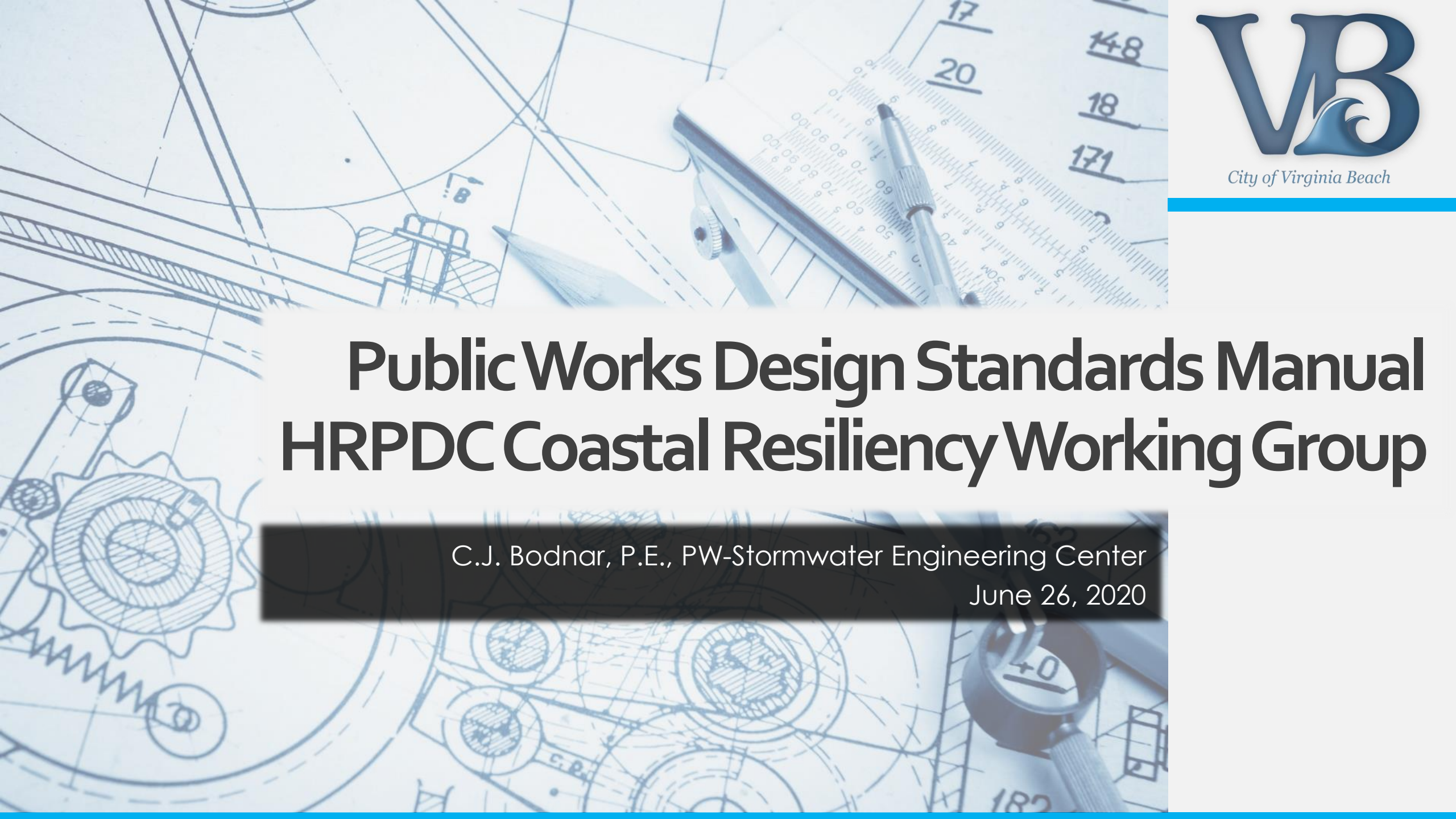




Public Works Design Standards Manual HRPDC Coastal Resiliency Working Group

C.J. Bodnar, P.E., PW-Stormwater Engineering Center
June 26, 2020

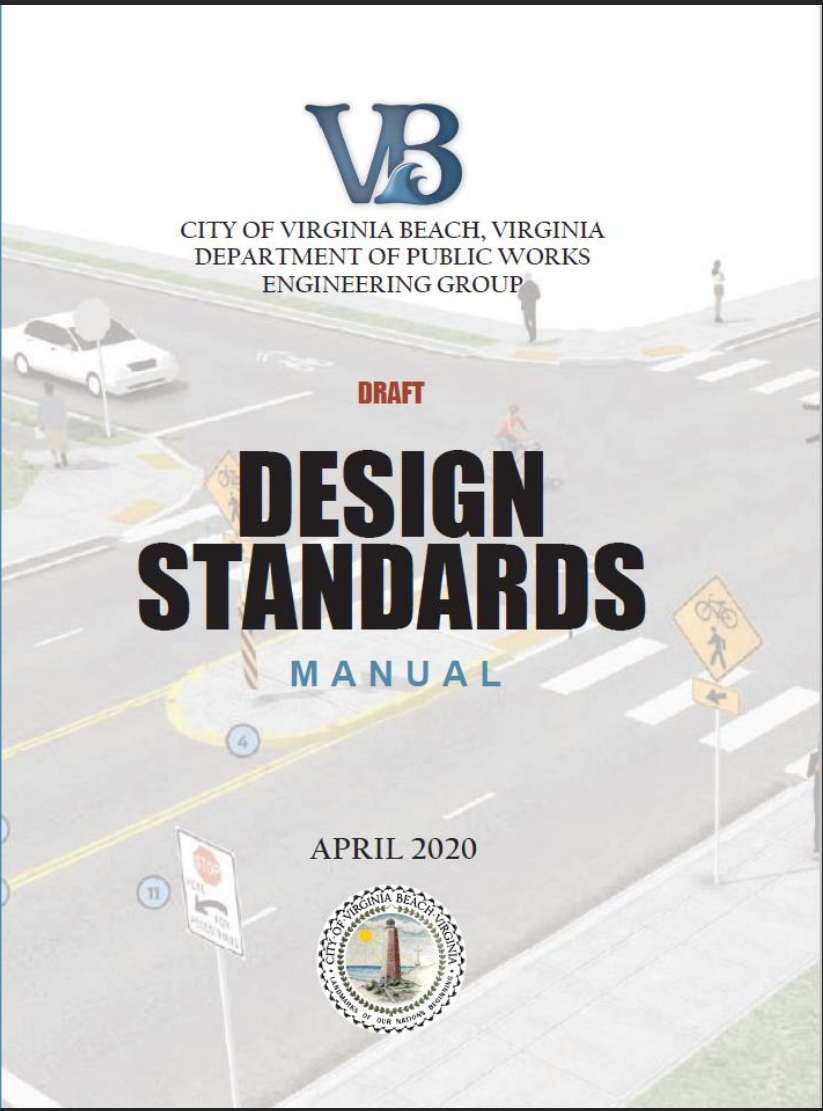
Public Works Specifications & Standards (PWS&S)

Public Works Design Standards Manual (PWDSM)

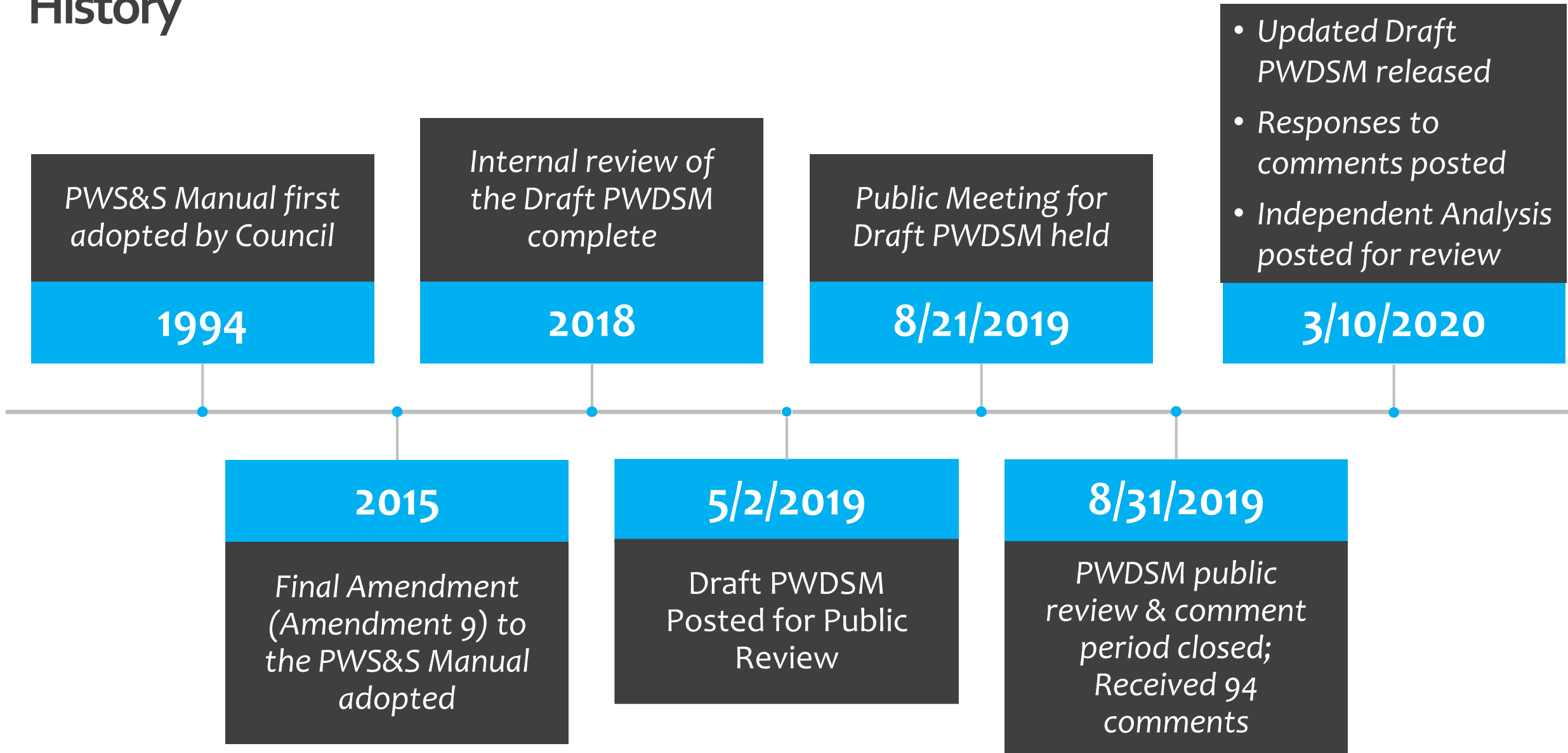
CITY OF VIRGINIA BEACH, VIRGINIA
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION



SPECIFICATIONS AND STANDARDS
THROUGH AMENDMENT 9
May 7, 2015



History



Public Involvement

Public Meeting held with Development and Engineering Community

12/4/2017

Meeting with TBA Members and City Staff

8/2/2018

DSC Regularly Scheduled TBA Coordination Meeting

1/14/2019

Public Meeting held with Development and Engineering Community

8/21/2019

Sea Level Wise City Council Briefing

1/14/2020

- *Various Informational Meetings with DSC & Engineering Community*
- *Sea Level Wise Public Meetings*

Various

2/5/2018

Meeting with TBA Members and City Staff

8/8/2018

DSC Quarterly Consultant Meeting

8/15/2019

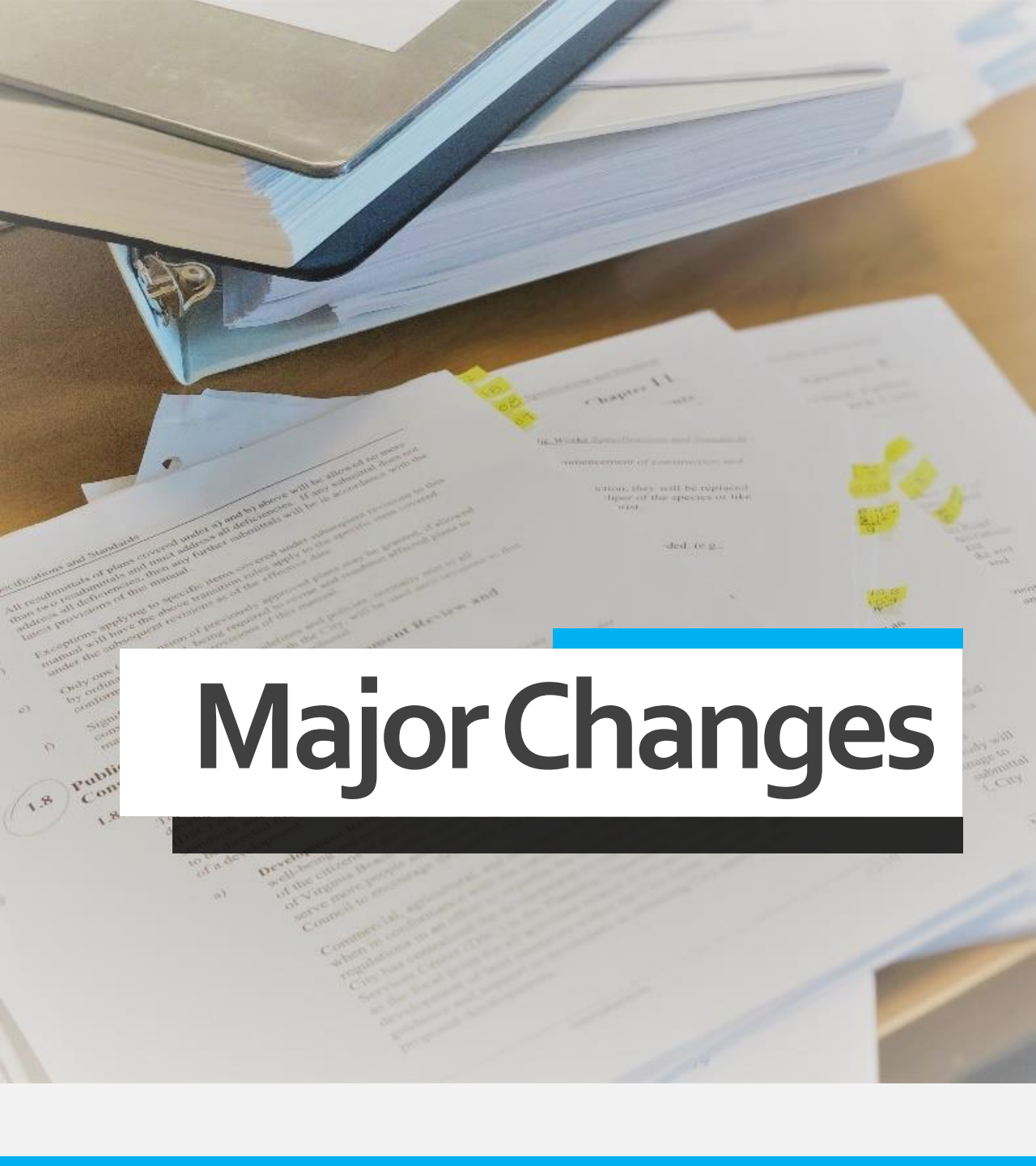
Meeting with TBA Members and City Staff

11/20/2019

DSC Regularly Scheduled TBA Coordination Meeting

5/11/2020

DSC Regularly Scheduled TBA Coordination Meeting



Major Changes

- Document updated and re-formatted, made user friendly
- Several sections removed and will be administered directly by Planning Department
- Technical Changes:
 - As-Built Drawings
 - Stormwater Conveyance Piping Material and Testing
 - Roadway Lighting Design
 - Stormwater Utility Fee Adjustment
 - Stormwater Design Requirements

As-Built Drawings

- Requirement Changes:
 - Higher Accuracy
 - Stormwater Management Facility (SWMF) and Pipe System Post-Construction Surveys
 - Updated Checklist
 - Engineer to Certify SWMF Construction (VSMP)
- Additional Requirements:
 - Profiles
 - Construction Baseline
 - Public Easements





Stormwater Conveyance Pipe

- Only Reinforced Concrete Pipe (RCP) allowed in Right-of-Way
- Developer/Contractor/Permittee required to perform CCTV of all constructed storm pipes; required to repair all deficiencies

Roadway Lighting Design

New Requirement: Streetlights must be designed for LED type lighting

- CIP Projects: City-Owned LED Lighting Required
- Private Development: Option of City-Owned LED Lighting or Dominion LED Lighting



CITY OF VIRGINIA BEACH

APPLICATION FOR STORMWATER MANAGEMENT
UTILITY FEE ADJUSTMENT



APPLICANT INFORMATION

Applicant Name:			
	Last	First	M.I.
Name of Property:			
Property Address:			
	Street Address	Apartment/Unit #	
	City	State	Zip Code
Phone:	()		
Email Address:			
Mailing Address:			
Property Parcel ID Number (G-PIN):			
Stormwater Utility Account Number:			

APPLICATION PROCEDURE

Please fill out all sections of this application and mail the application and all attachments to:

Department of Public Works Engineering Division
Stormwater Management Regulatory
2405 Courthouse Drive
Virginia Beach, VA 23456
(757) 385 - 4131

Or email a copy of this application and the attachments to:

vbstormwater@vbgov.com

APPLICANT CHECKLIST

Please indicate the basis for the application for Stormwater Management Utility Fee Adjustment.
THE APPLICANT MUST INCLUDE ALL OF THE ATTACHMENTS LISTED (CHECK OFF). If any information is missing from the application package, you will be asked to complete the request and re-submit. Please note that the City reserves the right to request additional information if necessary.

☐ IMPERVIOUS AREA CORRECTION

- ☐ Revised impervious area calculations.
- ☐ Overall Site Map depicting impervious area.
- ☐ Any other information to substantiate revised impervious area.

Stormwater Utility Fee Adjustment Program

Updated Instructions and Application:

- Provides Stormwater Fee Reduction for non-residential properties up to 50%
- Must have functional on-site Stormwater Management Facilities (SWMF)
- Must have a SWMF Maintenance Agreement with the City
- Adjustment based on quantity and quality treatment for the property



Stormwater Management New Requirements & Design Parameters :

- Modeling
- Rainfall
- Sea Level Rise
- Tailwater
- Groundwater

Stormwater Management

Modeling

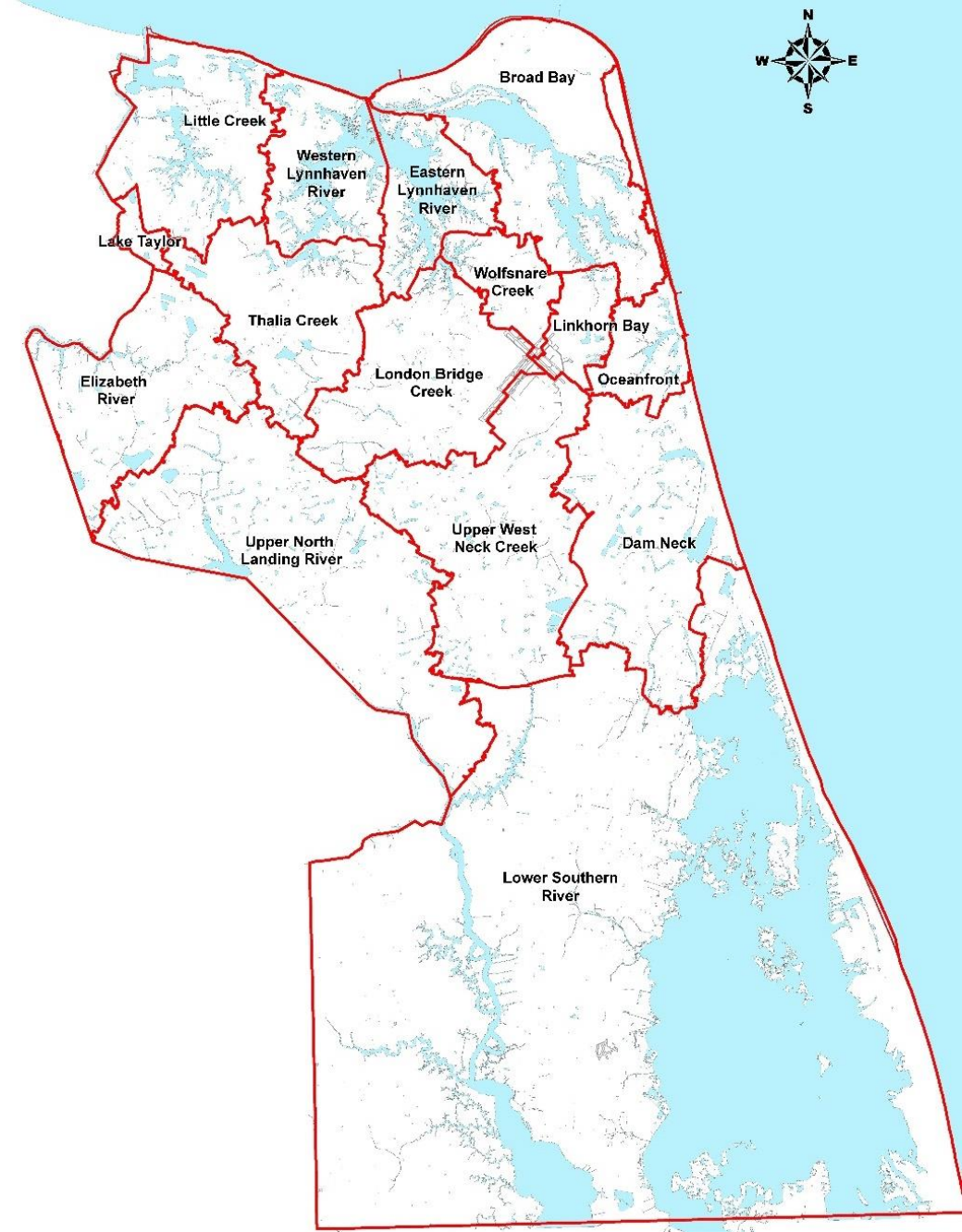
- City has completed an extensive Stormwater Modeling Program (\$12M+)
- New Procedures/Requirements:
 - Use of City Models Available to Designers
 - Designers must use EPA's Stormwater Management Model (SWMM) software when total disturbed area greater than 20,000 sf



Stormwater Management

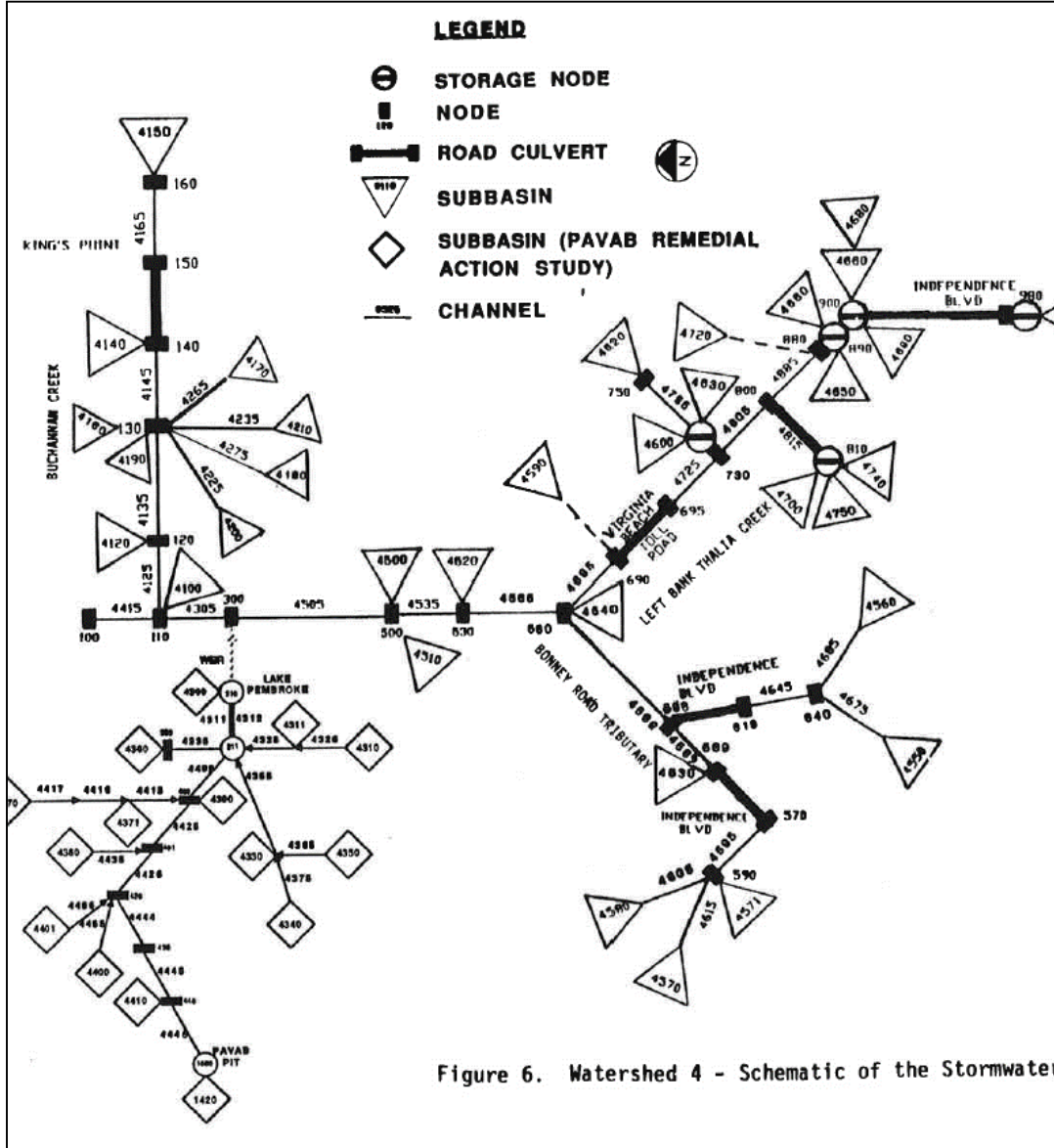
Modeling

- City modeled all drainage basins except Lower Southern Rivers using PCSWMM Software
 - PCSWMM uses EPA's Stormwater Management Model (SWMM) Software as its engine
 - EPA SWMM is a free program available from the US Government
- Lower Southern Rivers models prepared in MIKE suite of programs
 - Allows effects of wind into the modeling parameters



Stormwater Management

Modeling



1990 Model Schematic

46 Nodes 58 Conduits



3,184 Nodes 13,762 Conduits

Stormwater Management

Modeling

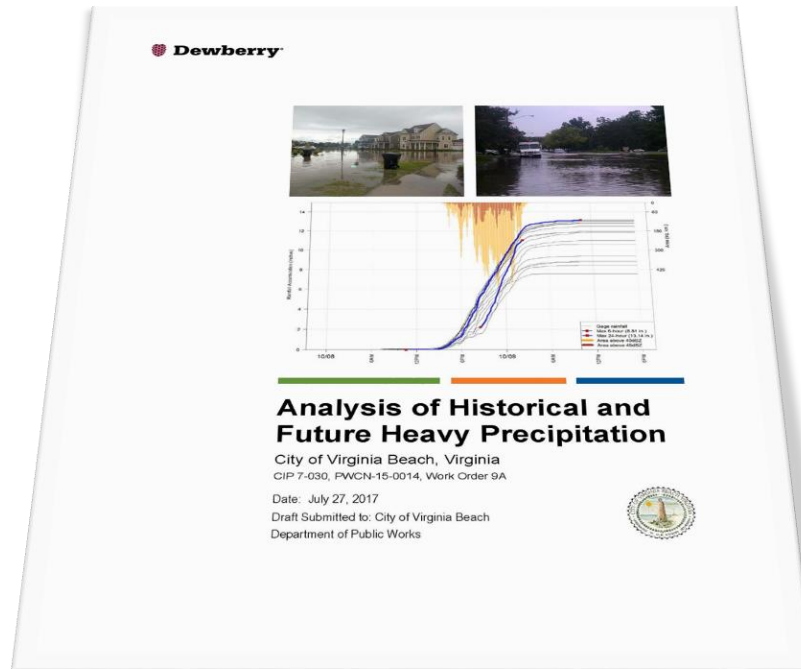
- Models include the Primary Stormwater System:
 - Pipes 24-inches in diameter and larger
 - Stormwater Management Facilities (Ponds and Lakes)
 - Natural conveyance systems (Ditches/Swales/Canals)
- Models prepared for 1-, 2-, 10-, 25-, 50-, 100- and 500-year storm events using recurrent tailwater elevations
- Models prepared for 1.5-ft and 3-ft sea level rise



Stormwater Management

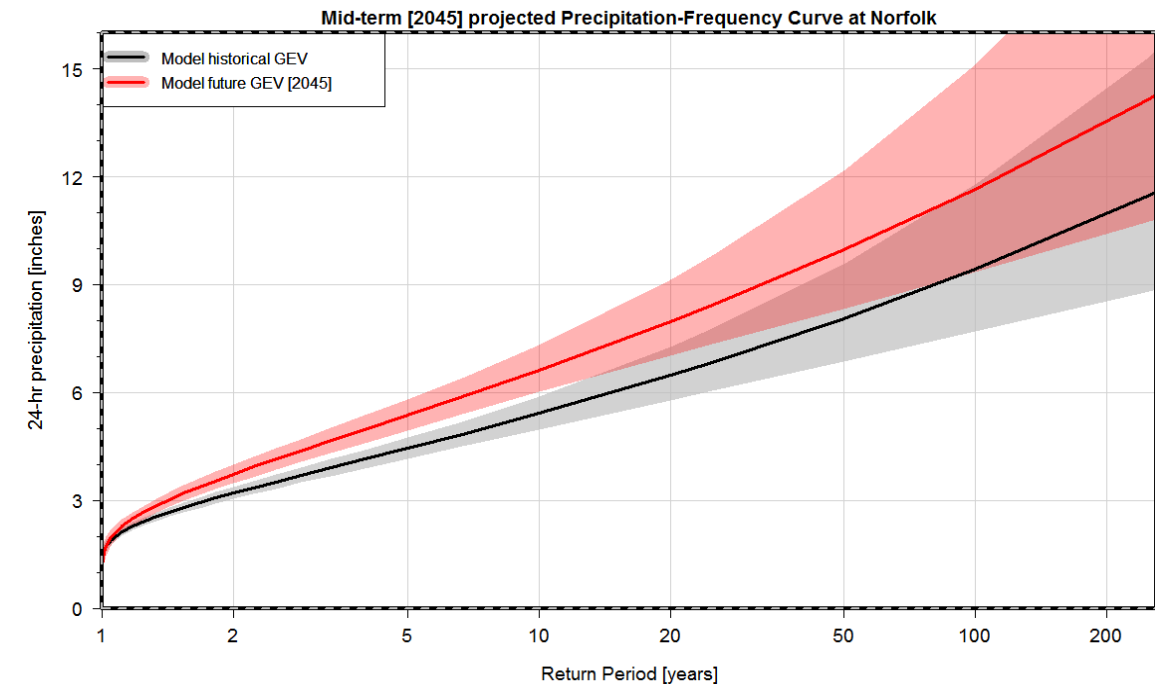
Rainfall

- Revision to NOAA Atlas 14 Table
- Designs must include new Rainfall depths (inches) (20% increase)
- Based on Study Commissioned by the City



Design Frequency	NOAA Atlas 14 Rainfall	Design Rainfall (NOAA Atlas 14 + 20%)
1-YR	3.00	3.60
2-YR	3.65	4.38
10-YR	5.64	6.77
25-YR	6.99	8.39
50-YR	8.16	9.79
100-YR	9.45	11.34

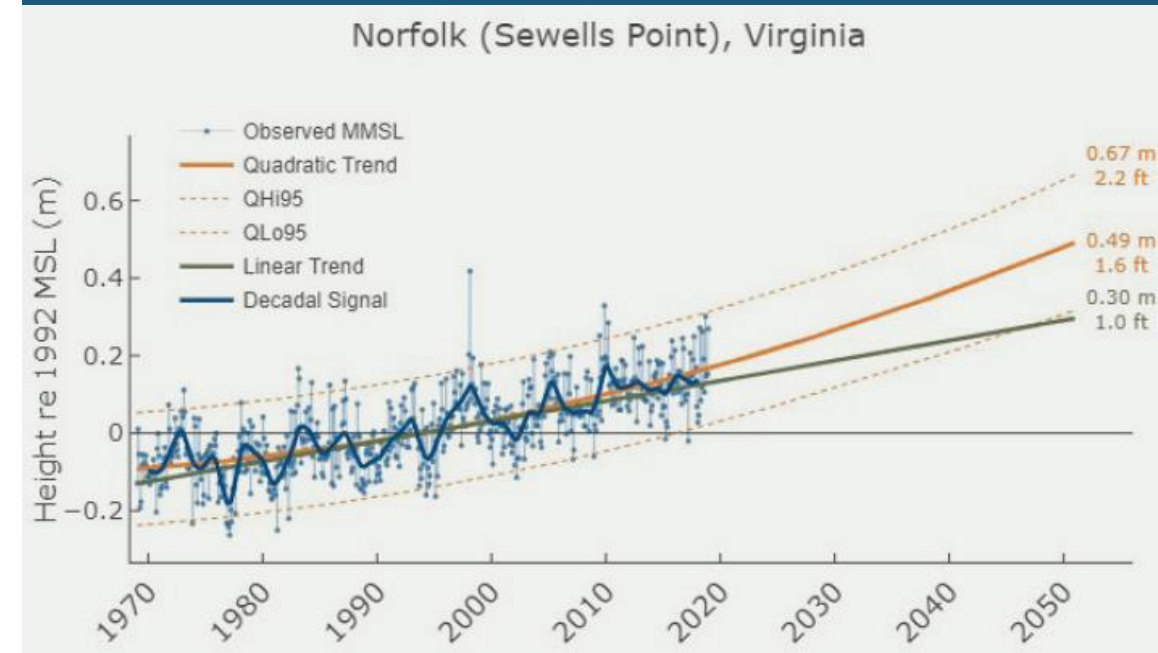
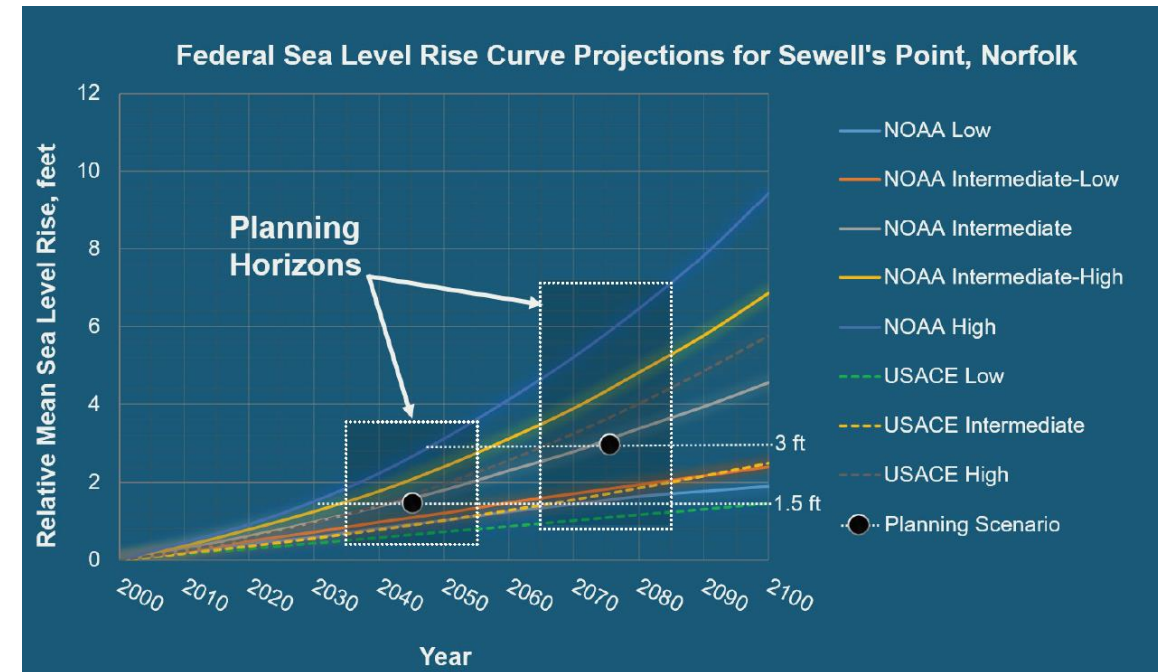
Note: NOAA Atlas 14 precipitation depths do not vary significantly across the City (generally < 0.1" difference). The NOAA 14 rainfall values shown represent the area northeast of Naval Air Station Oceana



Stormwater Management

Sea Level Rise

- Designs required to account for Sea Level Rise
- Design tidal elevations increased by:
 - Non-Critical Infrastructure: 1.5 ft.
 - Critical Infrastructure: 3 ft.
- Critical Infrastructure is defined by the Office of Emergency Management
Examples Include:
 - Evacuation Routes/Principle Highways
 - Hospitals
 - Fire Stations/Police Stations
 - Evacuation Centers

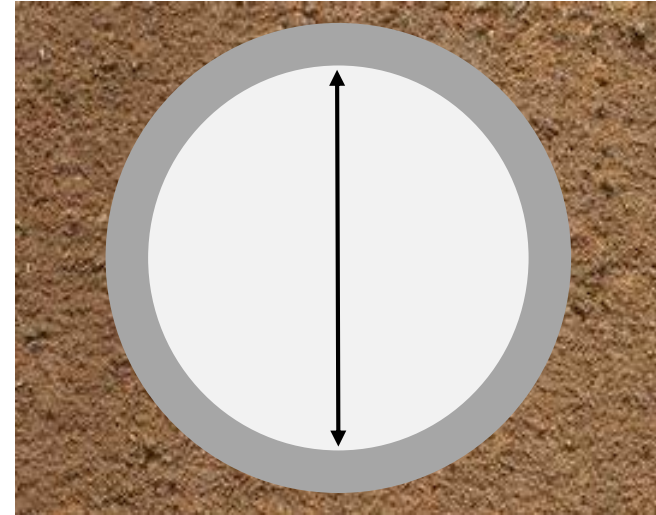


Stormwater Management

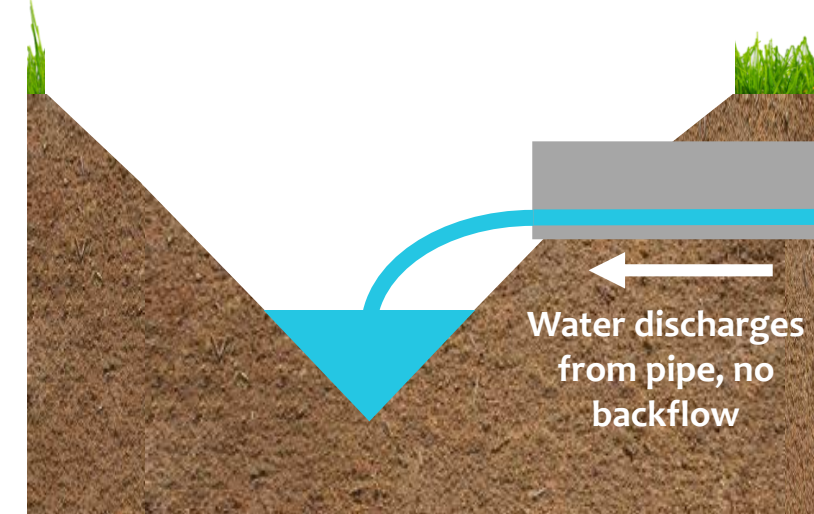
Tailwater

Pipe Cross Section No Tailwater

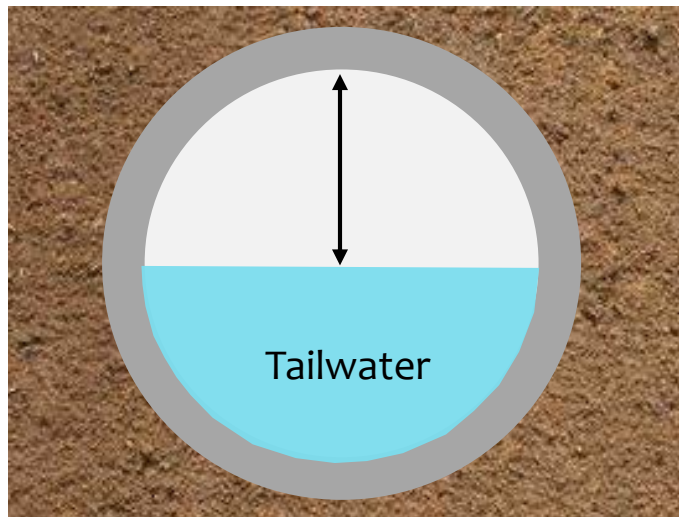
Pipe at Full Capacity



Stormwater System No Tailwater

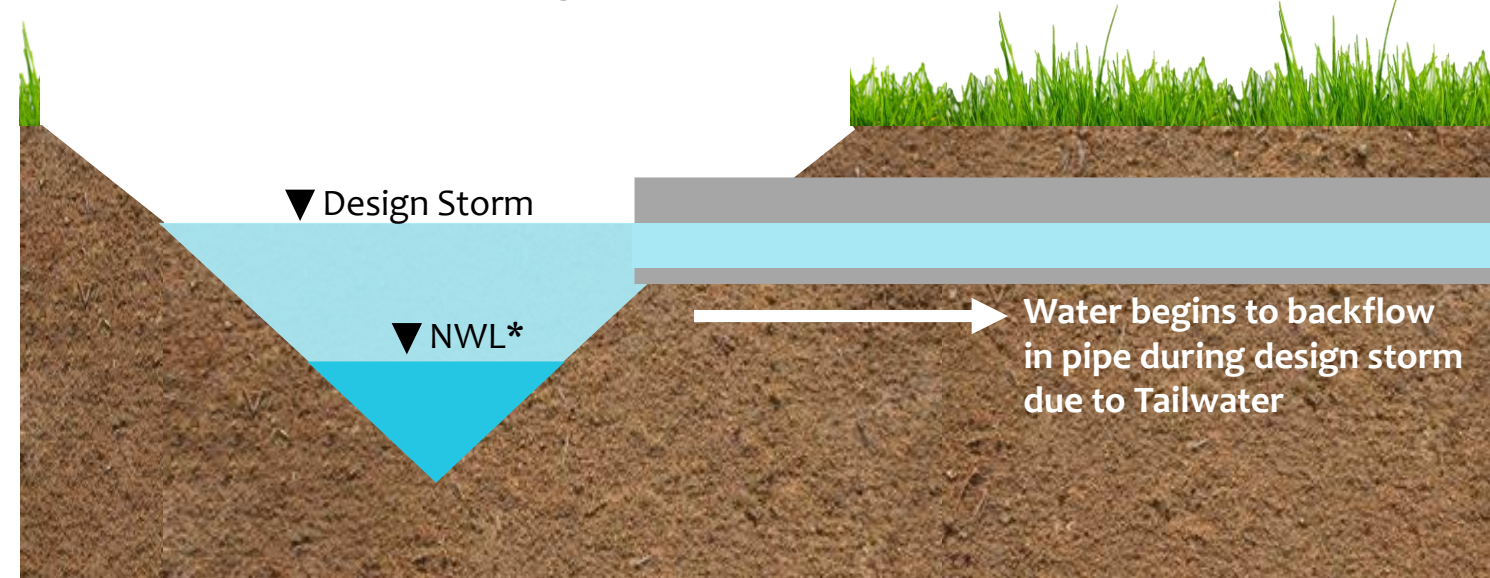


Pipe Cross Section with Tailwater
Results in Reduced Capacity



Stormwater System during Tailwater Condition

*NWL = Normal Water Level



Stormwater Management

Tailwater

To address the combination of rain and tidal surge, projects draining to tidally influenced waters must use higher elevation of:

- Highest Design Tidal Elevation from Joint Probability Pairs using Tables J-12, VIII-2, and VIII-3; **OR**
- 0.8 times the pipe diameter plus invert elevation of the system discharge pipe

Projects draining to non-tidal water bodies must use higher elevation of:

- Design year peak water surface elevation using Table VIII-2 to determine design year; **OR**
- 0.8 times the pipe diameter plus invert elevation of the system discharge pipe

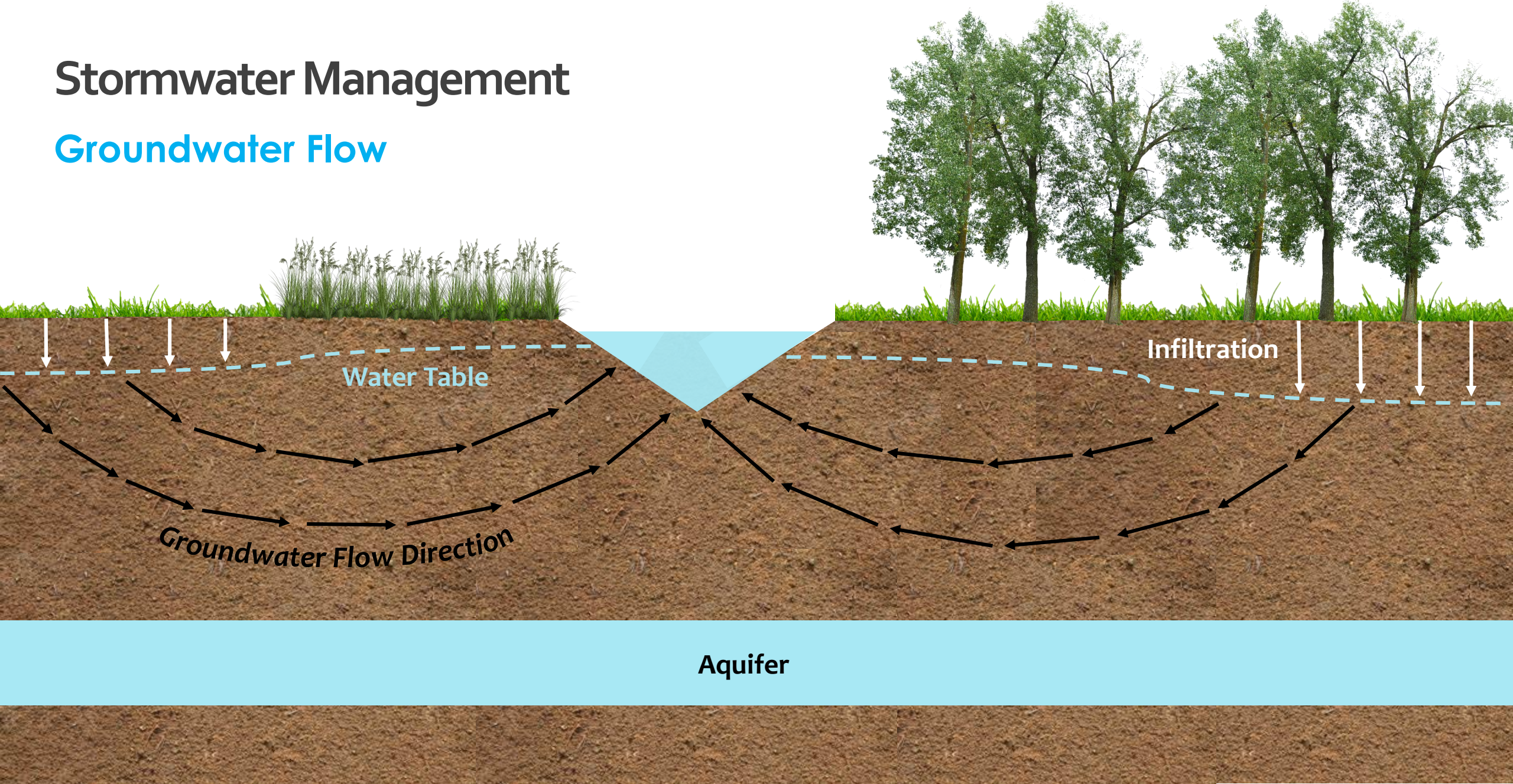
Table VIII-2 Design Storm Frequency for Determining Controlling Tailwater Elevation	
Contributing Drainage Area or Description	Design Storm Frequency
<300 Acres	10-year
≥ 300 Acres and < 500 Acres	25-year
≥ 500 Acres	50-year
Critical Infrastructure Projects*	100-year

Table VIII-3 Design Storm/Tide Joint Probability Pairs for Determining Controlling Tailwater Elevation							
10-YR Design		25-YR Design		50-YR Design		100-YR Design	
Tide	Rain	Tide	Rain	Tide	Rain	Tide	Rain
10-YR	1-YR	25-YR	1-YR	50-YR	1-YR	100-YR	1-YR
1-YR	10-YR	2-YR	2-YR	2-YR	50-YR	3-YR	100-YR

TABLE J-12 Design Tidal Elevations for Virginia Beach All Elevations in feet relative to the North American Vertical Datum (NAVD) of 1988										
Location	Design Level	1-YR	2-YR	3-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR
Lynnhaven Bay & River, Eastern Branch	Existing Condition	3.1	3.6	4.0	4.4	5.2	5.8	6.2	6.7	8.5
	1.5 ft SLR	4.6	5.1	5.5	5.9	6.7	7.3	7.7	8.2	10.0
	3.0 ft SLR	6.3	6.9	7.3	7.7	8.5	9.2	9.6	10.1	12.0

Stormwater Management

Groundwater Flow



Stormwater Management

Groundwater

- Designs must account for Groundwater Baseflow
- Requirement to add Groundwater Baseflow to peak flow rates
- Based on Study commissioned by the City

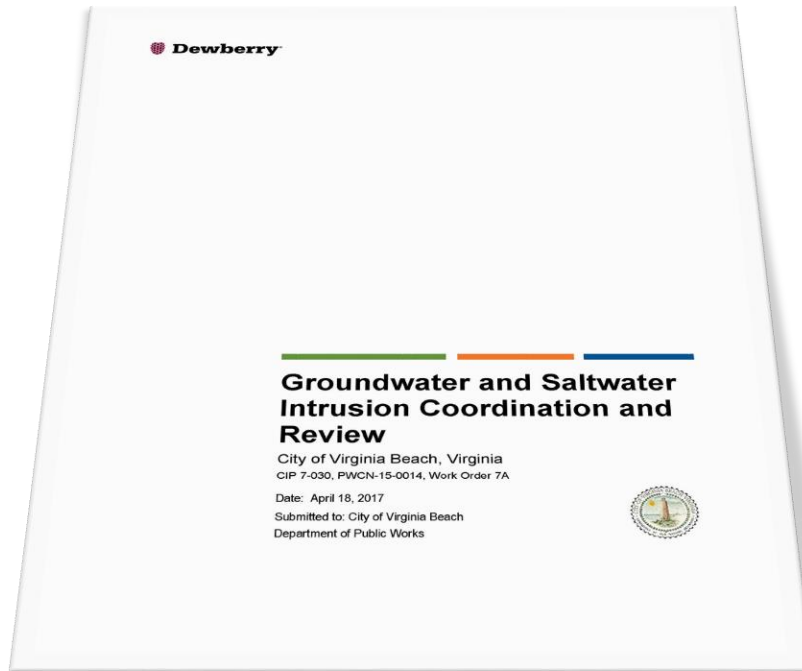


Table VIII-4 Groundwater Baseflows According To Drainage Area	
Drainage Area within Development or Project to Each Outfall (Acres)*	Seasonal High Baseflow (c.f.s.)
<50	0.2
≥ 50 and < 100	0.5
≥ 100 and < 250	1.2
≥ 250 and < 500	2.3
≥ 500 and < 1000	4.7
≥ 1000	Consult with Public Works Stormwater Engineering Center
* Exclude drainage areas upstream of the project.	

Average varies between 6" and 5' below the surface depending on location, amount of precipitation, and time of year



Independent Analysis

- Third Party Independent Analysis
- Scope:
 - Review Draft Design Standards
 - Evaluation of effort to comply with New Stormwater Design Standards Manual
 - Review Stormwater Model Development Methodology
 - Feasibility of Automated Design Integration Capabilities
 - **Comparison of Stormwater Designs of previously approved Site Plans (4), current vs proposed standards**



Independent Analysis

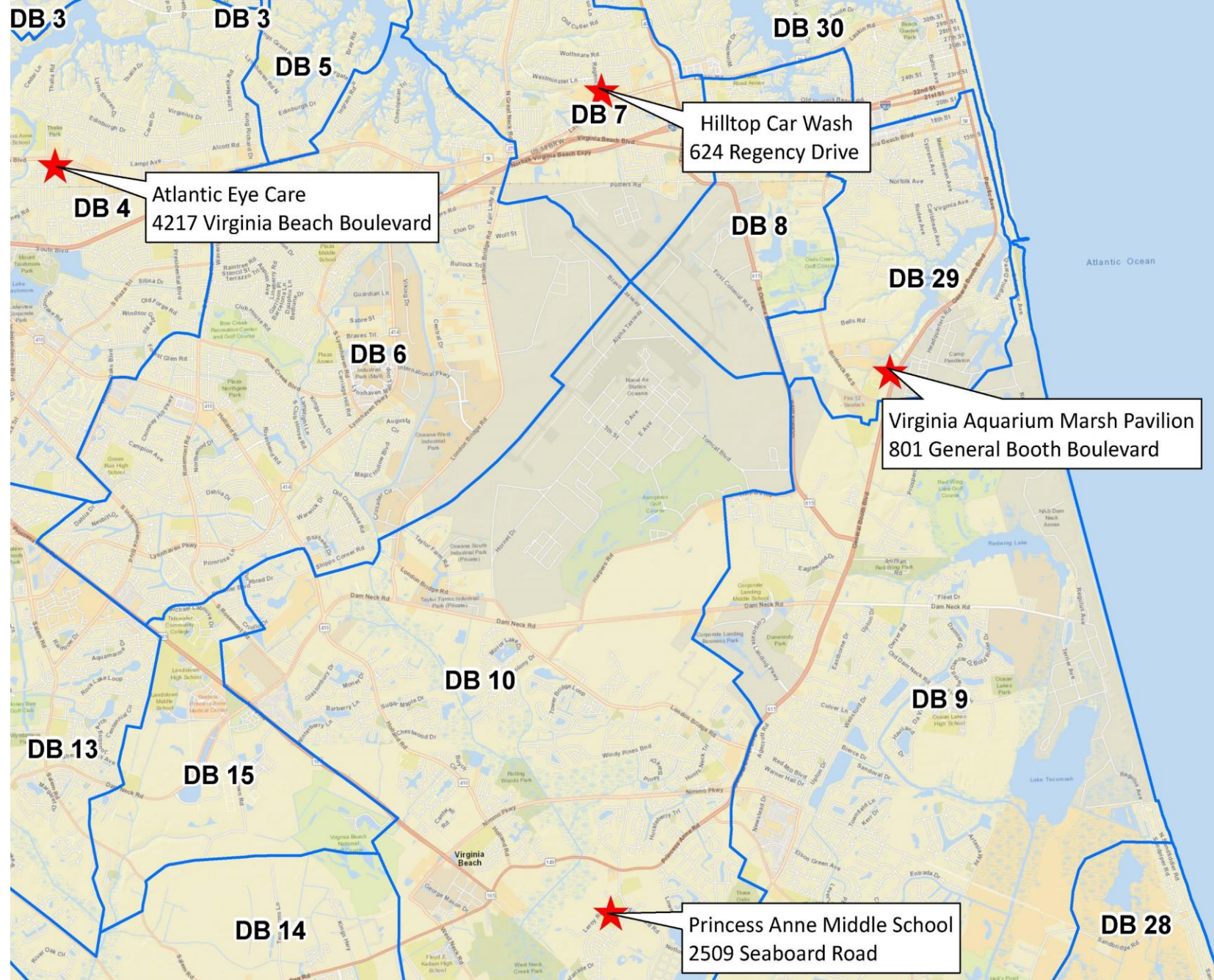
Site Locations

Site 1 - Hilltop Car Wash
624 Regency Drive

Site 2 - Atlantic Eye Care
4217 Virginia Beach Boulevard

Site 3 - VA Aquarium March Pavilion
801 General Booth Boulevard

Site 4 - Princess Anne Middle School
2509 Seaboard Road

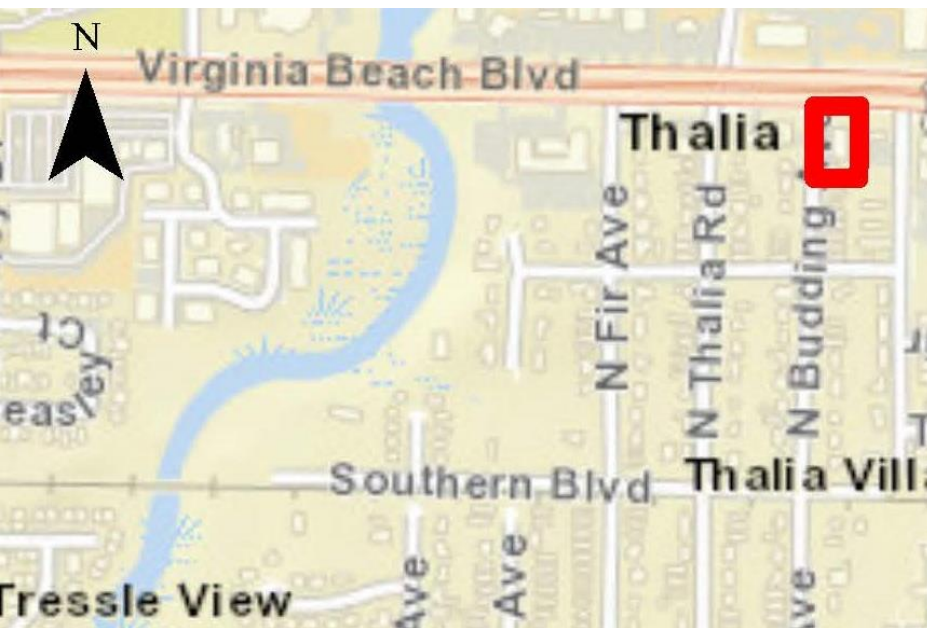


Independent Analysis

Site 2: Atlantic Eye Care

4217 Va. Beach Blvd

- Lot Size: ± 0.6 acres
- Disturbed Area: ± 0.3 acres
- Existing Use: Commercial/Residential
- Proposed Use: Commercial



Legend

- Parcels
- Current SWMF/BMPs
- Draft SWMF/BMPs (with & without 1.5' SLR)
- Asphalt Pavement
- Concrete



Independent Analysis

Site 2: Atlantic Eye Care

4217 Va. Beach Blvd

Summary of Results:

- No increase in minimum required storage
- No increase in minimum required BMP footprint
- No increase in stormwater infrastructure cost
- Design not influenced by 1.5' SLR
- Pipe size increases not required
- No loss in parking stalls
- Site grading/finished floor elevation adjustments not required

Atlantic Eye Care Stormwater Management Design Summary

Item	Current Standards	Draft Standards with 1.5' SLR	% Increase
SWMF/BMP Storage Volume (CF)	1,750	1,750	0%
SWMF/BMP Footprint (SF)	1,430	1,430	0%
Stormwater Infrastructure Cost	-	-	0%

Independent Analysis

Site 4: Princess Anne Middle School

2509 Seaboard Road

- Lot Size: ± 24.3 acres
- Disturbed Area: ± 25.6 acres*
- Existing Use: Commercial
- Proposed Use: Commercial



Legend

- Parcels
- Current SWMF/BMPs
- Draft SWMF/BMPs (with & without 1.5' SLR)
- Building
- Asphalt Pavement
- Concrete

*Area Includes minor off-site work

Independent Analysis

Site 4: Princess Anne Middle School

2509 Seaboard Road

Summary of Results:

- 26% increase in minimum required storage
- 25% increase in minimum required BMP footprint
- 12% increase in stormwater infrastructure cost
- Design not influenced by 1.5' SLR
- Pipe size increases not required
- Site grading/finished floor elevation adjustments not required

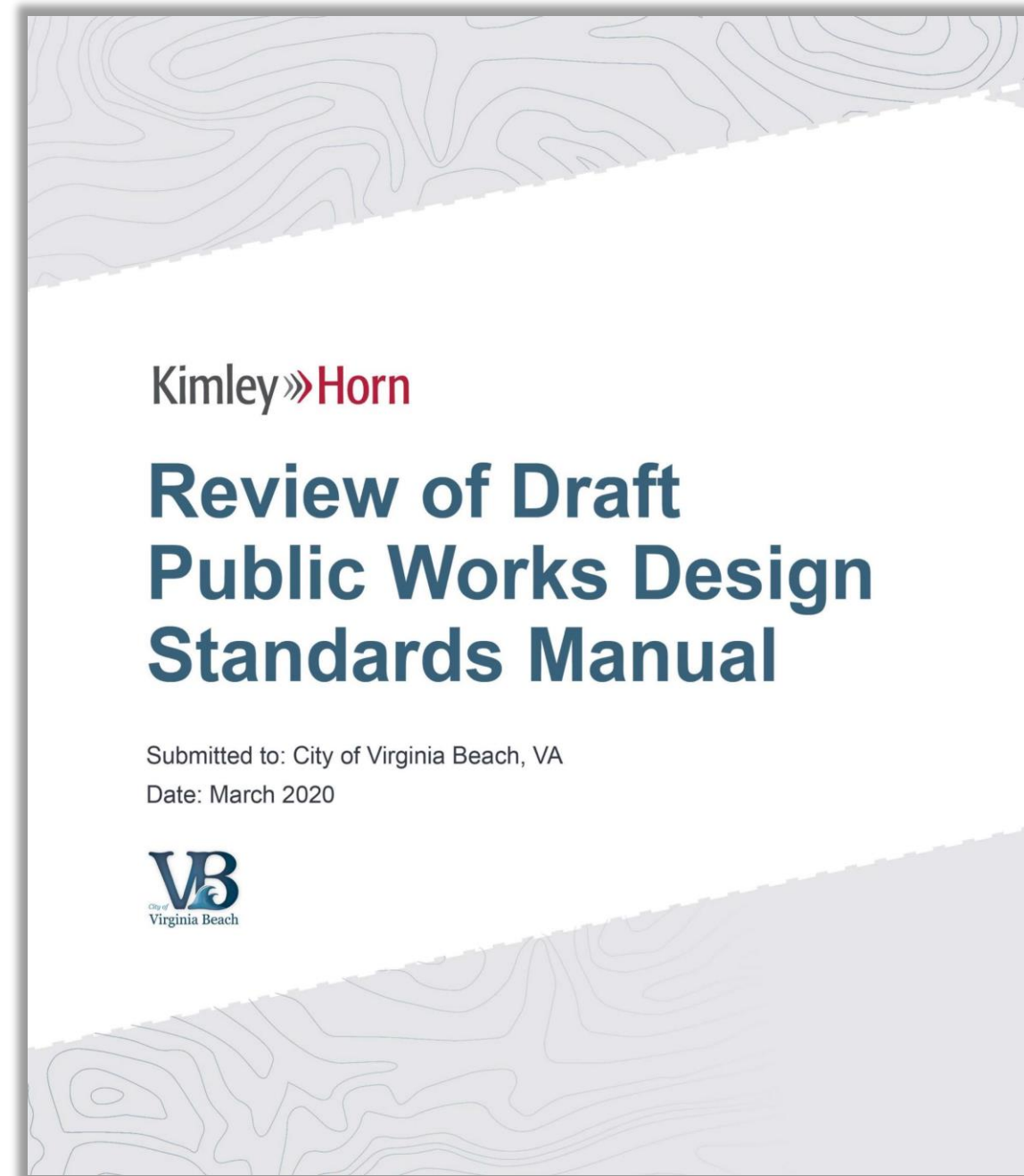
*Princess Anne Middle School
Stormwater Management Design Summary*

Item	Current Standards	Draft Standards with 1.5' SLR	% Increase
SWMF/BMP Storage Volume (AC-FT)	2.7	3.4	26%
SWMF/BMP Footprint (AC)	1.6	2.0	25%
Stormwater Infrastructure Cost	\$1,650,000	\$1,870,000	12%

Independent Analysis

Conclusions

- Impacts to site development resulting from new design standards are very much site dependent
- Impacts of Sea Level Rise on site design affected 1 of the 4 sites analyzed
- Stormwater Management design costs will increase
- Incorporating the new Stormwater design standards will prevent increases in upstream and downstream flooding, for 100-yr event

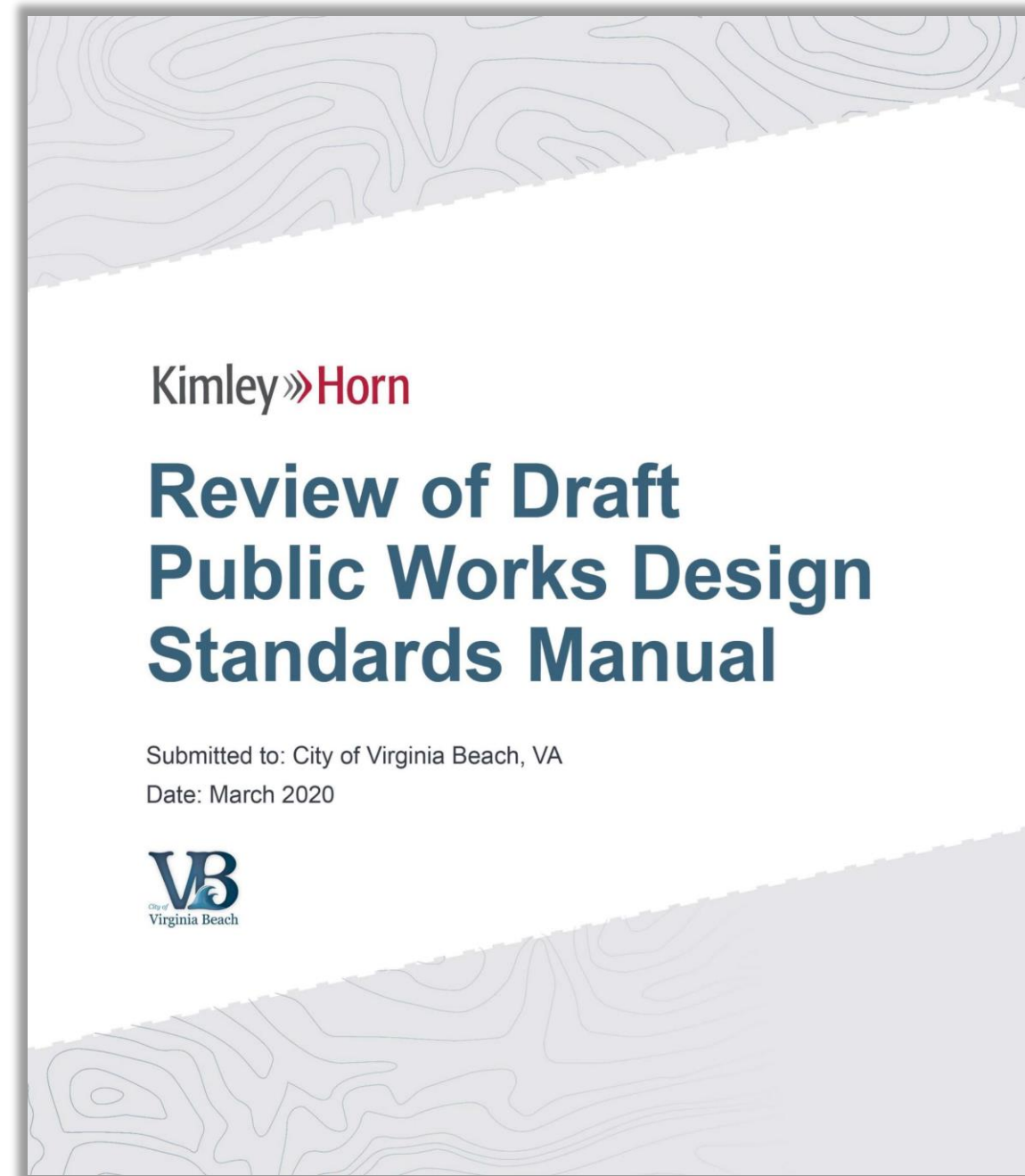


Independent Analysis

Recommendations:

The following changes were made to the PWDSM, based on recommendations:

1. EPA SWMM not required for sites:
 - With total disturbed area less than 20,000 sf; **OR**
 - That provide 10% or greater reduction in impervious area
2. Requirement to evaluate more intense storms with higher than 100-year frequency and 24-hr duration removed
 - Max design storm limited to 100-year storm
3. Requirement to assume fully saturated soils for site runoff removed



Stormwater Management Ordinance



Purpose

“The purpose of this Ordinance is to ensure the general health, safety, and welfare of the citizens of the City of Virginia Beach and protect the quality and quantity of state waters from the potential harm of unmanaged stormwater, including protection from a land disturbing activity causing unreasonable degradation of properties, water quality, stream channels, and other natural resources, and to establish procedures whereby stormwater requirements related to water quality and quantity shall be administered and enforced.”

Stormwater Management Ordinance

Major Changes

- Sec. 1-3. – Definitions
 - Added/Revised
- Sec. 1-7. – Review of stormwater management plans
 - Must submit construction record drawing for pipes, swales and/or ditches in addition to stormwater management facilities
- Sec. 1-13. – Water quantity, Sec. 1-25. – Stream channel erosion & Sec. 1-26. – Flooding
 - Requirements added to protect both upstream, downstream and adjacent properties from impacts due to flooding
- Sec. 1-15. - Design storms and hydrologic methods
 - Must increase the NOAA Atlas 14 design storm rainfall depths by 20%
 - Must use dynamic modeling (SWMM) to analyze the pre and post development conditions except for areas less than 20,000 sq. feet





Transition

Transition to New PWDSM

- PWS&S can be used if project accepted for review, but not approved prior to or within 30 days of PWDSM adoption date (July 16, 2020)
- Development plans must obtain approval from the City within 180 days of PWDSM adoption date (December 14, 2020)
- DSC will continue to serve as primary point of contact for private development projects coordinating as necessary with Public Works

"Adopting higher standards will be more expensive, but keeping the same standards will increase risk. Either way, there is a cost."

- HRPDC Coastal Resiliency Working Presentation



City of Virginia Beach
Public Works

Discussion

