

Construction Specifications

1. Bales shall be placed at the toe of a slope, on the contour, and in a row with the ends of each bale tightly abutting the adjacent bales.

2. Each bale shall be entrenched in the soil a minimum of 4" and placed so the bindings are horizontal.

3. Bales shall be securely anchored in place by either two 2" X 2" wooden stakes or re-bars driven through the bale 12" to 18" into the ground. The first stake in each bale shall be driven toward the previously laid bale at an angle to force the bales together. Stakes shall be driven flush with the top of the bale.

4. Straw bale dikes shall be inspected frequently and after each rain event and maintenance performed as necessary.

5. All bales shall be removed when the site has been stabilized. The trench where the bales were located shall be graded flush and stabilized.

5.0 STANDARDS AND SPECIFICATIONS

FOR

SILT FENCE

Definition

Temporary barriers of woven geotextile fabric used to intercept, reduce velocity and filter surface runoff from disturbed areas.

Purpose

Silt fences intercept sediment laden sheet flow runoff so that deposition of the transported sediment can occur. Silt fences can be used to intercept sheet flow only. Silt fence shall not be used as velocity checks in ditches or swales, or placed where it will intercept concentrated flow.

Conditions Where Practice Applies

Silt fence is limited to intercepting sheet flow runoff from limited distances according to slope. Silt fence provides filtering and velocity dissipation to promote gravity settling of sediments.

Design Criteria

1. Silt fence should be used with caution in areas of rocky soils that may prevent trenching.

2. Silt fence should be placed parallel to contours.

3. The length of silt fences must conform to the following:

Table 2 Silt Fence Design Constraints

Slope Steepness	(Maximum) Slope Length	(Maximum) Silt Fence Length
Flatter than 50:1 (2 %)	unlimited	unlimited
>50:1 to 10:1 (2- 10%)	125 feet	1,000 feet
>10:1 to 5:1(10-20%)	100 feet	750 feet
>5:1 to 3:1 (20- 33%)	60 feet	500 feet
>3:1 to 2:1 (33- 50%)	40 feet	250 feet
> 2:1 (> 50%)	20 feet	125 feet

4. In areas of less than 2% slope and sandy soils (USDA general classification system, soil class A) maximum slope length and silt fence length will be unlimited. In these areas, a silt fence may be the only perimeter control required.

5. Downslope from the silt fence should be undisturbed ground.

Construction Specifications

1. Fence posts shall be a minimum of 36 inches long driven 16" minimum into ground. Wood posts shall be 1 1/2" X 1 1/2" (minimum) square cut, or 1 3/4" (minimum) diameter round and shall be of sound quality hardwood. Steel posts will be standard T or U section weighing not less than 1.00 pound per linear foot.

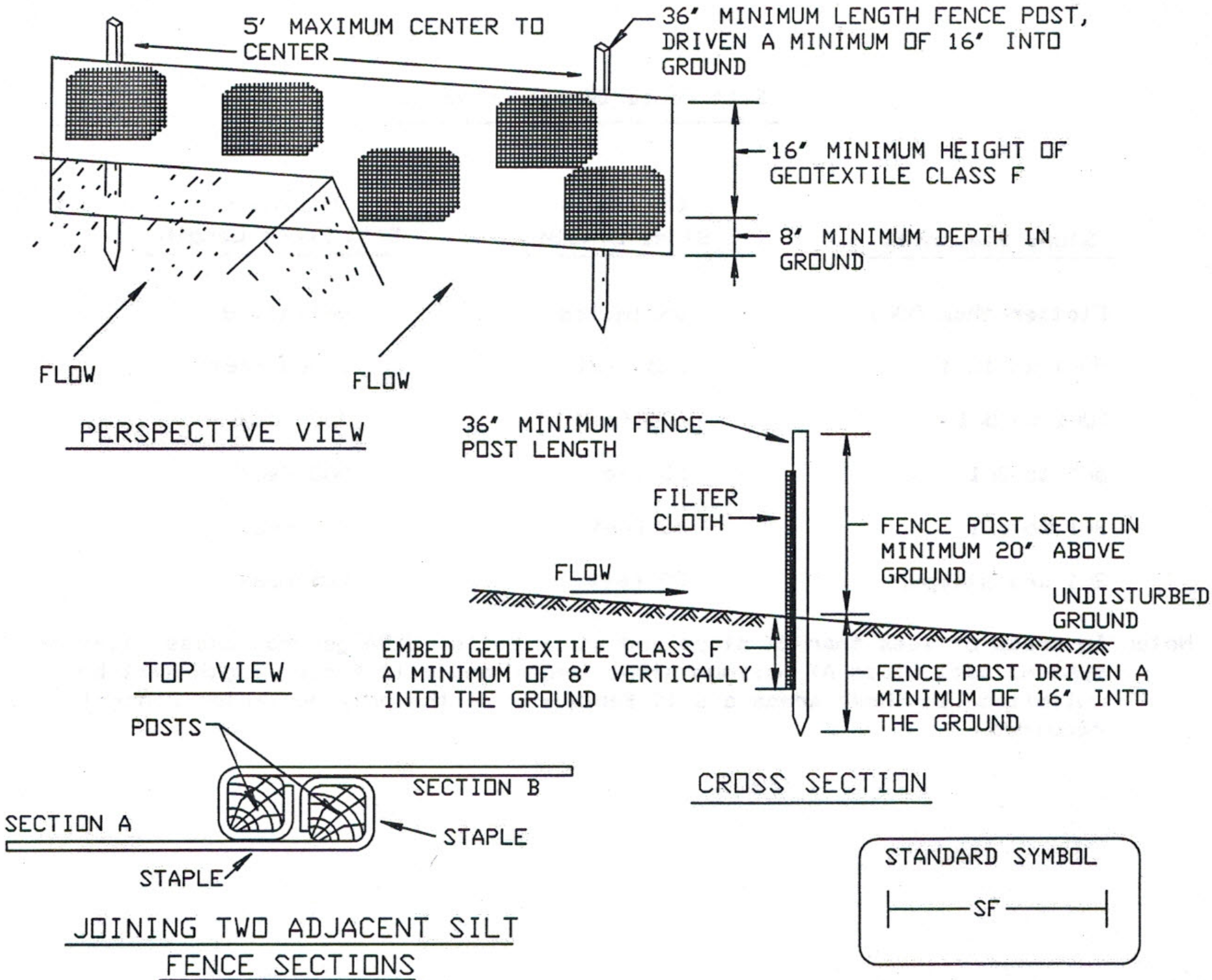
2. Geotextile shall be fastened securely to each fence post with wire ties or staples at top and mid-section and shall meet the following requirements for Geotextile Class F:

Tension Strength	50 lb/in (min.)	Test: ASTM D-4595
Tensile Modulus	20 lb/in (min.)	Test: ASTM D-4595
Flow Rate	0.3 gal/ft^2/minute (max.)	Test: ASTM D-5141
Filtering Efficiency	75% (min.)	Test: ASTM D-5141

3. Where ends of geotextile fabric come together, they shall be overlapped, folded and stapled to prevent sediment bypass.

4. Silt Fence shall be inspected after each rainfall event and maintained when bulges occur or when sediment accumulation reached 30% of the fabric height.

DETAIL 4 - SILT FENCE



Construction Specifications

1. Fence posts shall be a minimum of 36' long driven 16' minimum into the ground. Wood posts shall be 11/2" x 11/2" square (minimum) cut, or 13/4' diameter (minimum) round and shall be of sound quality hardwood. Steel posts will be standard T or U section weighting not less than 1.00 pond per linear foot.

2. Geotextile shall be fastened securely to each fence post with wire ties or staples at top and mid-section and shall meet the following requirements for Geotextile Class F:

Tensile Strength	50 lbs/in (min.)	Test: ASTM D-4595
Tensile Modulus	20 lbs/in (min.)	Test: ASTM D-4595
Flow Rate	0.3 gal/ft^2/minute (max.)	Test: ASTM D-5141
Filtering Efficiency	75% (min.)	Test: ASTM D-5141

3. Where ends of geotextile fabric come together, they shall be overlapped, folded and stapled to prevent sediment bypass.

4. Silt Fence shall be inspected after each rainfall event and maintained when bulges occur or when sediment accumulation reached 30% of the fabric height.

SILT FENCE

Silt Fence Design Criteria

Slope Steepness	(Maximum) Slope Length	(Maximum) Silt Fence Length
Flatter than 50:1	unlimited	unlimited
50:1 to 10:1	125 feet	1,000 feet
10:1 to 5:1	100 feet	750 feet
5:1 to 3:1	60 feet	500 feet
3:1 to 2:1	40 feet	250 feet
2:1 and steeper	20 feet	125 feet

Note: In areas of less than 2% slope and sandy soils (USDA general classification system, soil Class A) maximum slope length and silt fence length will be unlimited. In these areas a silt fence may be the only perimeter control required.

7.0 STANDARDS AND SPECIFICATIONS

FOR

STORM DRAIN INLET PROTECTION

Definition

A filter constructed around a storm drain inlet.

Purpose

Storm Drain Inlet Protection is used to filter sediment laden runoff before it enters the storm drain system.

Conditions Where Practices Applies

Storm drain inlet protection is a secondary sediment control device and is not to be used in place of a sediment trapping device unless approved by the appropriate approval authority.

Storm drain inlet protection should not be used on major arterial roadways and residential collector streets and higher.

Design Criteria

Storm drain inlet protection shall be used when the drainage area to an inlet is disturbed and the following conditions prevail:

1. It is not possible to temporarily divert the storm drain outfall into a sediment trapping device;

2. Watertight blocking of inlets is not advisable; and

3. Drainage area is at grade 1/4 acre (max.) for curb or standard inlet protections and 1 acre (max.) for median or at grade. For yard inlets, the total for inlets in series must be 1 acre or less and the contributing drainage area must have slopes flatter than 5%.

Maintenance

Maintenance requirements for storm drain inlet protection are intense, due to the susceptibility to clogging. When the structure does not drain completely within 48 hours after a storm event, it is clogged. When this occurs, accumulated sediment must be removed and the geotextile fabric and stone must be cleaned or replaced.

Construction Specifications

A. Standard Inlet Protection (Elevated or Yard Inlet)

1. Excavate completely around the inlet to a depth of 18" below the notch elevation.

2. Drive 2” X 4” construction grade lumber posts 1’ into the ground at each corner of the inlet. Place nail strips between the posts on the ends of the inlet. Assemble the top portion of the 2" X 4” frame using the overlap joint shown on Detail 6A. The top of the frame (weir) must be 6" below adjacent roadways where flooding and safety issues may arise.

3. Stretch 1/2" X 1/2" wire mesh tightly around the frame and fasten securely. The ends must meet and overlap at a post.

4. Stretch the Geotextile Class E[6] tightly over the wire mesh with the geotextile extending from the top of the frame to 18" below the inlet notch elevation. Fasten the geotextile firmly to the frame. The ends of the geotextile must meet at a post, be overlapped and folded, then fastened down.

5. Backfill around the inlet in compacted 6" layers until the layer of earth is level with the notch elevation on the ends and top elevation on the sides.

6. If the inlet is not in a sump, construct a compacted earth dike across the ditch line directly below it. The top of the earth dike should be at least 6" higher than the top of the frame.

7. The structure must be inspected periodically and after each rain and the geotextile replaced when it becomes clogged.

B. At Grade Inlet

1. Lift grate and wrap with Geotextile Class E to completely cover all openings, then set grate back in place.

2. Place 3/4 to 1-1/2[7] stone, 4 - 6" thick on the grate to secure the fabric.

3. If there are any signs of street flooding or water ponding, this structure must be cleaned or replaced or redesigned with a viable alternative.

[6] Refer to Table 44 (located on page L-53-1)
[7] Refer to Table 45 (located on page L-53-2)

C. Curb Inlet Protection (COG or COS Inlets)

1. Attach a continuous piece of 1/2" X 1/2" wire mesh (30" minimum width by throat length, plus 4') to the 2" x 4" weir (measuring throat length plus 2') as shown on the standard drawing.

2. Place a continuous piece of approved Geotextile Class E of the same dimensions as the wire mesh over the wire mesh and securely attach it to the 2" x 4" weir.

3. Securely nail the 2" X 4" weir to a 9" long vertical spacer to be located between the weir and the inlet face (max. 4' apart).

4. Place the assembly against the inlet throat and nail (minimum 2' lengths of 2" x 4" to the top of the weir at spacer locations). These 2" x 4" anchors shall extend across the inlet top and be held in place by sandbags or alternate weight.

5. The assembly shall be placed so that the end spacers are 1' beyond both ends of the throat opening.

6. Form the 1/2" x 1/2" wire mesh and the geotextile fabric to the concrete gutter and against the face of the curb on both sides of the inlet. Place clean 3/4" to 1 1/2" stone over the wire mesh and geotextile in such a manner as to prevent water from entering the inlet under or around the geotextile.

7. This type of protection must be inspected frequently and the geotextile fabric and stone replaced when clogged with sediment.

8. Assure that storm flow does not bypass the inlet by installing a temporary earth or asphalt dike to direct the flow to the inlet.

9. If there are any signs of street flooding or water ponding, this structure must be cleaned or replaced or redesigned with a viable alternative.

D. Median Inlet Protection (MIP)

1. Construct standard Slope Silt Fence having 5' post spacing 1' - 6" away from the existing inlet only on the sides of the inlet receiving sheet flow and in the location of the "wings".

2. In the location of concentrated flow, construct a stone check dam using 4" - 7" stone for the base faced on the upstream side with 3/4" – 1-1/2" aggregate, 1' thick. The stone check dam shall be 16" high with the weir 10" above the invert of the ditch or valley gutter and shall be the same width as the ditch or gutter bottom or 2' (min.). Where the end of the "wings" meet the ground shall be at or above the weir elevation.

3. If there are any signs of street flooding or water ponding, this structure must be cleaned or replaced or redesigned with a viable alternative.

E. At Grade Inlet Guard

1. Position guard sections to cover inlet with at least 2 inches of overlap on each end of inlet.

2. Overlap guards at least 2 inches at their intersections.

3. Position the desired filter cloth around guard so that it can be tucked in at the bottom.

4. Position the cloth so that the horizontal metal strip can hold the cloth in place.

5. Do not cover the 2 inch overflow holes with cloth.

6. Attach horizontal strip with sheet metal screws.

7. Place end clips into position so that the triangular end gap is covered and bend covers the face.

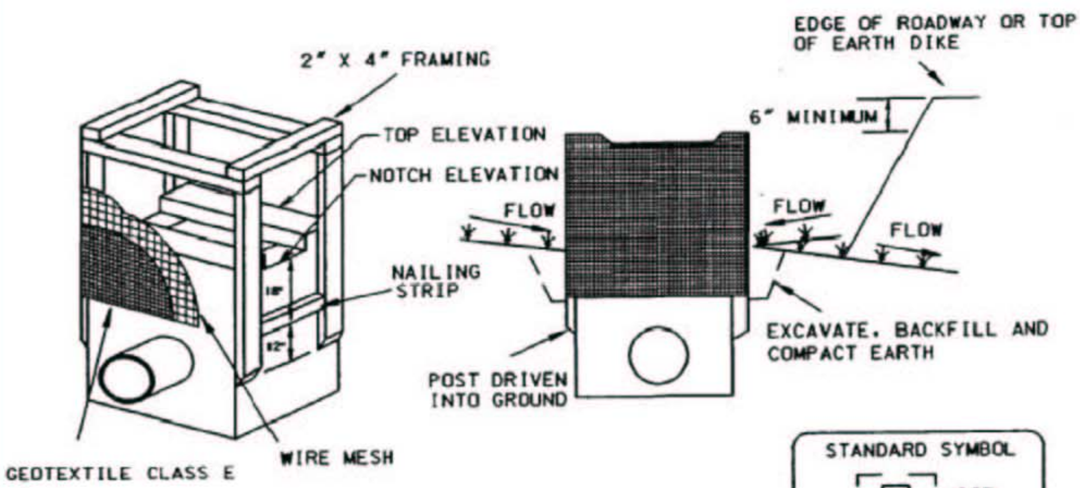
8. Place 2 inch attaching clips at the ends and intersections of the guards.

9. Insert the attaching bolt, nail or screw as shown in detail 6E.

10. **Make a watertight connection along the sides and bottom of the inlet guard with the street and curb.**

11. If there are any signs of street flooding or water ponding, this structure must be cleaned or replaced or redesigned with a viable alternative.

DETAIL 7A – STANDARD INLET PROTECTION



STANDARD SYMBOL

SIP

MAX. DRAINAGE AREA = 1/4 ACRE

Construction Specifications

1. Excavate completely around the inlet to a depth of 18" below the notch elevation.

2. Drive the 2" x 4" construction grade lumber posts 1' into the ground at each corner of the inlet. Place nail strips between the posts on the ends of the inlet. Assemble the top portion of the 2" x 4" frame using the overlap joint shown on Detail 23A. The top of the frame (weir) must be 6" below adjacent roadways where flooding and safety issues may arise.

3. Stretch the 1/2" x 1/2" wire mesh tightly around the frame and fasten securely. The ends must meet and overlap at a post.

4. Stretch the Geotextile Class E tightly over the wire mesh with the geotixtile extending from the top of the frame to 18" below the inlet notch elevation. Fasten the geotextile firmly to the frame. The ends of the geotextile must meet at a post, be overlapped and folded, then fastened down.

5. Backfill around the inlet in compacted 6" layers until the layer of earth is level with the notch elevation on the ends and top elevation on the sides.

6. If the inlet is not in a sump, construct a compacted earth dike across the ditch line directly below it. The top of the earth dike should be at least 6" higher than the top of the frame.

7. The structure must be inspected periodically and after each rain and the geotextile replaced when it becomes clogged.

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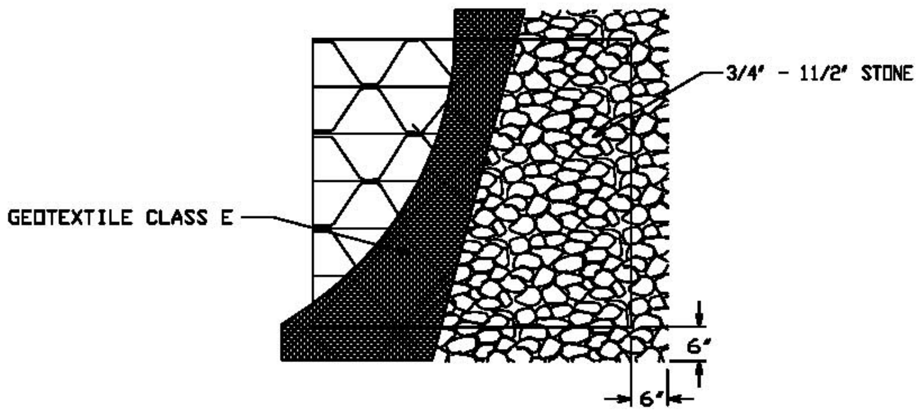
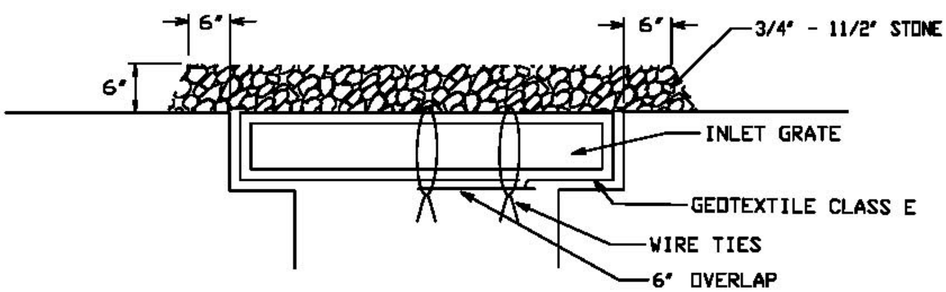
DETAIL 7B - AT GRADE INLET PROTECTION



PLAN/CUT AWAY VIEW



CROSS SECTION

STANDARD SYMBOL
AGIP

MAX. DRAINAGE AREA = 1/4 ACRE

Construction Specifications

1. Lift grate and wrap with Geotextile Class E to completely cover all openings, then set grate back in place.

2. Place 3/4" to 11/2" stone, 4"-6" thick on the grate to secure the fabric and provide additional filtration.

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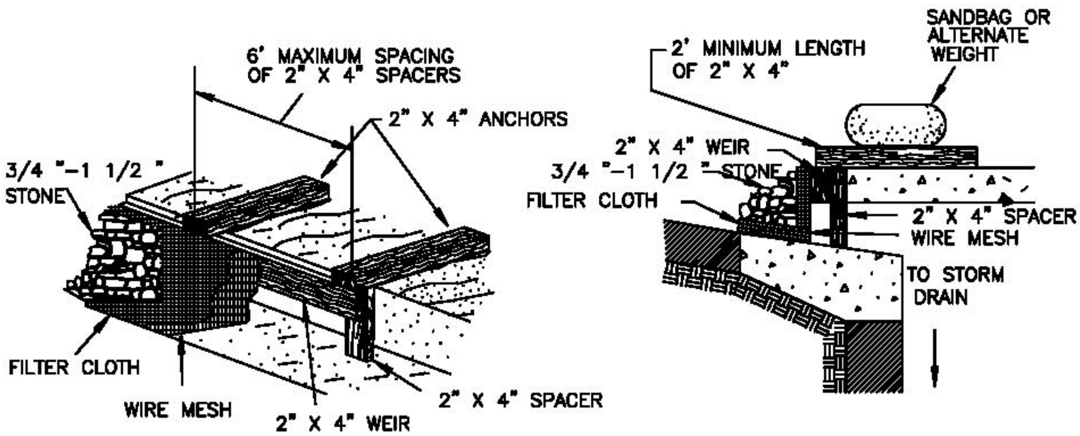
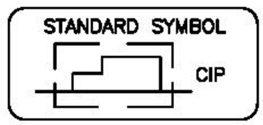
DETAIL 7C - CURB INLET PROTECTION (COG OR COS INLETS)



MAX. DRAINAGE AREA = 1/4 ACRE



Construction Specifications

1. Attach a continuous piece of wire mesh (30" minimum width by throat length plus 4') to the 2" x 4" weir (measuring throat length plus 2') as shown on the standard drawing.

2. Place a continuous piece of Geotextile Class E the same dimensions as the wire mesh over the wire mesh and securely attach it to the 2" x 4" weir.

3. Securely nail the 2" X 4" weir to a 9" long vertical spacer to be located between the weir and the inlet face (max. 4' apart).

4. Place the assembly against the inlet throat and nail (minimum 2' lengths of 2" x 4" to the top of the weir at spacer locations). These 2" x 4" anchors shall extend across the inlet top and be held in place by sandbags or alternate weight.

5. The assembly shall be placed so that the end spacers are a minimum 1' beyond both ends of the throat opening.

6. Form the 1/2 " x 1/2 " wire mesh and the geotextile fabric to the concrete gutter and against the face of the curb on both sides of the inlet. Place clean 3/4 " x 1 1/2 " stone over the wire mesh and geotextile in such a manner to prevent water from entering the inlet under or around the geotextile.

7. This type of protection must be inspected frequently and the filter cloth and stone replaced when clogged with sediment.

8. Assure that storm flow does not bypass the inlet by installing a temporary earth or asphalt dike to direct the flow to the inlet.

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24.0 STANDARDS AND SPECIFICATIONS

FOR

SUMP PIT

Description of Practice

A temporary pit from which pumping is conducted to remove excess water while minimizing sedimentation.

Purpose

The sump pit filters water being pumped to reduce sedimentation to receiving streams.

Conditions Where Practice Applies

Sump Pits are constructed when water collects and must be pumped away during excavating, cofferdam dewatering, maintenance or removal of sediment traps and basins or other uses as applicable.

Design Criteria

The number of sump pits and their locations shall be determined by the designer and included on the plans. Contractors may relocate sump pits to optimize use but discharge location changes must be coordinated with inspectors. A design is not required but construction must conform to the general criteria outlined on Detail 32B.

A perforated vertical standpipe is wrapped with 1/2" hardware cloth and Geotextile Class E[28], then placed in the center of an excavated pit which is then backfilled with filter material consisting of anything from clean gravel (minimal fines) to #57 stone (1 1/2" maximum diameter). Water is then pumped from the center of the standpipe to a suitable discharge area such as into a sediment trap, sediment basin or stabilized area.

Construction Specifications

1. Pit dimensions are variable, with the minimum diameter being twice the diameter of the standpipe.

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[28] Refer to Table 44 (located on page L-53-1)

2. The standpipe should be constructed by perforating a 12" to 36" diameter pipe then wrapping it with 1/2" hardware cloth and Geotextile Class E. The perforations shall be 1/2" X 6" slits or 1" diameter holes 6" on center.

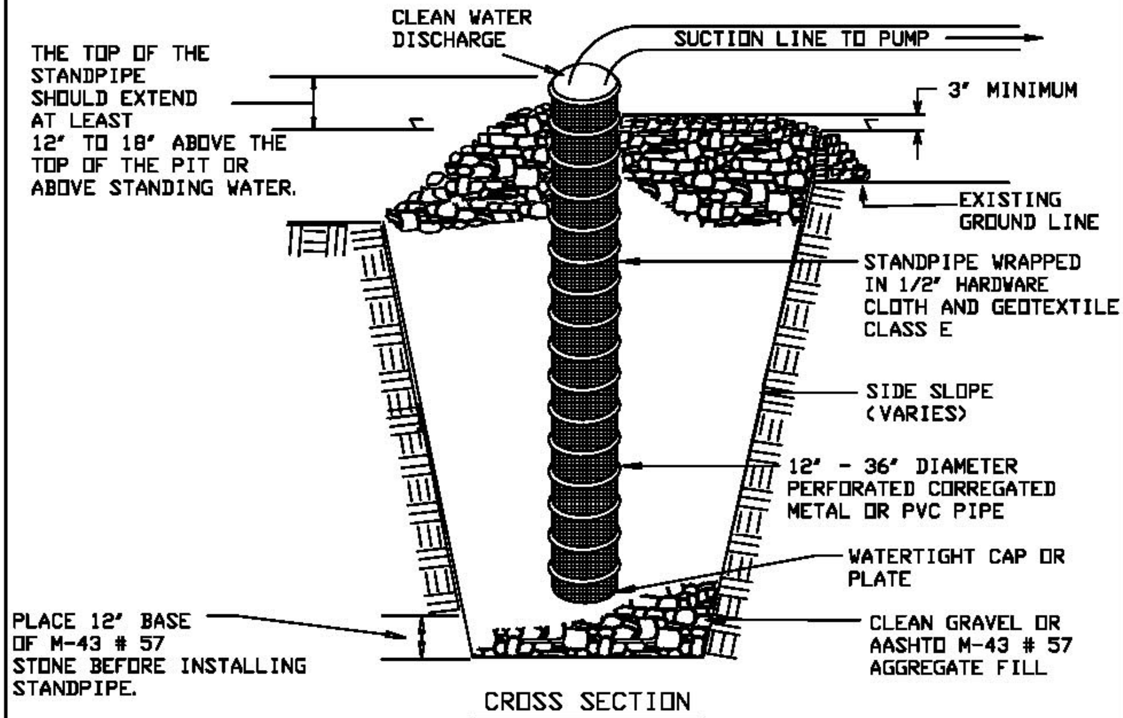
3. A base of filter material consisting of anything from clean gravel (minimal fines) to #57 stone (1 1/2" maximum diameter) should be placed in the pit to a depth of 12". After installing the standpipe, the pit surrounding the standpipe should then be backfilled with the same filter material.

4. The standpipe shall extend 12" to 18" above the lip of the pit or riser crest elevation (basin dewatering) and filter material should extend 3" minimum above the anticipated standing water level.

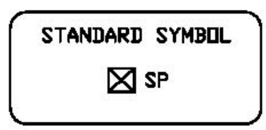
Maintenance

To maintain, sump pits must be removed and reconstructed when pump runs dry.

DETAIL 35B - SUMP PIT



CROSS SECTION



Construction Specifications

1. Pit dimensions are variable, with the minimum diameter being 2 times the standpipe diameter.

2. The standpipe should be constructed by perforating a 12" to 24" diameter corrugated or PVC pipe. Then wrapping with 1/2" hardware cloth and Geotextile Class E. The perforations shall be 1/2" x 6" slits or 1" diameter holes.

3. A base of filter material consisting of clean gravel or #57 stone should be placed in the pit to a depth of 12". After installing the standpipe, the pit surrounding the standpipe should then be backfilled with the same filter material.

4. The standpipe should extend 12" to 18" above the lip of the pit or the riser crest elevation (basin dewatering only) and the filter material should extend 3" minimum above the anticipated standing water elevation.

25.0 STANDARDS AND SPECIFICATIONS

FOR

PUMPED WATER FILTER BAGS

Definition

A temporary filtering device for water which is discharged from dewatering activities.

Purpose

To filter sediment-laden water prior to the water being discharged off-site.

Conditions Where Practice Applies

Filter bags may be used to filter water pumped from disturbed areas prior to discharging to waters of the District. They may also be used to filter water pumped from the sediment storage areas of sediment basins.

Design Criteria

The pumping rate should be specified on the plan drawings next to the typical detail. Pumping rates will vary depending on the size of the filter bag, and the type and amount of sediment discharged to the bag.

Filter bags should be installed according to the details shown in Detail 33.

Filter bags shall be made from non-woven geotextile material sewn with high strength, double stitched "J" type seams. They shall be capable of trapping particles larger than 150 microns.

A suitable means of accessing the bag with machinery required for disposal purposes must be provided. Filter bags shall be replaced when they become ½ full. Spare bags shall be kept available for replacement of those that have failed or are filled.

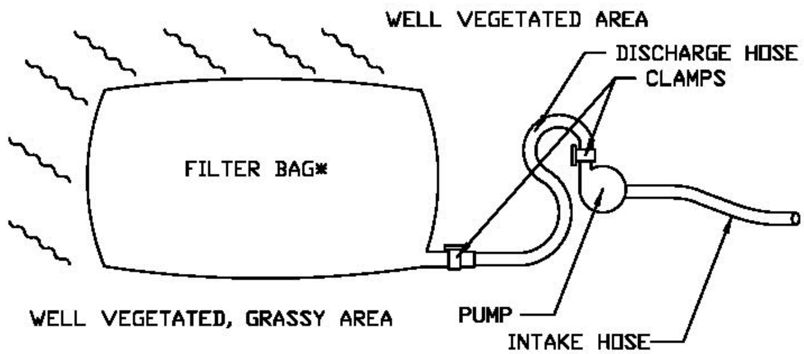
Bags shall be located in well-vegetated (grassy) area, and discharge onto stable, erosion resistant areas. Where this is not possible, a geotextile flow path shall be provided. Bags shall not be placed on slopes greater than 5%.

The pump discharge hose shall be inserted into the bags in the manner specified by the manufacturer and securely clamped.

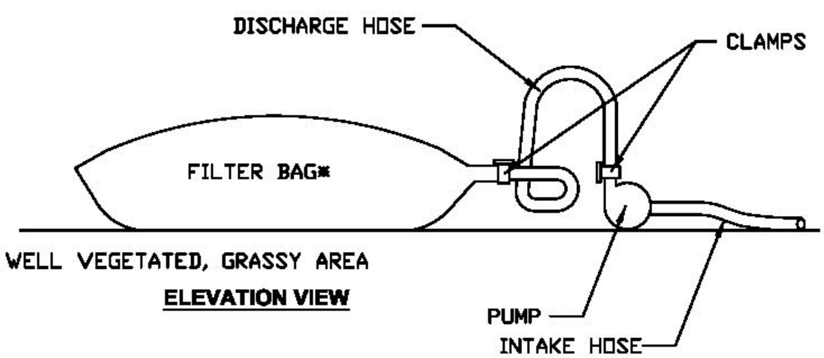
The pumping rate shall be no greater than 750 gpm or ½ the maximum specified by the manufacturer, whichever is less. Pump intakes should be floating and screened.

Filter bags shall be inspected daily. If any problem is detected, pumping shall cease immediately and not resume until the problem is corrected.

DETAIL 37 - PUMPED WATER FILTER BAG



PLAN VIEW



ELEVATION VIEW

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26.0 STANDARDS AND SPECIFICATIONS

FOR

SEDIMENT TANKS

Definition

A sediment tank is a compartmented tank container through which sediment laden water is pumped to trap and retain the sediment.

Purpose

To trap and retain sediment prior to pumping the water to drainage ways, adjoining properties, and rights-of-way below the sediment tank site.

Conditions Where Practice Applies

A sediment tank is to be used on sites where excavations are deep, and space is limited, such as urban construction, where direct discharge of sediment laden water to stream and storm drainage systems is to be avoided.

Design Criteria

1. A sediment tank must be sized (and operated) to allow pumped water to flow through the filtering device without overtopping the structure.

2. Material from any required excavation shall be stored in an area and protected in a manner that will prevent sediments from eroding and moving off-site.

Construction Specifications

1. Portable Sediment Tank - Horizontal (see Detail 34)

    a. The structure may be constructed with steel drums, sturdy wood or other material suitable for handling the pressure exerted by the volume of water.

    b. Sediment tanks will have a minimum depth of two feet

    c. The sediment tank shall be located for easy clean-out and disposal of the trapped sediment and to minimize the interference with construction activities.

d. The following formula shall be used to determine the storage volume of the sediment tank:

Pump discharge (g.p.m.) x 16 = cubic feet of storage required

e. Once the water level nears the top of the tank, the pump must be shut off while the tank drains and additional capacity is made available.

f. The tank shall be designed to allow for emergency flow over top of the tank.

g. Clean-out of the tank is required once one-third of the original capacity is depleted due to sediment accumulation. The tank shall be clearly marked showing the clean-out point.

2. Portable Sediment Tank - Vertical (see Detail 35)

   a. Location The sediment tank shall be located for ease of clean-out and disposal of the trapped sediment and to minimize interference with construction activities and pedestrian traffic.

   b. Tank Size The following formula should be used in determining the storage volume of the sediment tank: 1 cubic foot of storage for each gallon per minute of pump discharge capacity.

   c. Tanks may be connected in series. Geotextile fabric mesh sizes may vary from tank to tank with the downstream-most layer meeting Geotextile Class SE[29] or better.

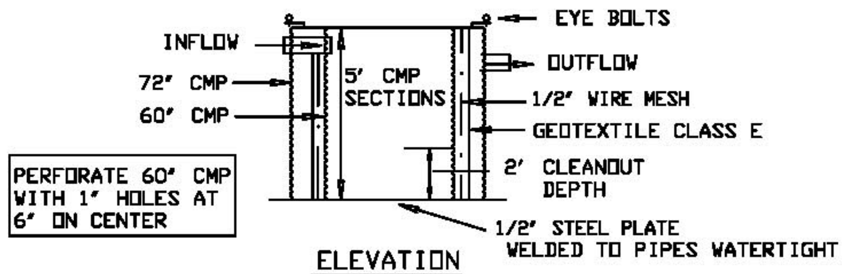
Maintenance (All sediment tanks)

1. The filtering devices must be inspected frequently and repaired or replaced once the sediment build-up prevents the structure from functioning as designed.

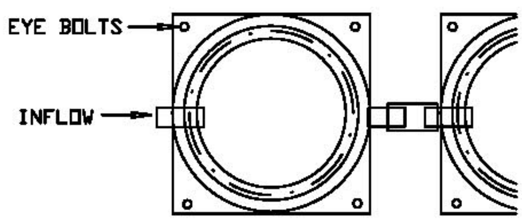
2. The accumulated sediment which is removed from a dewatering device must be spread on-site and stabilized or disposed of at an approved disposal site as per approved plan.

[29] Refer to Table 44 (located on page L-53-1)

DETAIL 36 - PORTABLE SEDIMENT TANK



ELEVATION



PLAN VIEW

STANDARD SYMBOL

☒ PST

Construction Specifications

1. The following formula should be used in determining the storage volume of the sediment tank: 1 cubic foot of storage for each gallon per minute of pump discharge capacity.

2. An example of a typical sediment tank is shown above. Other container designs can be used if the storage volume is adequate and approval is obtained from the local approving agency.

3. Tanks may be connected in series.

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44.0 STANDARDS AND SPECIFICATIONS

FOR

DUST CONTROL

Definition

Controlling dust blowing and movement on construction sites and roads.

Purpose

To prevent blowing and movement of dust from exposed soil surfaces, reduce on and off-site damage, health hazards, and improve traffic safety.

Conditions Where Practice Applies

This practice is applicable to areas subject to dust blowing and movement where on and off-site damage is likely without treatment.

Specifications

Temporary Methods:

A. Mulches - See standards for critical area stabilization with mulches only. Chemical or wood cellulose fiber binders may be used instead of asphalt to bind mulch material.

B. Vegetative Cover - See standards for temporary vegetative cover.

C. Spray-on Adhesives - On mineral soils (not effective on muck soils). Keep traffic off these areas.

	Water Dilution	Type of Nozzle	Apply Gallons/Ac.
Anionic asphalt emulsion	7:1	Coarse Spray	1,200
Latex emulsion	12.5:1	Fine Spray	235
Resin-in-water emulsion	4:1	Fine Spray	300

D. Tillage - To roughen surface and bring clods to the surface. This is an emergency measure which should be used before soil blowing starts. Begin plowing on windward side of site. Chisel-type plows spaced about 12" apart, spring-toothed harrows, and similar plows are examples of equipment which may produce the desired effect.

E. Irrigation - This is generally done as an emergency treatment. Site is sprinkled with water until the surface is moist. Repeat as needed.

F. Barriers - Solid board fences, snow fences, burlap fences, crate walls and similar material can be used to control air currents and soil blowing. Barriers placed at right angles to prevailing currents at intervals of about 10 times their height are effective in controlling soil blowing.

G. Calcium Chloride - Apply at rate that will keep surface moist. May need retreatment.

Permanent Methods:

A. Permanent Vegetation - See standards for permanent vegetative cover, and permanent stabilization with sod. Existing trees or large shrubs may afford valuable protection if left in place.

B. Topsoiling - Covering with less erosive soil materials. See standards for topsoiling.

C. Stone - Cover surface with crushed stone or coarse gravel.

References:

1. Agriculture Handbook 346. Wind Erosion Forces in the United States and Their use in Predicting Soil Loss.

2. Agriculture Information Bulletin 354. How to Control Wind Erosion, USDA-ARS.

APPENDIX B

Contech Engineered Solutions LLC
(DownSpout StormFilter™, Jellyfish® Filter, and Stormwater Management StormFilter®: Operation, Inspection, and Maintenance)

CONTECH STORMWATER SOLUTIONS INC.

Operation and Maintenance

DownSpout StormFilter™

Single-Stage Units

Important: These guidelines should be used as a part of your site stormwater management plan.

Overview

The single-stage DownSpout StormFilter™ (DSF) consists of a multi-chamber plastic unit that can contain up to two StormFilter cartridges. By configuring the StormFilter cartridges with various filter media, the DSF is designed to remove pollutants such as soluble zinc and other metals from rooftop runoff.

The DSF is installed above ground, occupying a small footprint (2.5' x 5'), and is easily integrated into most existing downspout configurations. The system can be equipped with built-in ports for viewing and sample collection to simplify monitoring. For higher levels of treatment, a second stage can be added.

One single-stage, two-cartridge DSF unit can treat runoff from roof areas up to 14,000 square feet. The DSF is also designed with an internal high flow bypass to minimize re-suspension of trapped pollutants in cases where extreme flows exceed the water quality design flow.

Design Operation

The DSF is installed as the primary receiver of roof runoff. Runoff is directly discharged to the DSF cartridge chamber by the existing downspout system. Once in the cartridge chamber, polluted water ponds and percolates horizontally through the media in the filter cartridges. Treated water collects in each cartridge's center tube from where it is directed by an under-drain manifold to the outlet pipe on the downstream side of the overflow weir and discharged.

When flows into the DSF exceed the water quality design value, excess water spills over the overflow weir, bypassing the cartridge chamber, and discharges to the outlet pipe.

Applications

The DSF is an affordable, easily-maintained solution for treating rooftop runoff from industrial facilities, warehouses, and commercial buildings. Its modular and changeable cartridges allow it to be upgraded to meet changing removal requirements without requiring purchase of additional equipment.

Maintenance Guidelines

The filter cartridges contained in the DSF are easily removed and replaced during maintenance activities according to the following guidelines:

1. Establish a safe working area as per typical catch basin service activity.
2. Remove lid.
3. Turn cartridge(s) counter-clockwise to disconnect from pipe manifold.
4. Remove 4” center cap from cartridge and replace with lifting cap.
5. Remove cartridge(s) from cartridge chamber by hand or with vactor truck boom.
6. Remove accumulated sediment via vactor truck (min. clearance 13” x 24”).
7. Rinse interior of chamber and vactor remaining water and sediment.
8. Install fresh cartridge(s) threading clockwise to pipe manifold.
9. Replace lid.
10. Return original cartridges to CONTECH Stormwater Solutions for cleaning and media disposal.

Media may be removed from the filter cartridges using the vactor truck before the cartridges are removed from the catch basin structure. Empty cartridges can be easily removed from the catch basin structure by hand. Empty cartridges should be reassembled and returned to CONTECH Stormwater Solutions, as appropriate.

Note: Customer is responsible for disposing of media in accordance with applicable regulations.

Materials required include a lifting cap, vactor truck, and fresh filter cartridges. Contact CONTECH Stormwater Solutions for specifications and availability of the lifting cap. The owner may refresh spent cartridges. Refreshed cartridges are also available from CONTECH Stormwater Solutions on an exchange basis. Contact the maintenance department of CONTECH Stormwater Solutions at (800) 548-4667 for more information.

Maintenance is estimated at 24 minutes of site time. For units with more than one cartridge, add approximately 5 minutes for each additional cartridge. Add travel time as required.

Jellyfish® Filter Manhole Installations Inspection and Maintenance Manual

CONTECH Engineered Solutions
1-800-548-4667

Inspection and Maintenance Overview

The primary purpose of the Jellyfish® Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, these pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Maintenance activities may be required in the event of an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

Inspection activities are typically conducted form surface observations and include:

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW)

Maintenance activities typically include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed.

It is recommended that Jellyfish Filter inspection and maintenance be performed by professionally trained individuals, with experience in stormwater maintenance and disposal services. Maintenance procedures may require manned entry into the Jellyfish structure. Only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Procedures, safety and damage prevention precautions, and other information, included in these guidelines, should be reviewed and observed prior to all inspection and maintenance activities.

Inspection Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent.*

- Post-construction inspection is required prior to putting the Jellyfish Filter into service. All construction debris or construction-related sediment within the device must be removed, and any damage to system components repaired.
- A minimum of two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
- Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
- Inspection is recommended after each major storm event.
- Immediately after an upstream oil, fuel or other chemical spill.

Inspection Tools and Equipment

The following equipment and tools are typically required when performing a Jellyfish Filter inspection:

- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Inspection Procedure

The following procedure is recommended when performing inspections:

- Provide traffic control measures as necessary.
- Inspect the MAW for floatable pollutants such as trash, debris, and oil sheen.
- Measure oil and sediment depth by lowering a sediment probe through the MAW opening until contact is made with the floor of the structure. Retrieve the probe, record sediment depth, and presences of any oil layers and repeat in multiple locations within the MAW opening. *Sediment depth of 12 inches or greater indicates maintenance is required.*
- Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
- Inspect the MAW, cartridge deck, and backwash pool weir, for cracks or broken components. If damaged, repair is required.
- **Dry weather inspections:** inspect the cartridge deck for standing water.
  - No standing water under normal operating condition.
  - Standing water **inside** the backwash pool, but not outside the backwash pool, this condition indicates that the filter cartridges need to be rinsed.
  - Standing water **outside** the backwash pool may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- **Wet weather inspections:** observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW.
  - **Less than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
  - **Greater than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
  - **18 inches or greater** and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges are occluded with sediment and need to be rinsed.

Maintenance Requirements

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

- Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.

- Floatable trash, debris, and oil must be removal.
- Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.
- Replace filter cartridge if rinsing does not remove accumulated sediment from the tentacles, or if tentacles are damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
- Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
- The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged by the spill.

Maintenance Tools and Equipment

The following equipment and tools are typically required when performing Jellyfish Filter maintenance:

- Vacuum truck
- Ladder
- Garden hose and low pressure sprayer
- Rope or cord to lift filter cartridges from the cartridge deck to the surface
- Adjustable pliers for removing filter cartridge tentacles from cartridge head plate
- Plastic tub or garbage can for collecting effluent from rinsed filter cartridge tentacles
- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Proper safety equipment for confined space entry
- Replacement filter cartridge tentacles if required

Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

- Provide traffic control measures as necessary.
- Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures.
- **Caution:** Dropping objects onto the cartridge deck may cause damage.
- Perform **Inspection Procedure** prior to maintenance activity.
- To access the cartridge deck for filter cartridge service, descend the ladder and step directly onto the deck. **Caution:** Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.
- **Filter Cartridge Rinsing Procedure**
  - Remove a cartridge lid.
  - Remove the cartridge from the receptacle using the lifting loops in the cartridge head plate. **Caution:** Should a snag occur, do not force the cartridge upward as damage to the tentacles may result. Rotate the cartridge with a slight sideways motion to clear the snag and continue removing the cartridge.

- Thread a rope or cord through the lifting loops and lift the filter cartridge from the cartridge deck to the top surface outside the structure.
- **Caution:** Immediately replace and secure the lid on the exposed empty receptacle as a safety precaution. Never expose more than one empty cartridge receptacle.
- Repeat the filter cartridge removal procedure until all of the cartridges are located at the top surface outside the structure.
- Disassemble the tentacles from each filter cartridge by rotating counter-clockwise. Remove the tentacles from the cartridge head plate.
- Position a receptacle in a plastic tub or garbage can such that the rinse water is captured. Using a low-pressure garden hose sprayer, direct a wide-angle water spray at a downward 45° angle onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. **Caution:** Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane.
- Remove rinse water from rinse tub or garbage can using a vacuum hose as needed.
- Slip the O-ring over the pipe nipple on the top end of the tentacle and reassemble onto the cartridge head plate; hand tighten.
- If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Contech to order replacement tentacles.
- Lower a rinsed filter cartridge to the cartridge deck. Remove the cartridge lid on a receptacle and carefully lower the filter cartridge into the receptacle until the head plate gasket is seated squarely on the lip of the receptacle. **Caution:** Should a snag occur when lowering the cartridge into the receptacle, do not force the cartridge downward; damage may occur. Rotate the cartridge with a slight sideways motion to clear the snag and complete the installation.
- Replace the cartridge lid on the exposed receptacle. Check the fit before completing rotation to a firm hand-tight attachment. Rinse away any accumulated grit from the receptacle threads if needed to get a proper fit.
- Repeat cartridge installation until all cartridges are installed.

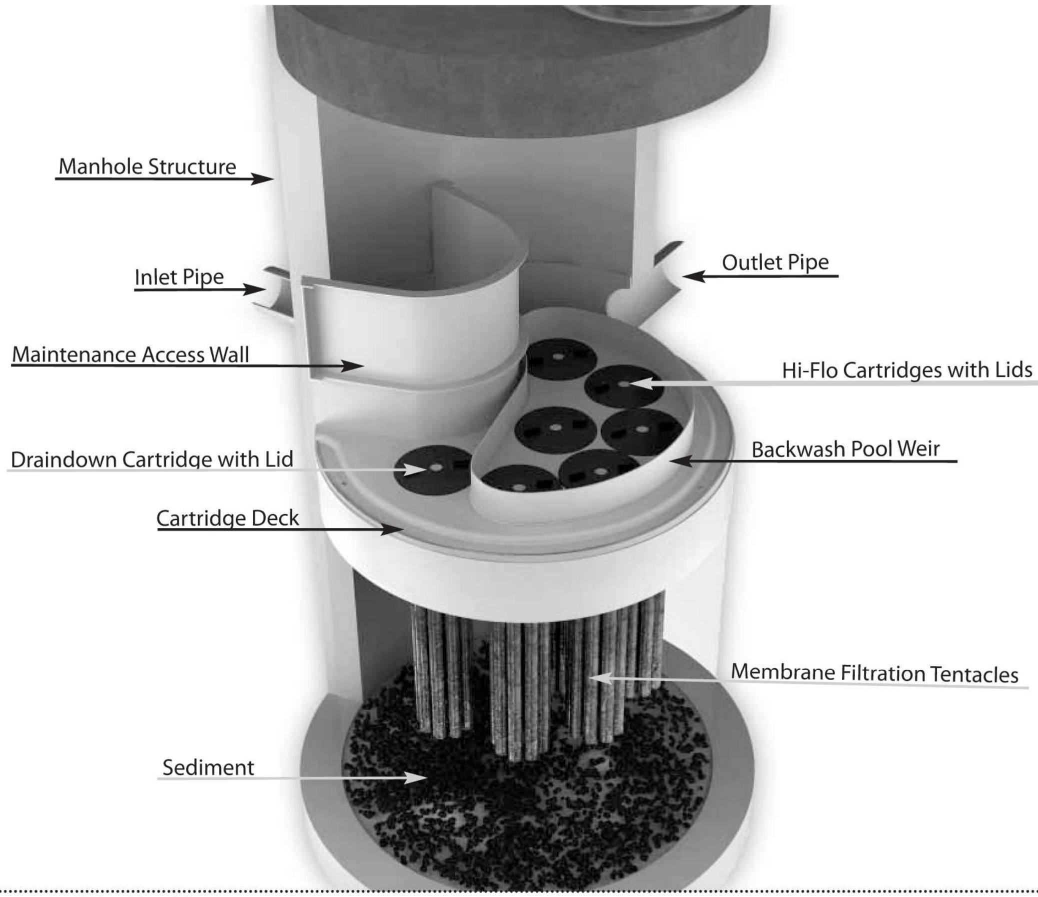
- **Vacuum Cleaning Procedure**
  - **Caution:** Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning **only through the maintenance access wall (MAW) opening**, being careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck. The separator skirt surrounds the filter cartridge zone, and could be torn if contacted by the wand. **Do not lower the vacuum wand through a cartridge receptacle**, as damage to the receptacle will result.
  - To remove floatable trash, debris, and oil, lower the vacuum hose into the MAW opening and vacuum floatable pollutants off the surface of the water. Alternatively, floatable solids may be removed by a net or skimmer.
  - Using a vacuum hose, remove the water from the lower chamber to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank.
  - Remove the sediment from the bottom of the unit through the MAW opening.
  - For larger diameter Jellyfish Filter manholes (8-ft, 10-ft, 12-ft diameter), complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle..
  - After the unit is clean, re-fill the lower chamber with water if required by the local jurisdiction, and re-install filter cartridges.
  - Dispose of sediment, floatable trash and debris, oil, spent tentacles, and water according to local regulatory requirements.

- **Chemical Spills**
    - o **Caution:** If a chemical spill has been captured by the Jellyfish Filter, do not attempt maintenance. Immediately contact the local hazard response agency, and contact Contech Engineered Services.

Below is a cut-away schematic of the Jellyfish Filter manhole with key components identified (6-ft diameter manhole is depicted).

FIGURE 1

Jellyfish Filter and Components

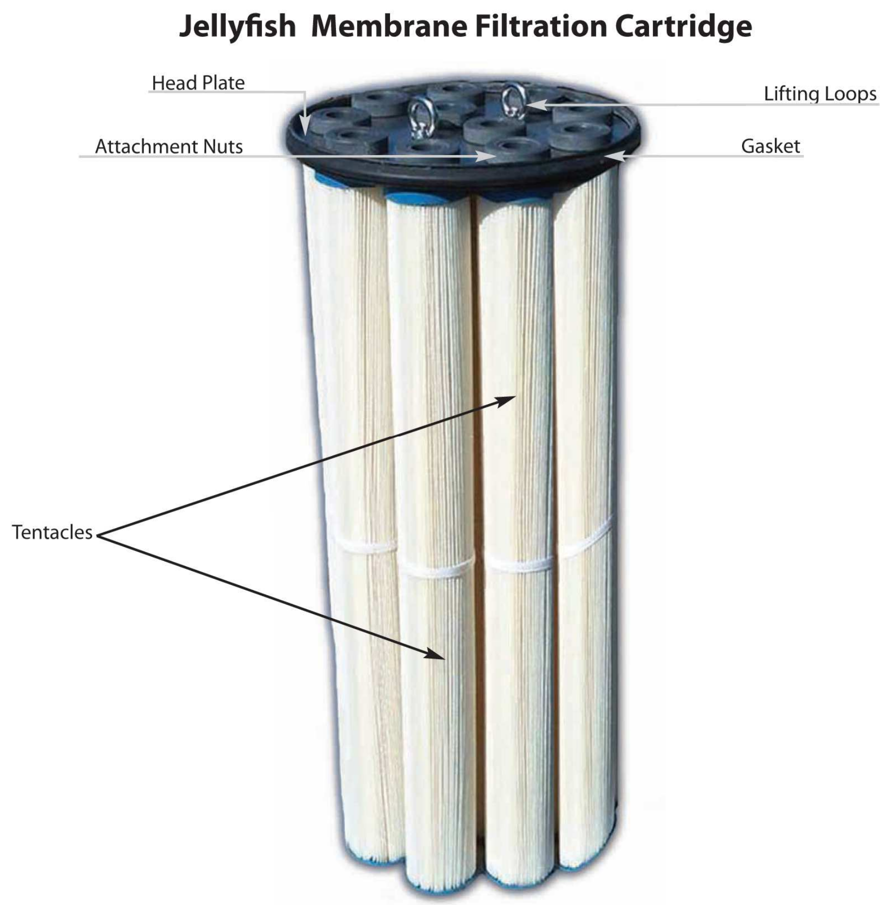


Note: Separator Skirt Not Shown

The Jellyfish Filter has no moving parts to wear out and therefore maintenance activities are generally focused on pollutant removal and filter cartridge service.

Below is a schematic of a Jellyfish Filter membrane filtration cartridge. Tentacles can be easily removed from the head plate and rinsed or replaced as needed.

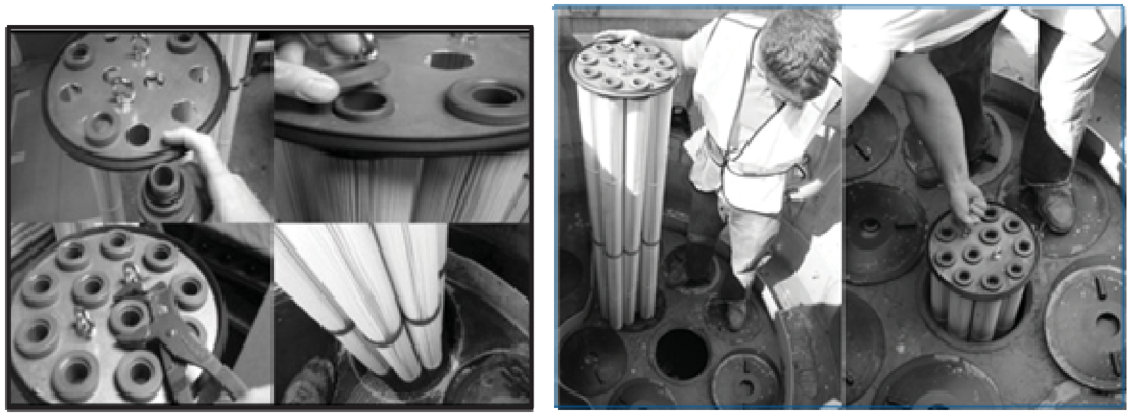
FIGURE 2



The depth of sediment and oil can be measured from the surface by using a sediment probe or dipstick tube equipped with a ball check valve and inserted through the Jellyfish Filter's maintenance access wall opening. The large opening provides convenient access for inspection and vacuum removal of water and pollutants.

A maintenance worker stationed on the surface uses a vacuum hose to evacuate water, sediment, and floatables from the Jellyfish Filter by inserting the vacuum wand through the maintenance access wall opening.

A view of a Jellyfish Filter cartridge deck from the surface showing all the cartridge lids intact and no standing water on the deck (left image), and inspection of the flexible separator skirt from inside the maintenance access wall opening (right image).



Assembly of a Jellyfish Filter cartridge (left) and installation of a filter cartridge into a cartridge receptacle in the deck (right).

Rinsing of dirty filter cartridge tentacles with a low-pressure garden hose sprayer, and using a plastic garbage container to capture rinse water.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to the Jellyfish Filter’s long and effective service life.

Ordering Replacement Parts
Jellyfish Filter cartridges, replacement tentacles, cartridge lids, and other system components can be ordered by contacting: **Contech Engineered Solutions, 1-800-548-4667**

Chapter 1

1 – Owner Specific Jellyfish Filter Product Information

Below you will find a reference page that can be filled out according to your Jellyfish Filter specification to help you easily inspect, maintain and order parts for your system.

Owner Name:	
Phone Number:	
Site Address:	
Site GPS Coordinates/unit location:	
Unit Location Description:	
Jellyfish Filter Model No.:	
Cartridge Installation Date:	
No. of Hi-Flo Cartridges	
Length of Hi-Flo Cartridges:	
Lid Orifice Diameter on Hi-Flo Cartridge:	
No. of Draindown Cartridges:	
Length of Draindown Cartridges:	
Lid Orifice Diameter on Draindown Cartridge:	
No. of Blank Cartridge Lids:	
Online System (Yes/No):	
Offline System (Yes/No):	

Notes:

Jellyfish Filter Inspection and Maintenance Log

Owner: ______________________________ Jellyfish Model No.:______________________

Location: ____________________________ GPS Coordinates: ______________________

Land Use: Commercial:______ Industrial: ______ Service Station:______

Road/Highway:____ Airport: ________ Residential: _________ Parking Lot:______

Date/Time:						
Inspector:						
Maintenance Contractor:						
Visible Oil Present: (Y/N)						
Oil Quantity Removed						
Floatable Debris Present: (Y/N)						
Floatable Debris removed: (Y/N)						
Water Depth in Backwash Pool						
Draindown Cartridges externally rinsed and re-commissioned: (Y/N)						
New tentacles put on Cartridges: (Y/N)						
Hi-Flo cartridges externally rinsed and recommissioned (Y/N):						
New tentacles put on Hi-Flo Cartridges: (Y/N)						
Sediment Depth Measured: (Y/N)						
Sediment Depth (inches or mm):						
Sediment Removed: (Y/N)						
Cartridge Lids intact: (Y/N)						
Observed Damage:						
Comments:						

CONTECH® ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

> **Warning**: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

> **Important:** Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Inspection Report

Date: Personnel:

Location:________________________ System Size: ____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

Sediment Thickness in Forebay: ________________________________ Date: ____________

Sediment Depth on Vault Floor: ____

Structural Damage: ____

Estimated Flow from Drainage Pipes (if available):____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water:____________________________

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: ____

☐ Minor Structural Repairs: ____

☐ Drainage Area Report ____

Excessive Oil Loading: Yes ☐ No ☐ Source: ____________________________

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ____________________________

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ____________________________

Items Needing Further Work: ____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

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Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: ____________________ Personnel: ____

Location: ____________________ System Size: ____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

List Safety Procedures and Equipment Used: ____

____

____

System Observations

Months in Service:

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): ____

Sediment Depth on Vault Floor: ____

Structural Damage: ____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: ______________________________

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ______________________________

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ______________________________

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: ______________________________

Replace Cartridges: Yes ☐ No ☐ Details: ______________________________

Sediment Removed: Yes ☐ No ☐ Details: ______________________________

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: ______________________________

Residuals (debris, sediment) Disposal Methods: ____

Notes:

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RECYCLED PAPER

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other Contech division offerings, visit contech-cpi.com or call 800.338.1122.

Support

- Drawings and specifications are available at www.conteches.com.
- Site-specific design support is available from our engineers.

800.338.1122
www.conteches.com

An Exelon Company

Appendix C
Contech O&M Manuals

Jellyfish® Filter Manhole Installations Inspection and Maintenance Manual

CONTECH Engineered Solutions
1-800-548-4667

Inspection and Maintenance Overview

The primary purpose of the Jellyfish® Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, these pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Maintenance activities may be required in the event of an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

Inspection activities are typically conducted form surface observations and include:

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW)

Maintenance activities typically include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed.

It is recommended that Jellyfish Filter inspection and maintenance be performed by professionally trained individuals, with experience in stormwater maintenance and disposal services. Maintenance procedures may require manned entry into the Jellyfish structure. Only professional maintenance service providers trained in confined space entry procedures should enter the vessel. Procedures, safety and damage prevention precautions, and other information, included in these guidelines, should be reviewed and observed prior to all inspection and maintenance activities.

Inspection Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent.*

- Post-construction inspection is required prior to putting the Jellyfish Filter into service. All construction debris or construction-related sediment within the device must be removed, and any damage to system components repaired.
- A minimum of two inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
- Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
- Inspection is recommended after each major storm event.
- Immediately after an upstream oil, fuel or other chemical spill.

Inspection Tools and Equipment

The following equipment and tools are typically required when performing a Jellyfish Filter inspection:

- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Inspection Procedure

The following procedure is recommended when performing inspections:

- Provide traffic control measures as necessary.
- Inspect the MAW for floatable pollutants such as trash, debris, and oil sheen.
- Measure oil and sediment depth by lowering a sediment probe through the MAW opening until contact is made with the floor of the structure. Retrieve the probe, record sediment depth, and presences of any oil layers and repeat in multiple locations within the MAW opening. *Sediment depth of 12 inches or greater indicates maintenance is required.*
- Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
- Inspect the MAW, cartridge deck, and backwash pool weir, for cracks or broken components. If damaged, repair is required.
- **Dry weather inspections:** inspect the cartridge deck for standing water.
    - No standing water under normal operating condition.
    - Standing water **inside** the backwash pool, but not outside the backwash pool, this condition indicates that the filter cartridges need to be rinsed.
    - Standing water **outside** the backwash pool may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- **Wet weather inspections:** observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW.
    - **Less than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
    - **Greater than 6 inches**, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
    - **18 inches or greater** and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges are occluded with sediment and need to be rinsed.

Maintenance Requirements

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

- Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.

- Floatable trash, debris, and oil must be removal.
- Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.
- Replace filter cartridge if rinsing does not remove accumulated sediment from the tentacles, or if tentacles are damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
- Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
- The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged by the spill.

Maintenance Tools and Equipment

The following equipment and tools are typically required when performing Jellyfish Filter maintenance:

- Vacuum truck
- Ladder
- Garden hose and low pressure sprayer
- Rope or cord to lift filter cartridges from the cartridge deck to the surface
- Adjustable pliers for removing filter cartridge tentacles from cartridge head plate
- Plastic tub or garbage can for collecting effluent from rinsed filter cartridge tentacles
- Access cover lifting tool
- Sediment probe (clear hollow tube with check valve)
- Tape measure
- Flashlight
- Camera
- Inspection and maintenance log documentation
- Safety cones and caution tape
- Hard hats, safety shoes, safety glasses, chemical-resistant gloves, and hearing protection for service providers
- Proper safety equipment for confined space entry
- Replacement filter cartridge tentacles if required

Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

- Provide traffic control measures as necessary.
- Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures.
- **Caution:** Dropping objects onto the cartridge deck may cause damage.
- Perform **Inspection Procedure** prior to maintenance activity.
- To access the cartridge deck for filter cartridge service, descend the ladder and step directly onto the deck. **Caution:** Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.
- **Filter Cartridge Rinsing Procedure**
    - Remove a cartridge lid.
    - Remove the cartridge from the receptacle using the lifting loops in the cartridge head plate. **Caution:** Should a snag occur, do not force the cartridge upward as damage to the tentacles may result. Rotate the cartridge with a slight sideways motion to clear the snag and continue removing the cartridge.

- Thread a rope or cord through the lifting loops and lift the filter cartridge from the cartridge deck to the top surface outside the structure.
- **Caution:** Immediately replace and secure the lid on the exposed empty receptacle as a safety precaution. Never expose more than one empty cartridge receptacle.
- Repeat the filter cartridge removal procedure until all of the cartridges are located at the top surface outside the structure.
- Disassemble the tentacles from each filter cartridge by rotating counter-clockwise. Remove the tentacles from the cartridge head plate.
- Position a receptacle in a plastic tub or garbage can such that the rinse water is captured. Using a low-pressure garden hose sprayer, direct a wide-angle water spray at a downward 45° angle onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. **Caution:** Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane.
- Remove rinse water from rinse tub or garbage can using a vacuum hose as needed.
- Slip the O-ring over the pipe nipple on the top end of the tentacle and reassemble onto the cartridge head plate; hand tighten.
- If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Contech to order replacement tentacles.
- Lower a rinsed filter cartridge to the cartridge deck. Remove the cartridge lid on a receptacle and carefully lower the filter cartridge into the receptacle until the head plate gasket is seated squarely on the lip of the receptacle. **Caution:** Should a snag occur when lowering the cartridge into the receptacle, do not force the cartridge downward; damage may occur. Rotate the cartridge with a slight sideways motion to clear the snag and complete the installation.
- Replace the cartridge lid on the exposed receptacle. Check the fit before completing rotation to a firm hand-tight attachment. Rinse away any accumulated grit from the receptacle threads if needed to get a proper fit.
- Repeat cartridge installation until all cartridges are installed.

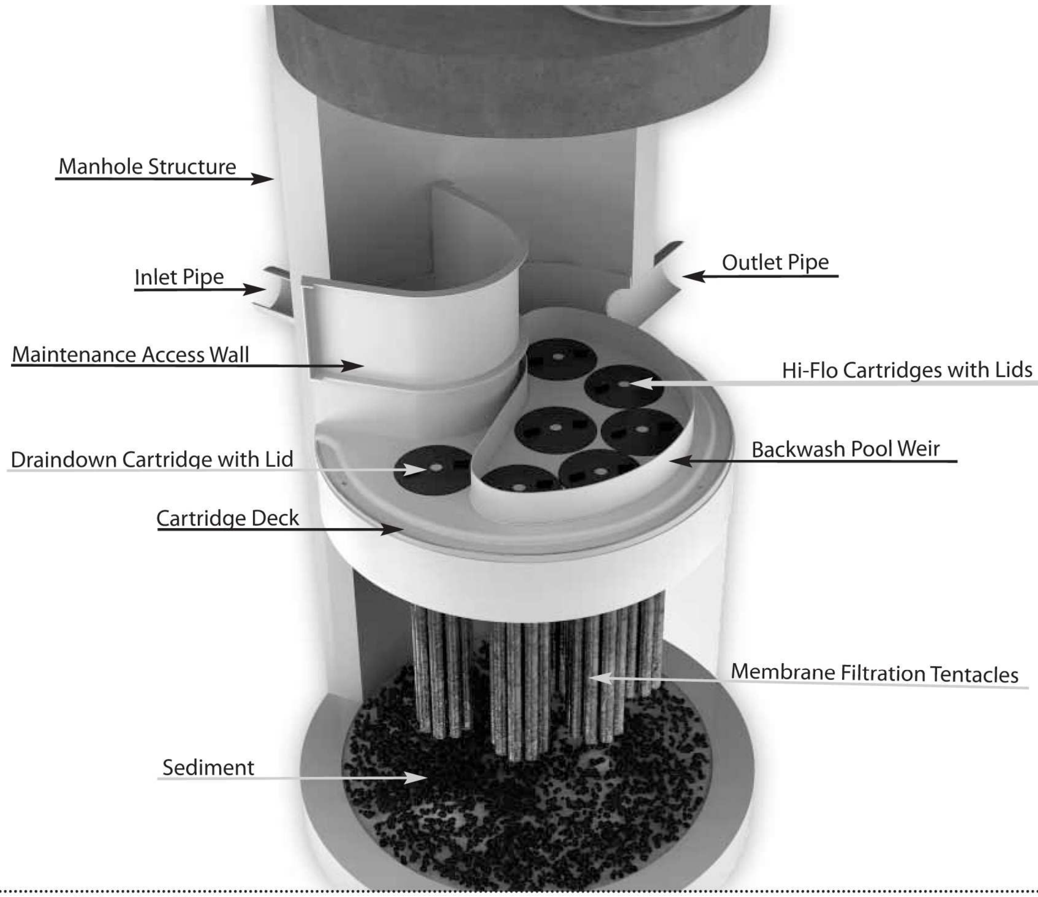
- **Vacuum Cleaning Procedure**
  - **Caution:** Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning **only through the maintenance access wall (MAW) opening**, being careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck. The separator skirt surrounds the filter cartridge zone, and could be torn if contacted by the wand. **Do not lower the vacuum wand through a cartridge receptacle**, as damage to the receptacle will result.
  - To remove floatable trash, debris, and oil, lower the vacuum hose into the MAW opening and vacuum floatable pollutants off the surface of the water. Alternatively, floatable solids may be removed by a net or skimmer.
  - Using a vacuum hose, remove the water from the lower chamber to the sanitary sewer, if permitted by the local regulating authority, or into a separate containment tank.
  - Remove the sediment from the bottom of the unit through the MAW opening.
  - For larger diameter Jellyfish Filter manholes (8-ft, 10-ft, 12-ft diameter), complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle..
  - After the unit is clean, re-fill the lower chamber with water if required by the local jurisdiction, and re-install filter cartridges.
  - Dispose of sediment, floatable trash and debris, oil, spent tentacles, and water according to local regulatory requirements.

- **Chemical Spills**
    - o **Caution:** If a chemical spill has been captured by the Jellyfish Filter, do not attempt maintenance. Immediately contact the local hazard response agency, and contact Contech Engineered Services.

Below is a cut-away schematic of the Jellyfish Filter manhole with key components identified (6-ft diameter manhole is depicted).

FIGURE 1

Jellyfish Filter and Components



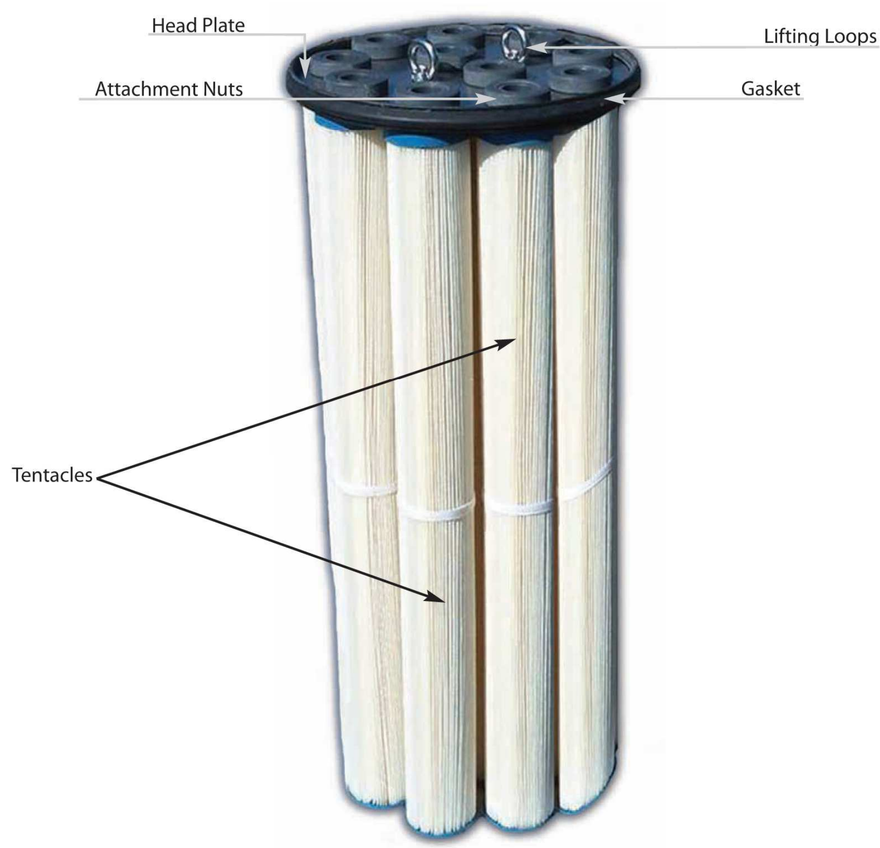
Note: Separator Skirt Not Shown

The Jellyfish Filter has no moving parts to wear out and therefore maintenance activities are generally focused on pollutant removal and filter cartridge service.

Below is a schematic of a Jellyfish Filter membrane filtration cartridge. Tentacles can be easily removed from the head plate and rinsed or replaced as needed.

FIGURE 2

Jellyfish Membrane Filtration Cartridge

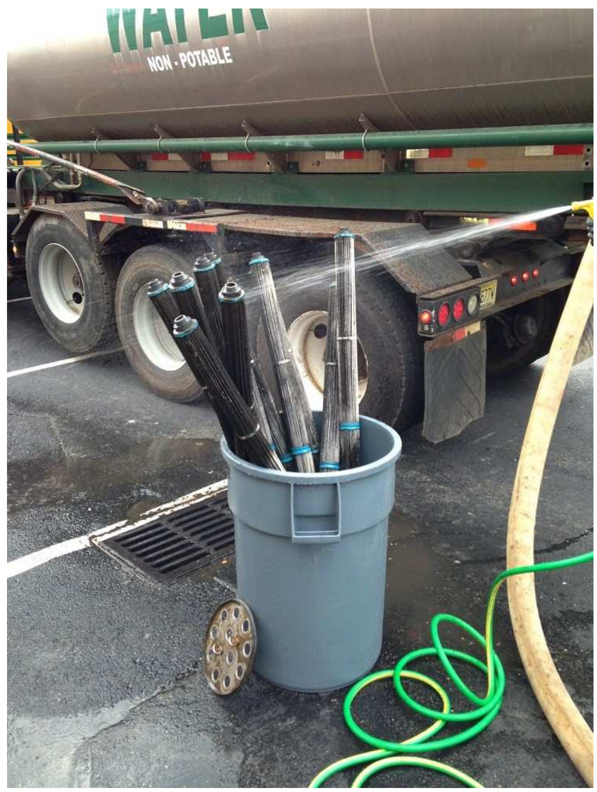


The depth of sediment and oil can be measured from the surface by using a sediment probe or dipstick tube equipped with a ball check valve and inserted through the Jellyfish Filter's maintenance access wall opening. The large opening provides convenient access for inspection and vacuum removal of water and pollutants.

A maintenance worker stationed on the surface uses a vacuum hose to evacuate water, sediment, and floatables from the Jellyfish Filter by inserting the vacuum wand through the maintenance access wall opening.


A view of a Jellyfish Filter cartridge deck from the surface showing all the cartridge lids intact and no standing water on the deck (left image), and inspection of the flexible separator skirt from inside the maintenance access wall opening (right image).

Assembly of a Jellyfish Filter cartridge (left) and installation of a filter cartridge into a cartridge receptacle in the deck (right).



Rinsing of dirty filter cartridge tentacles with a low-pressure garden hose sprayer, and using a plastic garbage container to capture rinse water.

The benefits of regular inspection and maintenance are many – from ensuring maximum operation efficiency, to keeping maintenance costs low, to the continued protection of natural waterways – and provide the key to the Jellyfish Filter's long and effective service life.

Ordering Replacement Parts
Jellyfish Filter cartridges, replacement tentacles, cartridge lids, and other system components can be ordered by contacting: **Contech Engineered Solutions, 1-800-548-4667**

CONTECH ENGINEERED SOLUTIONS

StormFilter Inspection and Maintenance Procedures

The Stormwater Management StormFilter®

Maintenance Guidelines

The primary purpose of the Stormwater Management StormFilter® is to filter and prevent pollutants from entering our waterways. Like any effective filtration system, periodically these pollutants must be removed to restore the StormFilter to its full efficiency and effectiveness.

Maintenance requirements and frequency are dependent on the pollutant load characteristics of each site. Maintenance activities may be required in the event of a chemical spill or due to excessive sediment loading from site erosion or extreme storms. It is a good practice to inspect the system after major storm events.

Maintenance Procedures

Although there are many effective maintenance options, we believe the following procedure to be efficient, using common equipment and existing maintenance protocols. The following two-step procedure is recommended::

1. **Inspection**
   - Inspection of the vault interior to determine the need for maintenance.
2. **Maintenance**
   - Cartridge replacement
   - Sediment removal

Inspection and Maintenance Timing

At least one scheduled inspection should take place per year with maintenance following as warranted.

First, an inspection should be done before the winter season. During the inspection the need for maintenance should be determined and, if disposal during maintenance will be required, samples of the accumulated sediments and media should be obtained.

Second, if warranted, a maintenance (replacement of the filter cartridges and removal of accumulated sediments) should be performed during periods of dry weather.

In addition to these two activities, it is important to check the condition of the StormFilter unit after major storms for potential damage caused by high flows and for high sediment accumulation that may be caused by localized erosion in the drainage area. It may be necessary to adjust the inspection/ maintenance schedule depending on the actual operating conditions encountered by the system. In general, inspection activities can be conducted at any time, and maintenance should occur, if warranted, during dryer months in late summer to early fall.

Maintenance Frequency

The primary factor for determining frequency of maintenance for the StormFilter is sediment loading.

A properly functioning system will remove solids from water by trapping particulates in the porous structure of the filter media inside the cartridges. The flow through the system will naturally decrease as more and more particulates are trapped. Eventually the flow through the cartridges will be low enough to require replacement. It may be possible to extend the usable span of the cartridges by removing sediment from upstream trapping devices on a routine as-needed basis, in order to prevent material from being re-suspended and discharged to the StormFilter treatment system.

The average maintenance lifecycle is approximately 1-5 years. Site conditions greatly influence maintenance requirements. StormFilter units located in areas with erosion or active construction may need to be inspected and maintained more often than those with fully stabilized surface conditions.

Regulatory requirements or a chemical spill can shift maintenance timing as well. The maintenance frequency may be adjusted as additional monitoring information becomes available during the inspection program. Areas that develop known problems should be inspected more frequently than areas that demonstrate no problems, particularly after major storms. Ultimately, inspection and maintenance activities should be scheduled based on the historic records and characteristics of an individual StormFilter system or site. It is recommended that the site owner develop a database to properly manage StormFilter inspection and maintenance programs..

Inspection Procedures

The primary goal of an inspection is to assess the condition of the cartridges relative to the level of visual sediment loading as it relates to decreased treatment capacity. It may be desirable to conduct this inspection during a storm to observe the relative flow through the filter cartridges. If the submerged cartridges are severely plugged, then typically large amounts of sediments will be present and very little flow will be discharged from the drainage pipes. If this is the case, then maintenance is warranted and the cartridges need to be replaced.

Warning: In the case of a spill, the worker should abort inspection activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct an inspection:

Important: Inspection should be performed by a person who is familiar with the operation and configuration of the StormFilter treatment unit.

1. If applicable, set up safety equipment to protect and notify surrounding vehicle and pedestrian traffic.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the access portals to the vault and allow the system vent.
4. Without entering the vault, visually inspect the inside of the unit, and note accumulations of liquids and solids.
5. Be sure to record the level of sediment build-up on the floor of the vault, in the forebay, and on top of the cartridges. If flow is occurring, note the flow of water per drainage pipe. Record all observations. Digital pictures are valuable for historical documentation.
6. Close and fasten the access portals.
7. Remove safety equipment.
8. If appropriate, make notes about the local drainage area relative to ongoing construction, erosion problems, or high loading of other materials to the system.
9. Discuss conditions that suggest maintenance and make decision as to weather or not maintenance is needed.

Maintenance Decision Tree

The need for maintenance is typically based on results of the inspection. The following Maintenance Decision Tree should be used as a general guide. (Other factors, such as Regulatory Requirements, may need to be considered)

1. Sediment loading on the vault floor.
   a. If >4" of accumulated sediment, maintenance is required.
2. Sediment loading on top of the cartridge.
   a. If >1/4" of accumulation, maintenance is required.
3. Submerged cartridges.
   a. If >4" of static water above cartridge bottom for more than 24 hours after end of rain event, maintenance is required. (Catch basins have standing water in the cartridge bay.)
4. Plugged media.
   a. If pore space between media granules is absent, maintenance is required.
5. Bypass condition.
   a. If inspection is conducted during an average rain fall event and StormFilter remains in bypass condition (water over the internal outlet baffle wall or submerged cartridges), maintenance is required.
6. Hazardous material release.
   a. If hazardous material release (automotive fluids or other) is reported, maintenance is required.
7. Pronounced scum line.
   a. If pronounced scum line (say ≥ 1/4" thick) is present above top cap, maintenance is required.

Maintenance

Depending on the configuration of the particular system, maintenance personnel will be required to enter the vault to perform the maintenance.

Important: If vault entry is required, OSHA rules for confined space entry must be followed.

Filter cartridge replacement should occur during dry weather. It may be necessary to plug the filter inlet pipe if base flows is occurring.

Replacement cartridges can be delivered to the site or customers facility. Information concerning how to obtain the replacement cartridges is available from Contech Engineered Solutions.

Warning: In the case of a spill, the maintenance personnel should abort maintenance activities until the proper guidance is obtained. Notify the local hazard control agency and Contech Engineered Solutions immediately.

To conduct cartridge replacement and sediment removal maintenance:

1. If applicable, set up safety equipment to protect maintenance personnel and pedestrians from site hazards.
2. Visually inspect the external condition of the unit and take notes concerning defects/problems.
3. Open the doors (access portals) to the vault and allow the system to vent.
4. Without entering the vault, give the inside of the unit, including components, a general condition inspection.
5. Make notes about the external and internal condition of the vault. Give particular attention to recording the level of sediment build-up on the floor of the vault, in the forebay, and on top of the internal components.
6. Using appropriate equipment offload the replacement cartridges (up to 150 lbs. each) and set aside.
7. Remove used cartridges from the vault using one of the following methods:

Method 1:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

   Using appropriate hoisting equipment, attach a cable from the boom, crane, or tripod to the loose cartridge. Contact Contech Engineered Solutions for suggested attachment devices.

B. Remove the used cartridges (up to 250 lbs. each) from the vault.

Important: Care must be used to avoid damaging the cartridges during removal and installation. The cost of repairing components damaged during maintenance will be the responsibility of the owner.

C. Set the used cartridge aside or load onto the hauling truck.

D. Continue steps a through c until all cartridges have been removed.

Method 2:

A. This activity will require that maintenance personnel enter the vault to remove the cartridges from the under drain manifold and place them under the vault opening for lifting (removal). Disconnect each filter cartridge from the underdrain connector by rotating counterclockwise 1/4 of a turn. Roll the loose cartridge, on edge, to a convenient spot beneath the vault access.

B. Unscrew the cartridge cap.

C. Remove the cartridge hood and float.

D. At location under structure access, tip the cartridge on its side.

E. Empty the cartridge onto the vault floor. Reassemble the empty cartridge.

F. Set the empty, used cartridge aside or load onto the hauling truck.

G. Continue steps a through e until all cartridges have been removed.

8. Remove accumulated sediment from the floor of the vault and from the forebay. This can most effectively be accomplished by use of a vacuum truck.
9. Once the sediments are removed, assess the condition of the vault and the condition of the connectors.
10. Using the vacuum truck boom, crane, or tripod, lower and install the new cartridges. Once again, take care not to damage connections.
11. Close and fasten the door.
12. Remove safety equipment.
13. Finally, dispose of the accumulated materials in accordance with applicable regulations. Make arrangements to return the used **empty** cartridges to Contech Engineered Solutions.

Related Maintenance Activities - Performed on an as-needed basis

StormFilter units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the StormFilter to be successful, it is imperative that all other components be properly maintained. The maintenance/repair of upstream facilities should be carried out prior to StormFilter maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads.

Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Inspection Report

Date: Personnel:

Location: ________________________ System Size: ____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

Sediment Thickness in Forebay: ____ Date: ________________

Sediment Depth on Vault Floor: ____

Structural Damage: ____

Estimated Flow from Drainage Pipes (if available): ____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: ____

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: ____

☐ Minor Structural Repairs: ____

☐ Drainage Area Report ____

Excessive Oil Loading: Yes ☐ No ☐ Source: ____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ____

Items Needing Further Work: ____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

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Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: ______________________ Personnel: ____

Location: ______________________ System Size: ____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

List Safety Procedures and Equipment Used: ____

____

____

System Observations

Months in Service:

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): ____

Sediment Depth on Vault Floor: ____

Structural Damage: ____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: ______________________________

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: ______________________________

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: ______________________________

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: ______________________________

Replace Cartridges: Yes ☐ No ☐ Details: ______________________________

Sediment Removed: Yes ☐ No ☐ Details: ______________________________

Quantity of Sediment Removed (estimate?):

Minor Structural Repairs: Yes ☐ No ☐ Details: ______________________________

Residuals (debris, sediment) Disposal Methods: ____

Notes:

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RECYCLED PAPER

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800-338-1122

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Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater and earth stabilization products. For information on other Contech division offerings, visit contech-cpi.com or call 800.338.1122.

Support

• Drawings and specifications are available at www.conteches.com.

• Site-specific design support is available from our engineers.

800.338.1122
www.conteches.com

Operation and Maintenance

DownSpout StormFilter™

Single-Stage Units

Important: These guidelines should be used as a part of your site stormwater management plan.

Overview

The single-stage DownSpout StormFilter™ (DSF) consists of a multi-chamber plastic unit that can contain up to two StormFilter cartridges. By configuring the StormFilter cartridges with various filter media, the DSF is designed to remove pollutants such as soluble zinc and other metals from rooftop runoff.

The DSF is installed above ground, occupying a small footprint (2.5' x 5'), and is easily integrated into most existing downspout configurations. The system can be equipped with built-in ports for viewing and sample collection to simplify monitoring. For higher levels of treatment, a second stage can be added.

One single-stage, two-cartridge DSF unit can treat runoff from roof areas up to 14,000 square feet. The DSF is also designed with an internal high flow bypass to minimize re-suspension of trapped pollutants in cases where extreme flows exceed the water quality design flow.

Design Operation

The DSF is installed as the primary receiver of roof runoff. Runoff is directly discharged to the DSF cartridge chamber by the existing downspout system. Once in the cartridge chamber, polluted water ponds and percolates horizontally through the media in the filter cartridges. Treated water collects in each cartridge's center tube from where it is directed by an under-drain manifold to the outlet pipe on the downstream side of the overflow weir and discharged.

When flows into the DSF exceed the water quality design value, excess water spills over the overflow weir, bypassing the cartridge chamber, and discharges to the outlet pipe.

Applications

The DSF is an affordable, easily-maintained solution for treating rooftop runoff from industrial facilities, warehouses, and commercial buildings. Its modular and changeable cartridges allow it to be upgraded to meet changing removal requirements without requiring purchase of additional equipment.

Maintenance Guidelines

The filter cartridges contained in the DSF are easily removed and replaced during maintenance activities according to the following guidelines:

1. Establish a safe working area as per typical catch basin service activity.
2. Remove lid.
3. Turn cartridge(s) counter-clockwise to disconnect from pipe manifold.
4. Remove 4” center cap from cartridge and replace with lifting cap.
5. Remove cartridge(s) from cartridge chamber by hand or with vactor truck boom.
6. Remove accumulated sediment via vactor truck (min. clearance 13” x 24”).
7. Rinse interior of chamber and vactor remaining water and sediment.
8. Install fresh cartridge(s) threading clockwise to pipe manifold.
9. Replace lid.
10. Return original cartridges to CONTECH Stormwater Solutions for cleaning and media disposal.

Media may be removed from the filter cartridges using the vactor truck before the cartridges are removed from the catch basin structure. Empty cartridges can be easily removed from the catch basin structure by hand. Empty cartridges should be reassembled and returned to CONTECH Stormwater Solutions, as appropriate.

Note: Customer is responsible for disposing of media in accordance with applicable regulations.

Materials required include a lifting cap, vactor truck, and fresh filter cartridges. Contact CONTECH Stormwater Solutions for specifications and availability of the lifting cap. The owner may refresh spent cartridges. Refreshed cartridges are also available from CONTECH Stormwater Solutions on an exchange basis. Contact the maintenance department of CONTECH Stormwater Solutions at (800) 548-4667 for more information.

Maintenance is estimated at 24 minutes of site time. For units with more than one cartridge, add approximately 5 minutes for each additional cartridge. Add travel time as required.

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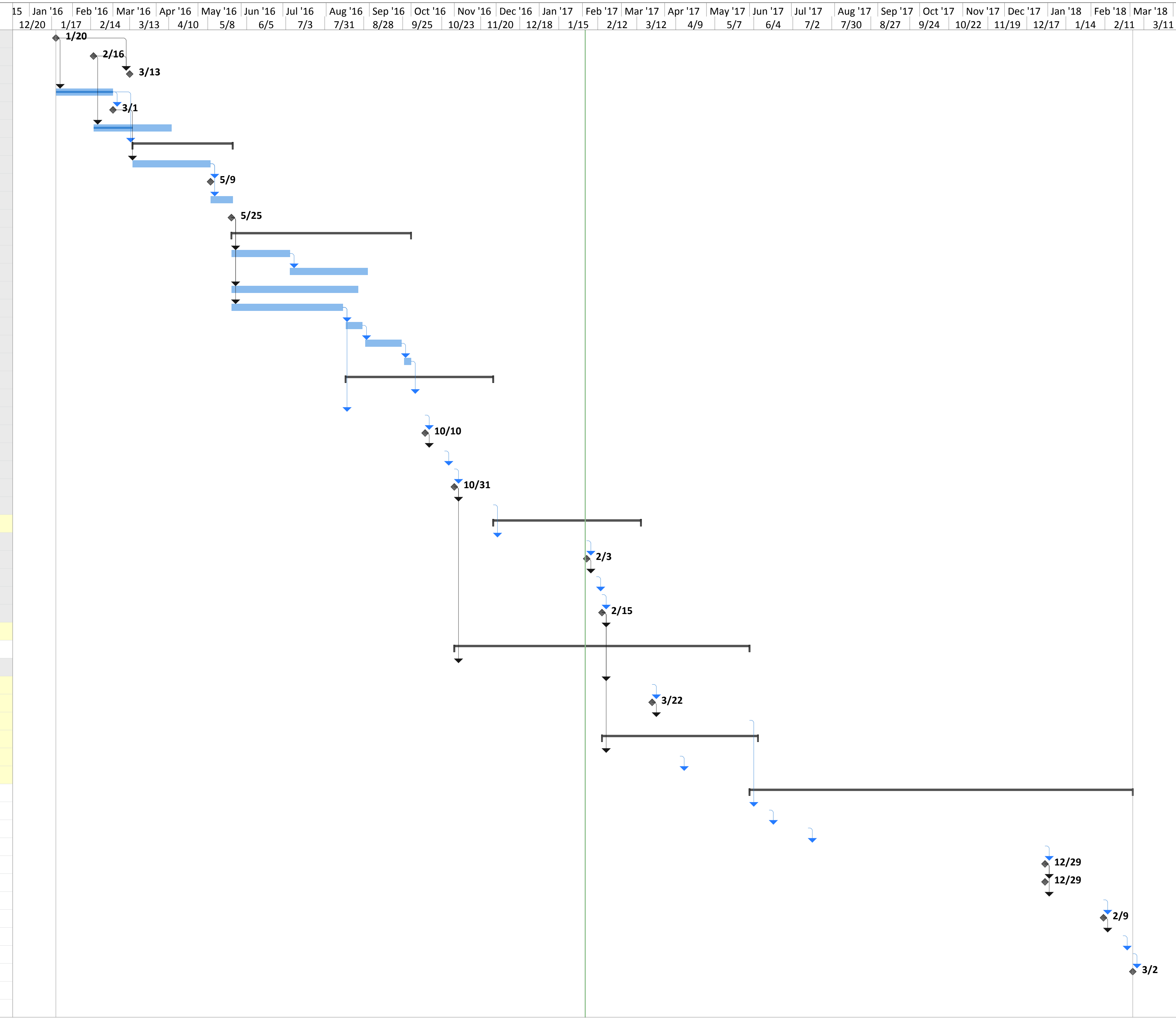
An Exelon Company

Appendix D
Schedule

Benning Road Site Stormwater Measures

ID	Task Name	Duration	Start	Finish	Predecessors
1	Targeted Sampling Events 1-3 (Completed by AMEC)	0 days	Wed 1/20/16	Wed 1/20/16	
2	Site Recon by Design Team	0 days	Tue 2/16/16	Tue 2/16/16	
3	Roof Runoff Sampling (Completed by AMEC)	0 days	Sun 3/13/16	Sun 3/13/16	1,2
4	Design Basis Report (Internal)	29 days	Wed 1/20/16	Mon 2/29/16	1
5	Submit Design Basis Report to Pepco (Internal)	0 days	Tue 3/1/16	Tue 3/1/16	4
6	Stormwater Modeling (Draft)	40 days	Tue 2/16/16	Mon 4/11/16	2
7	**Conceptual Design Report**	**52 days**	**Tue 3/15/16**	**Wed 5/25/16**	**4**
8	Prepare Design Package	40 days	Tue 3/15/16	Mon 5/9/16	5
9	Submit Design Package	0 days	Mon 5/9/16	Mon 5/9/16	8
10	EPA/DOJ Review	12 days	Tue 5/10/16	Wed 5/25/16	8
11	Conference Call with EPA	0 days	Wed 5/25/16	Wed 5/25/16	
12	**Additional Data Collection**	**93 days**	**Wed 5/25/16**	**Fri 9/30/16**	
13	Treatability Sampling	30 days	Wed 5/25/16	Tue 7/5/16	11
14	Bench-Scale Treatability Testing	40 days	Wed 7/6/16	Tue 8/30/16	13
15	Stormwater Sampling and Flow Monitoring (up to 3 events)	65 days	Wed 5/25/16	Tue 8/23/16	11
16	Survey of Topography and Storm Drain Laterals	58 days	Wed 5/25/16	Fri 8/12/16	11
17	Revised Drainage Areas	10 days	Mon 8/15/16	Fri 8/26/16	16
18	Calibrate Stormwater Model	20 days	Mon 8/29/16	Fri 9/23/16	17
19	Complete Material Balances	5 days	Mon 9/26/16	Fri 9/30/16	18
20	**Final Conceptual Design Report**	**76 days**	**Mon 8/15/16**	**Mon 11/28/16**	
21	Size Equipment	20 days	Mon 10/3/16	Fri 10/28/16	19
22	Prepare Final Conceptual Design Report	41 days	Mon 8/15/16	Mon 10/10/16	16
23	Submit Final Conceptual Design Report to Pepco	0 days	Mon 10/10/16	Mon 10/10/16	22
24	Pepco Review	10 days	Tue 10/11/16	Mon 10/24/16	23
25	Incorporate Pepco Comments	5 days	Tue 10/25/16	Mon 10/31/16	24
26	Submit Final Conceptual Design Report to EPA	0 days	Mon 10/31/16	Mon 10/31/16	25
27	EPA/DOJ Review	20 days	Tue 11/1/16	Mon 11/28/16	26
28	**Final Treatment System Design Report**	**76 days**	**Tue 11/29/16**	**Tue 3/14/17**	
29	Prepare Final Treatment System Design Report	49 days	Tue 11/29/16	Fri 2/3/17	27
30	Submit Final Treatment System Design Report	0 days	Fri 2/3/17	Fri 2/3/17	29
31	Pepco Review	5 days	Mon 2/6/17	Fri 2/10/17	30
32	Incorporate Pepco Comments	2 days	Mon 2/13/17	Tue 2/14/17	31
33	Submit Treatment System Design Report to EPA	0 days	Wed 2/15/17	Wed 2/15/17	32
34	EPA/DOJ Review and Approval	20 days	Wed 2/15/17	Tue 3/14/17	33
35	**Permits and Approvals**	**152 days**	**Tue 11/1/16**	**Wed 5/31/17**	
36	Pre-Application Meetings	54 days	Tue 11/1/16	Fri 1/13/17	26
37	Prepare Permit Applications	26 days	Wed 2/15/17	Wed 3/22/17	33
38	Submit Permits Applications	0 days	Wed 3/22/17	Wed 3/22/17	37
39	Application Approval	50 days	Thu 3/23/17	Wed 5/31/17	38
40	**Procurement**	**80 days**	**Wed 2/15/17**	**Tue 6/6/17**	
41	Site Work Contractor	40 days	Wed 2/15/17	Tue 4/11/17	33
42	Long Lead Items	40 days	Wed 4/12/17	Tue 6/6/17	41
43	**Construction**	**197 days**	**Thu 6/1/17**	**Fri 3/2/18**	
44	Notice to Proceed	10 days	Thu 6/1/17	Wed 6/14/17	39
45	Mobilization and Site Preparation	20 days	Thu 6/15/17	Wed 7/12/17	44
46	Treatment Systems Construction	122 days	Thu 7/13/17	Fri 12/29/17	45
47	Treatment System Placed Into Operation	0 days	Fri 12/29/17	Fri 12/29/17	46
48	Begin Performance Testing	0 days	Fri 12/29/17	Fri 12/29/17	47
49	Prepare As Built Report	30 days	Mon 1/1/18	Fri 2/9/18	47
50	Submit Draft As Built Report to Pepco	0 days	Fri 2/9/18	Fri 2/9/18	49
51	Pepco Review	10 days	Mon 2/12/18	Fri 2/23/18	50
52	Incorporate Pepco Comments	5 days	Mon 2/26/18	Fri 3/2/18	51
53	Submit Final As Built Report to EPA	0 days	Fri 3/2/18	Fri 3/2/18	52
54					
55	Assumptions and Notes				



Project: Stormwater Project Sche				
Task	Summary	External Milestone	Inactive Summary	Manual Summary Rollup
Split	Project Summary	Inactive Task	Manual Task	Manual Summary
Milestone	External Tasks	Inactive Milestone	Duration-only	Start-only

Finish-only	Manual Progress
Deadline	
Progress	

55 Assumptions and Notes

Assumptions:

- Task 12 – It is assumed that geotechnical test pits/borings and infiltration testing will not be required.
- Tasks 13, 14, 15, and 44 are dependent on a qualifying storm event for collection of stormwater data.
- Task 34, 35, 36 and 37 - Required DC permits are limited to DCRA Erosion & Sediment Control, building permits only. It is assumed that the project is exempt from all other stormwater management requirements, and design and permitting reviews by the District Department of Energy and Environment (DOEE) or other DC agencies are not required; if DOEE reviews and approvals are needed, the schedule will have to be revised.
- Task 44 - The treatment system is intended to reduce copper, zinc, lead, and iron levels in the runoff to meet the current NPDES permit requirements; reduction of other contaminants will not be required.
- Task 44 - The placement in operation does not guarantee compliance with permit limits right away as the system design is based on limited data. It is anticipated that achieving compliance with permit limits would entail multiple rounds of iterative performance sampling and treatment parameter adjustment.
- The schedule does not account for significant weather delays.

Notes:

- Tasks highlighted grey have been completed.
- Task highlighted yellow have been upadated since the previous schedule.