Analysis of Storm Sewer Resiliency in light of proposed Tottenville Shoreline Improvements

Tottenville, Staten Island, NY

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Stantec | NEW YORK STATE OF OPPORTUNITY | DASNY | Governor's Office of Storm Recovery | NYC Parks

Agenda

- Safety Moment
- Project Background
- Scope of Work
- Methodology
- Existing Conditions
- Proposed Conditions
- Results & Recommendations

Stop & Talk: Aggressive Driving

Health, Safety, Security, & Environment

Aggressive driving is defined as the operation of a motor vehicle in an unsafe and hostile manner. The picture below further demonstrates aggressive behavior. The following tips are suggested to reduce your chances of becoming involved in an aggressive driving or road rage incident:

- Observe common courtesy and consciously try to avoid actions which can provoke other drivers.
- Keep your emotions in check and think about the consequences of your behavior before you react.
- Be Aware of actions which can provoke aggression.
- Avoid behaviors which are likely to provoke aggression:
    - Eye contact
    - Aggressive tailgating
    - Aggressive horn use
    - Aggressive headlight use
- Follow the rules of the road.
- Remaining calm and courteous behind the wheel lowers your risk of an unpleasant encounter – with another driver and with law enforcement.
- Don't drive when you are upset, angry or overtired.
- Adjust your attitude.
- Give the other driver the benefit of the doubt.
- Avoid all conflict if possible.

- Self-control is crucial in managing stress and aggression.

- Reduce Your Stress
    - Learn to spot the warning signs of stress, and try to avoid situations which are likely to cause stress.
- If you are making a long trip:
    - Plan your route and have a map in your vehicle.
    - Take breaks to stretch and walk around.
    - Eat light snacks as opposed to heavy meals.
- Road congestion is a major contributing factor to traffic disputes:
    - Consider altering your schedule.
    - Allow plenty of time to get where you are going.
    - Improve the comfort of your vehicle.
    - Listen to music that reduces your anxiety.
    - Concentrate on being relaxed.
    - Take a deep breath.

This link provides more information on avoiding aggressive driving: https://exchange.aaa.com/wp-content/uploads/2013/06/Road-Rage-Brochure.pdf

If you have questions, please contact your supervisor, Office Safety and Environment Coordinator (OSEC), or local HSSE representative

Stantec

HSSE Stop & Talk are written for educational purposes and are not intended to replace safe work practices or procedures.
ver. June 2019

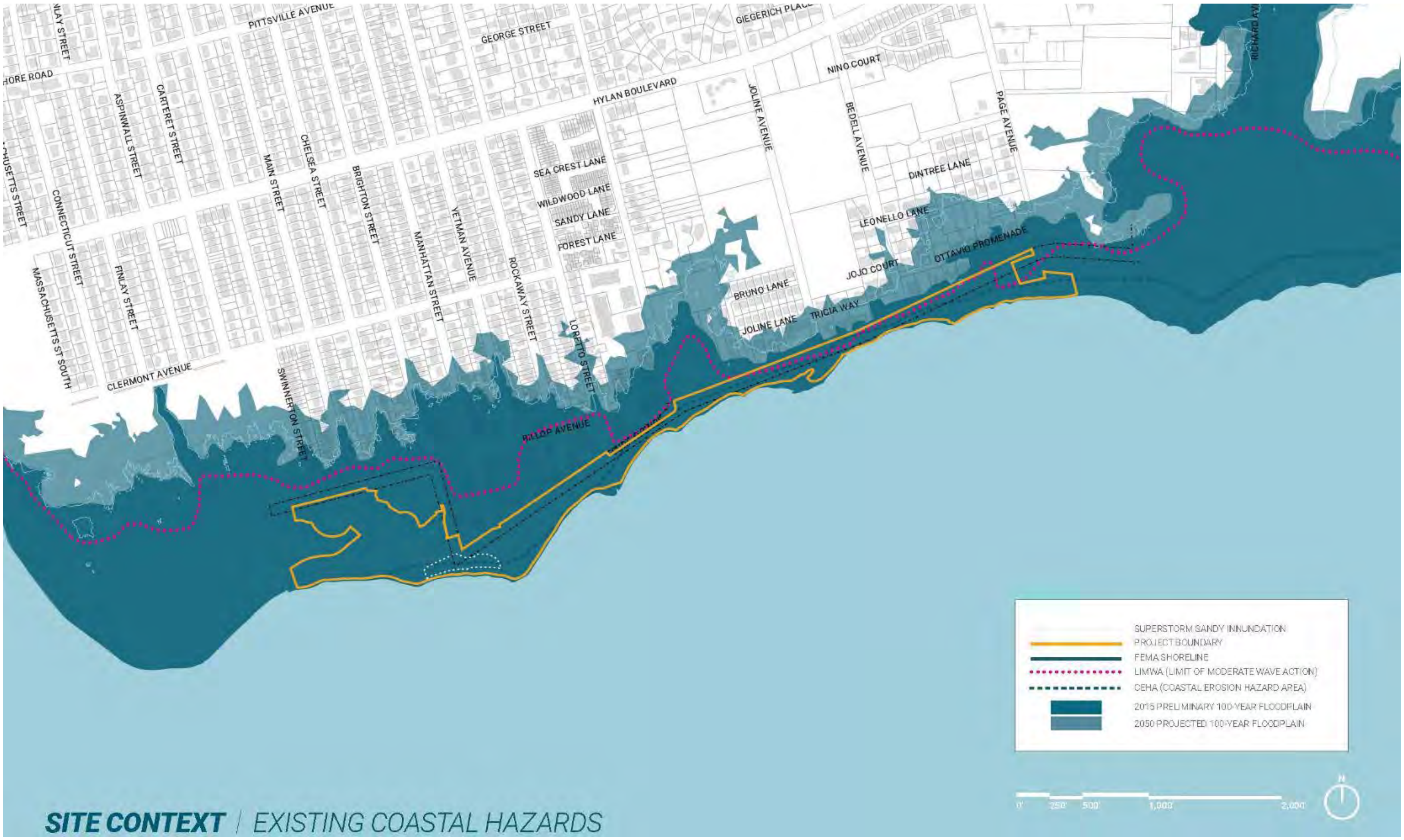
Tottenville Shoreline Protection Project

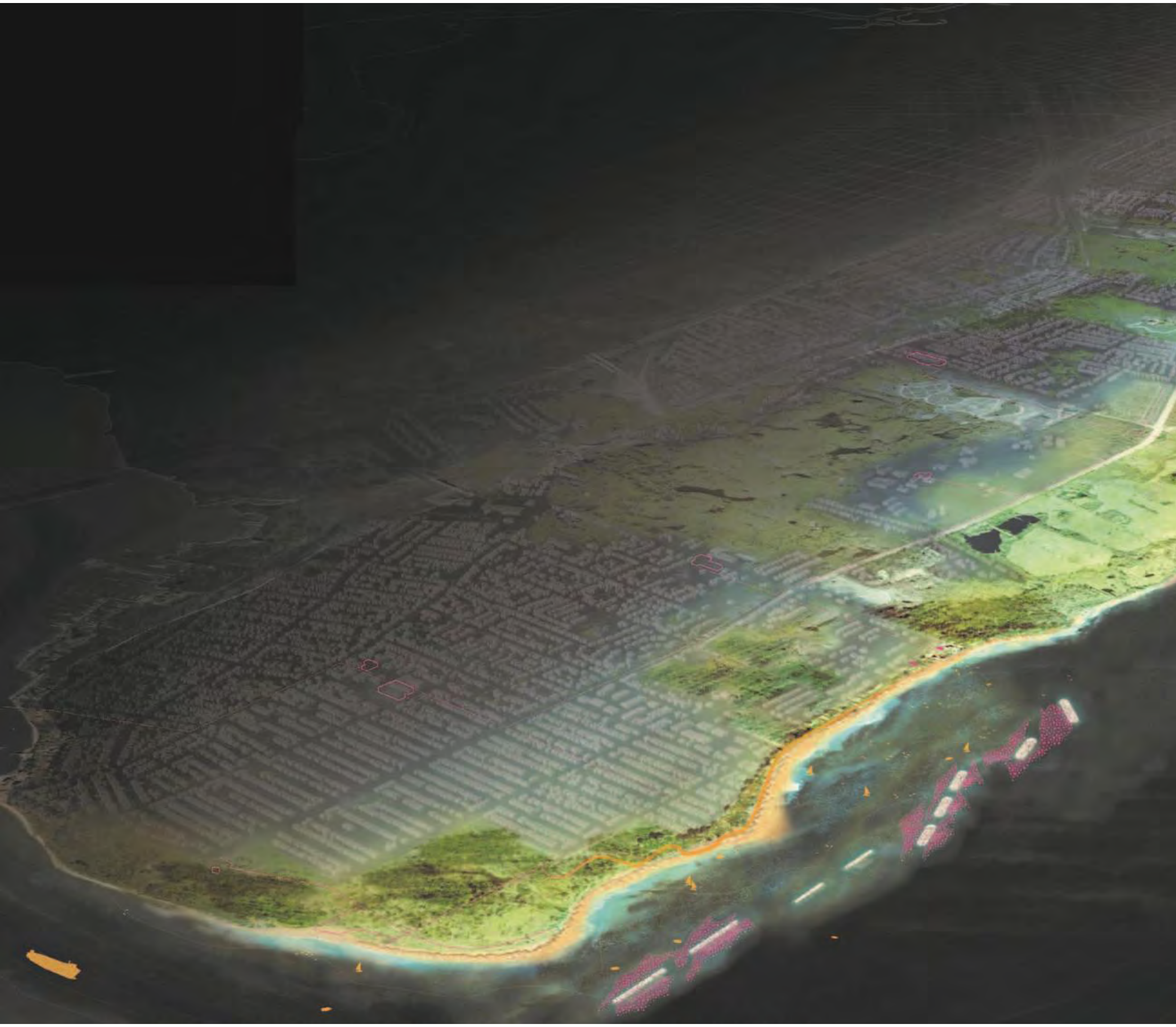
Project Background

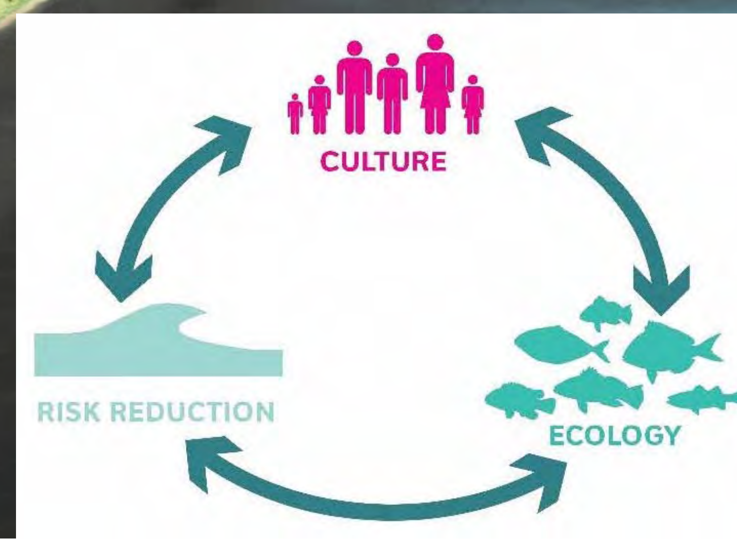
- Reduce Wave Action
- Reduce Coastal Erosion
- Enhance Ecosystems
- Enhance Shoreline Access

Project Background

Tottenville Shoreline Protection Project

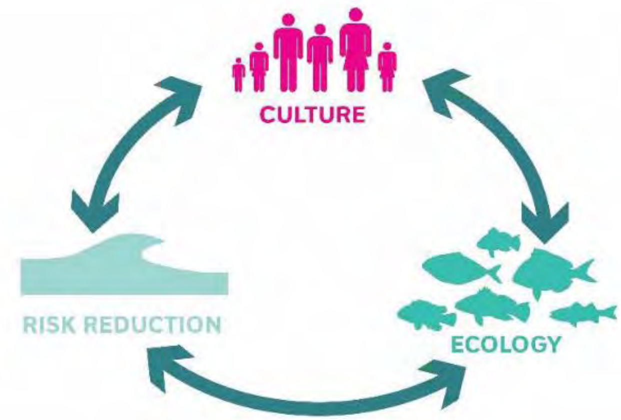


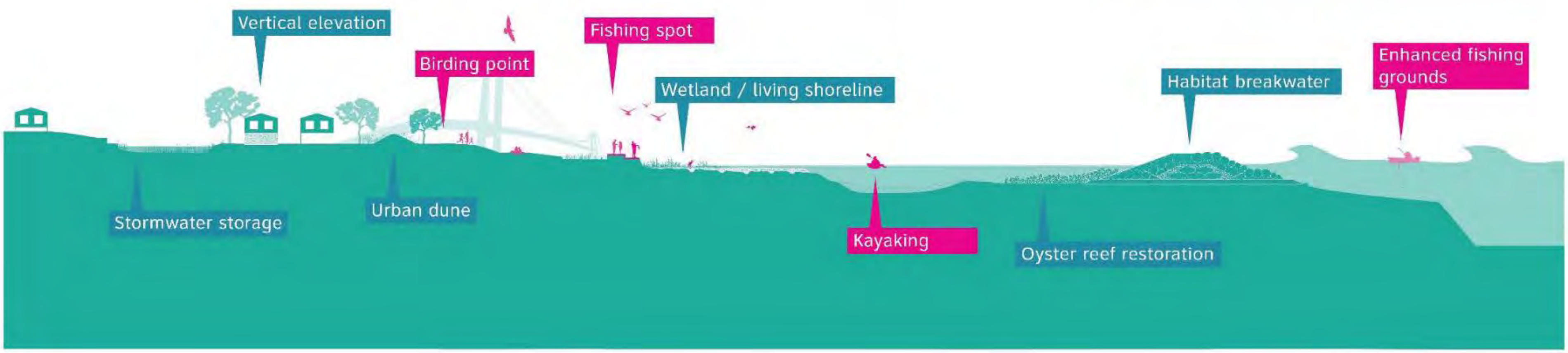




CULTURE
RISK REDUCTION
ECOLOGY

IT IS PART OF A LAYERED APPROACH!

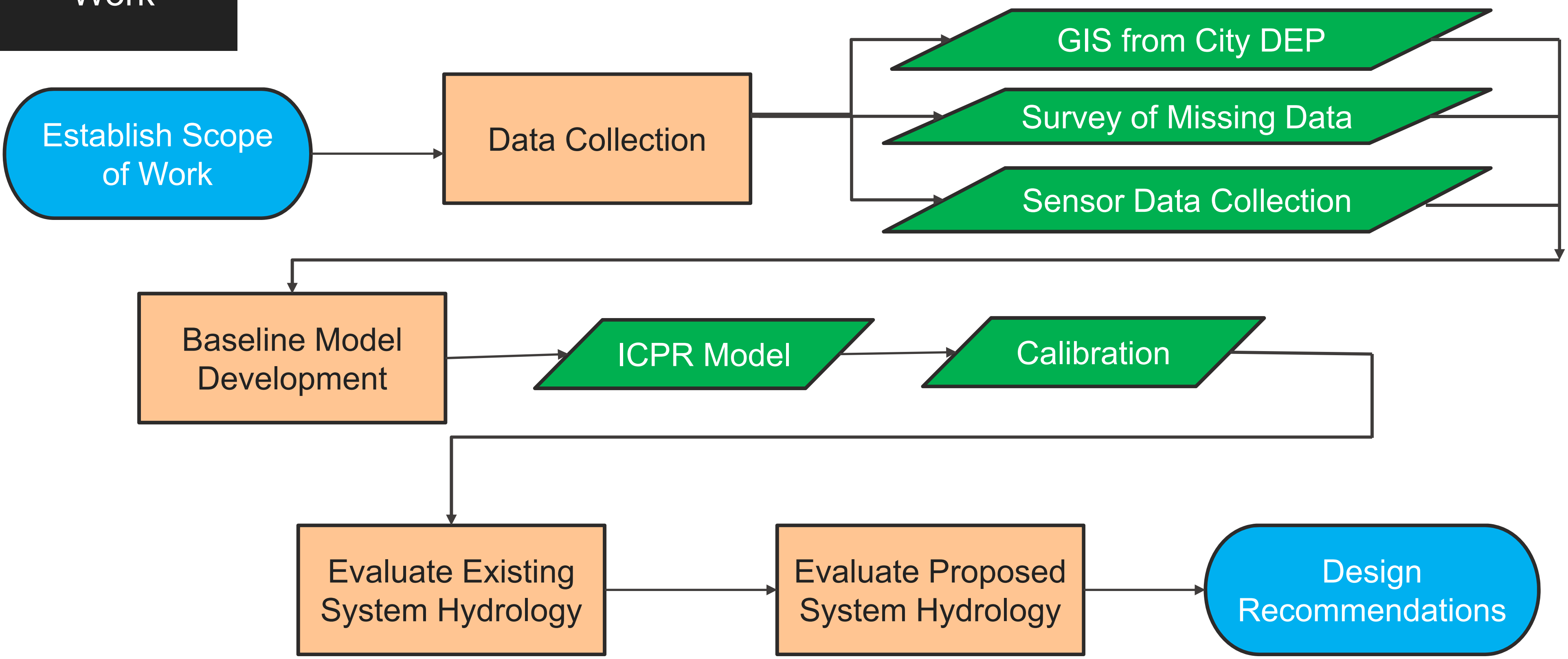




OVERALL CONCEPT | *THE LAYERED APPROACH*

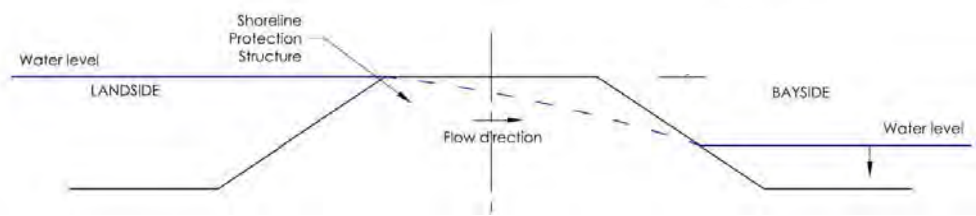
Scope of Work

Scope of Work



Scope of Work

Physical Processes



- Rainfall
- Storm Sewer System
- Pipe Obstructions
- Tailwater
- Coastal Forcing
- Seepage/Infiltration

Methodology

Methodology

ICPR4 – Interconnected Channel and Pond Routing Model Software

ESRI Arc Hydro Tools

Rainfall runoff – Curve Number method, NRCS TR-55

Storm System Hydraulics – nodal network

Coastal Forcing – Tailwater conditions for tide range from Sandy Hook Station and SLR (30”).

Seepage/Infiltration Processes

Methodology

Modeling Assumptions

- Design Storm: 5-year, 1-hour duration (1.7”)
- Existing Conditions surface terrain
- Hydrologic conditions for all cover types: “Good Condition”
- Storm System Hydraulics with ICPR4
- Groundwater seepage through the proposed TSPP structure
- Worst-case scenario (High Tide meets peak runoff discharge)
- Multiple Scenarios:
  - 30” Sea level rise for all scenarios
  - With and without Storm Surge
    - 10 year storm surge (no overtopping)
    - 100 year storm surge (overtopping)
  - With and without tide gates at existing DEP outfalls
  - With and without obstructed storm sewers

Data - Vertical Datums

Record Drawings and GIS Data of Storm system in Richmond (Staten Island) Datum.

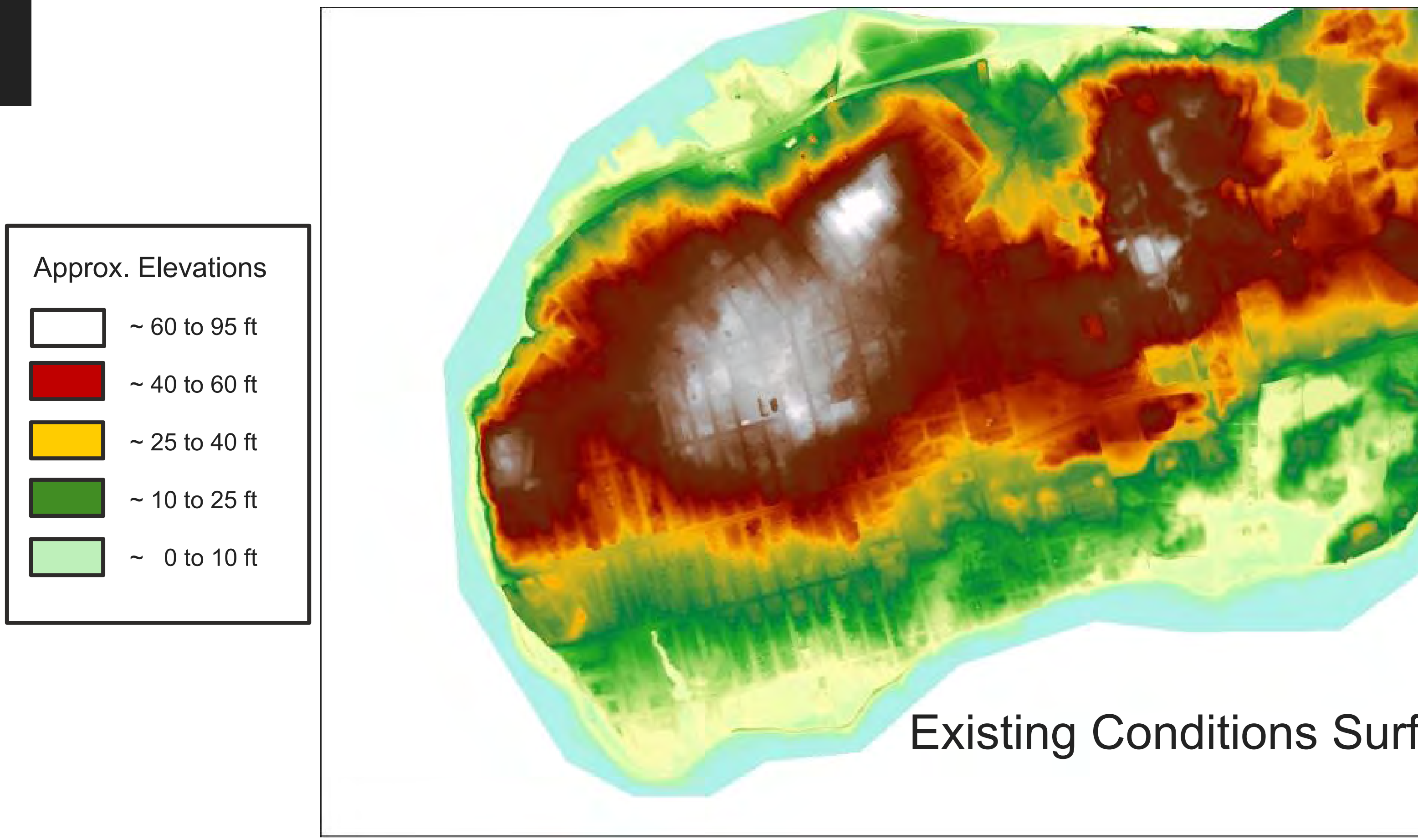
Surface DEM, survey and tidal data in NAVD88 datum.

Richmond to NAVD88 Conversion rate:

Richmond + *2.092 ft* = NAVD88

Methodology

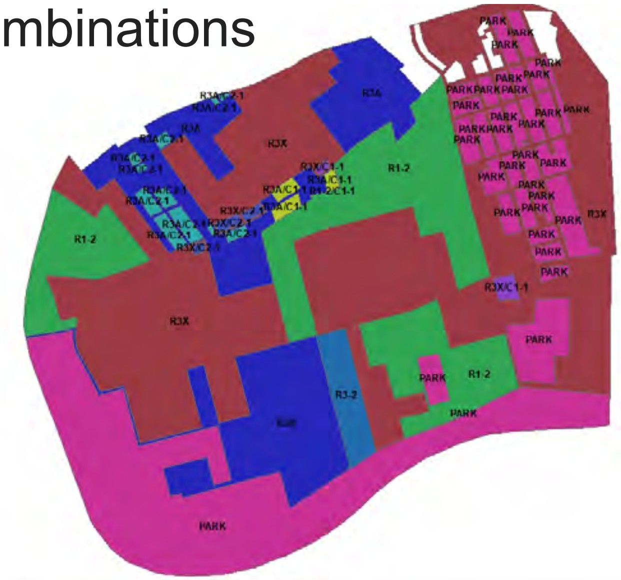
ICPR map layers

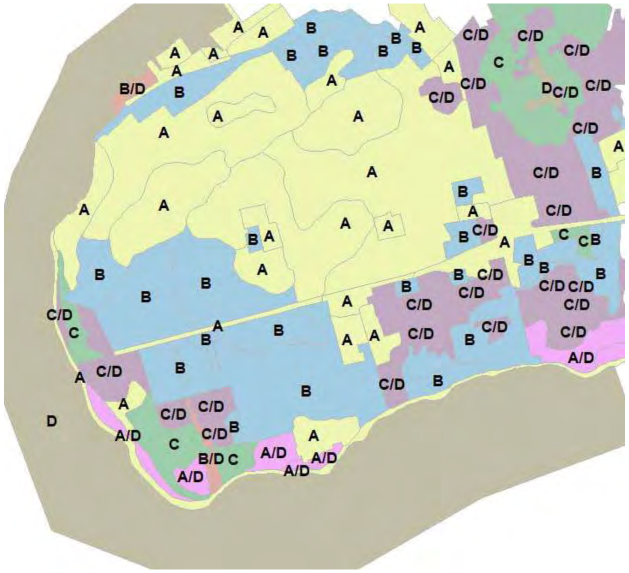


Existing Conditions Surface DEM

ICPR map layers

- Land use maps – impervious data set to correlate with map layer
- NRCS soil data – CN data set assigned by soil / land use combinations





Methodology

Basin Delineation - Initial

ArcHydro tools used to delineate basins initially

Approximately 100 basins

Methodology

Basin Delineation - Refined

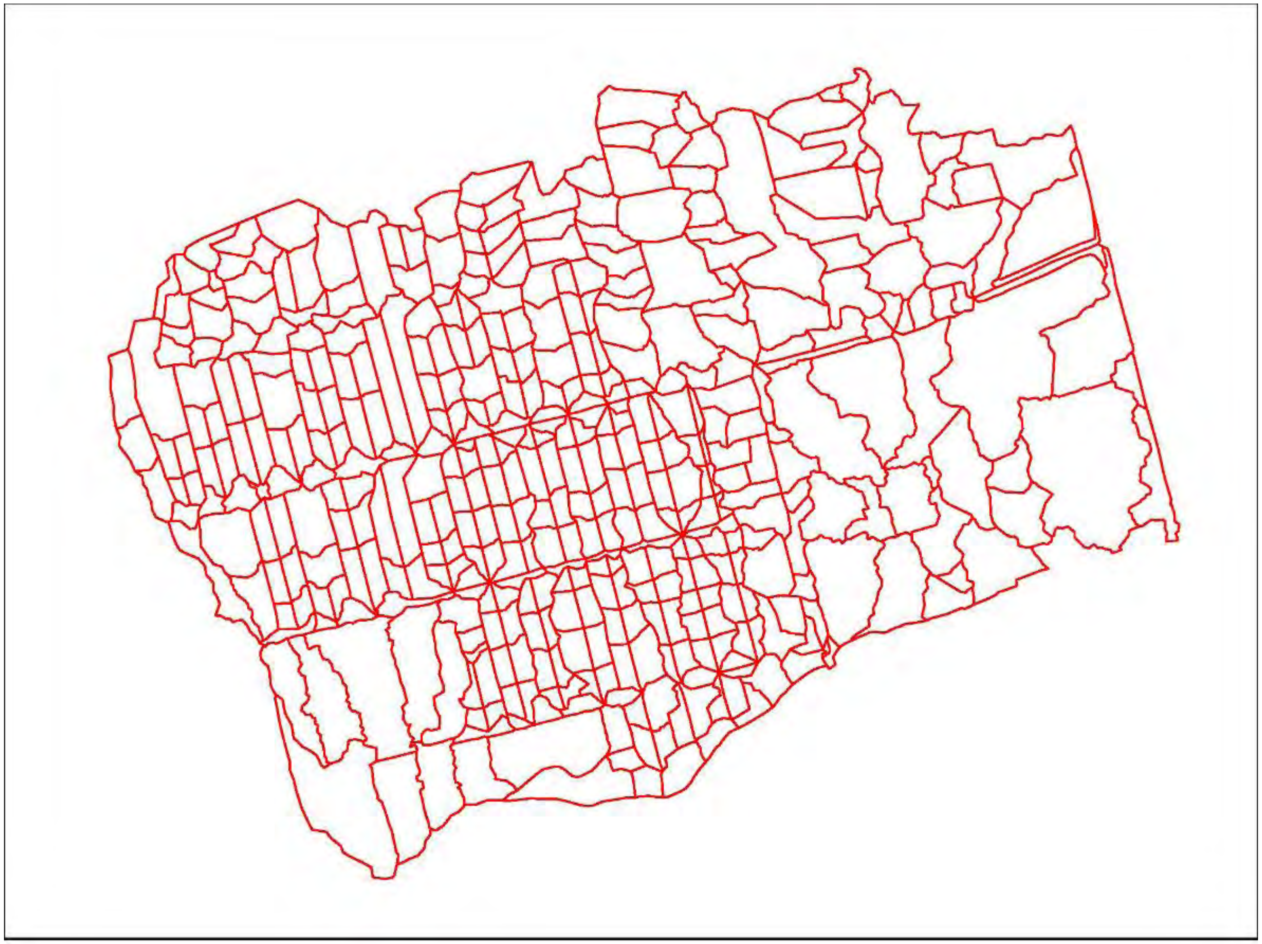
432 Basins

526 ac.

Average: 1.2 ac.

Largest: 16.4 ac.

Smallest 0.1 ac.



Methodology

Catch Basins

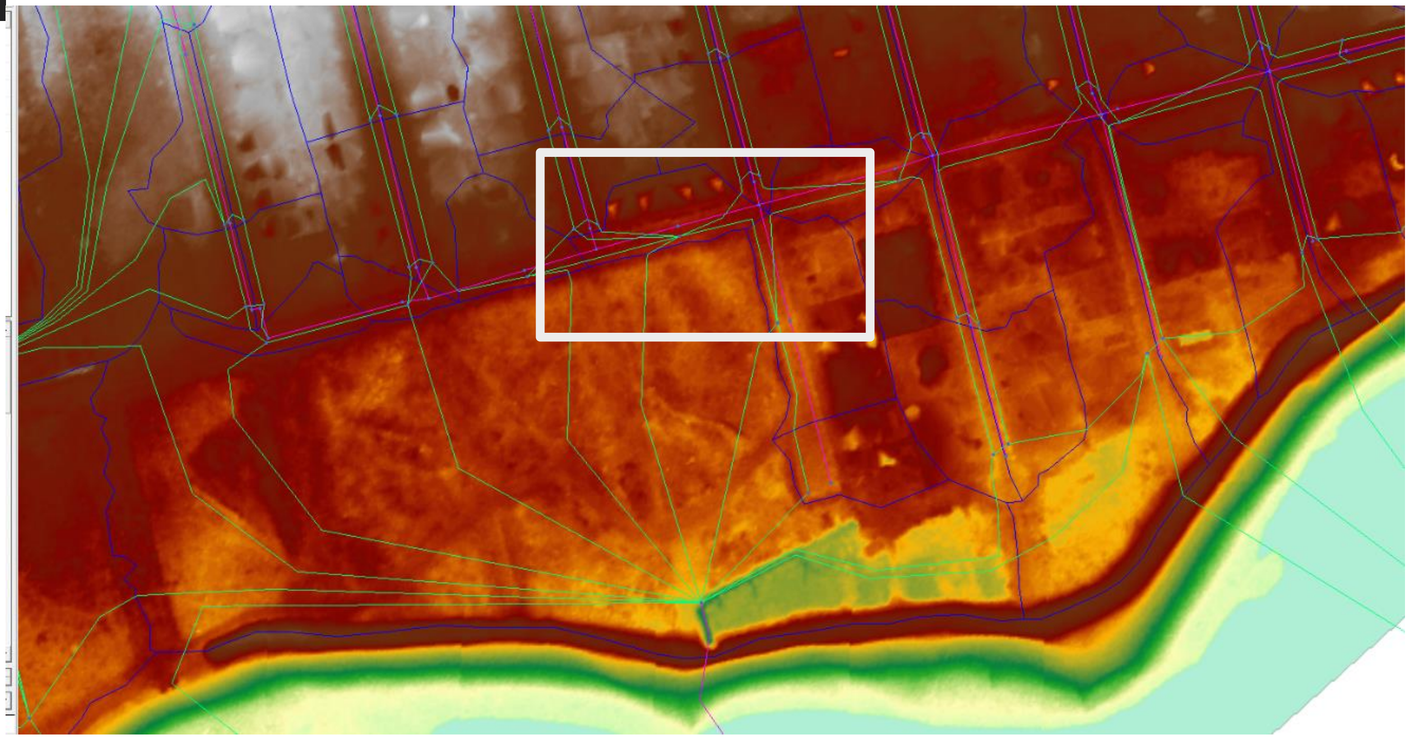
- Standard Grate for Drop Structures

Non-standard Grates include open throat inlets

Verified with Field Observations, Google Maps and/or Bing Maps Surface viewer

Existing Conditions Model

Surface Terrain with Nodal Network



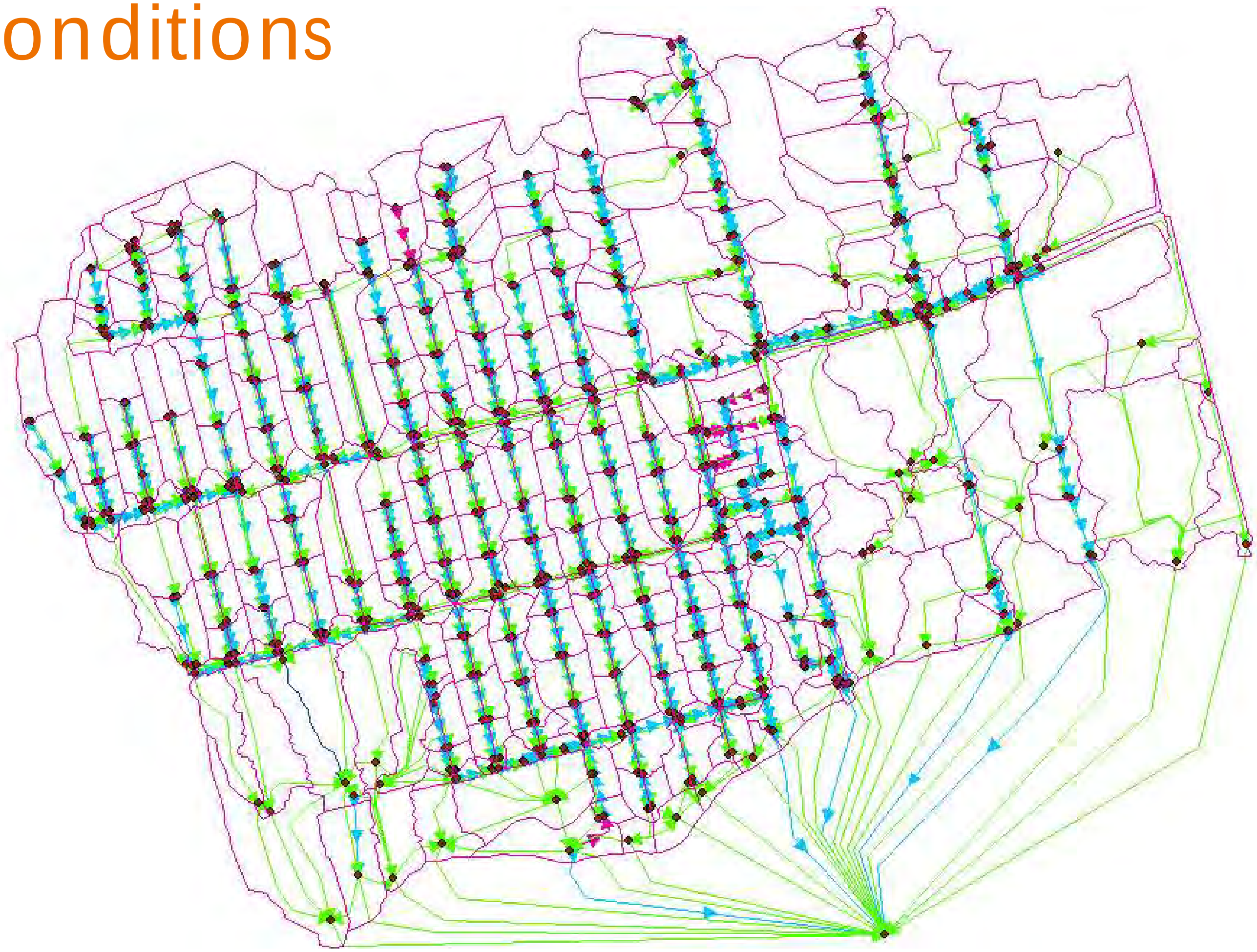
Existing Conditions Model

Aerial with Storm Sewer System

Existing Conditions Model

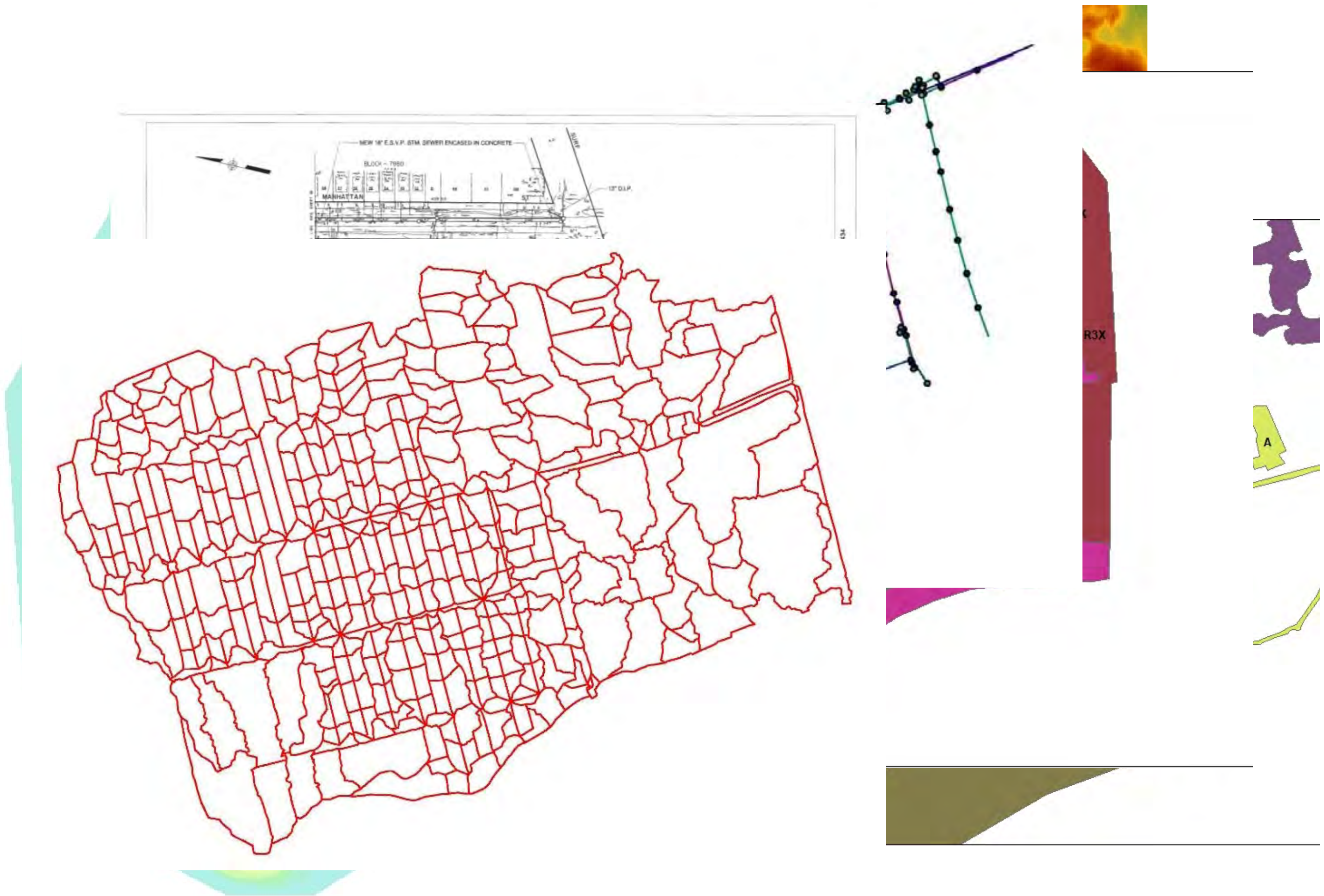
Existing Conditions

- 432 Basins
- 753 nodes
- 1431 links



Model
Methodology

Existing Conditions Model Input



- DEM
- NRCS Soils
- Land Use Maps
- NYC DEP sewer asset GDB
- As-Built Plans
- Basin Delineation
- Survey Data
- Tailwater scenarios

Model
Methodology

Existing Conditions - Calibration

- Calibration
  - Flow Meters
  - Rainfall Gauges
  - Tailwater
  - Adjustments to model parameters

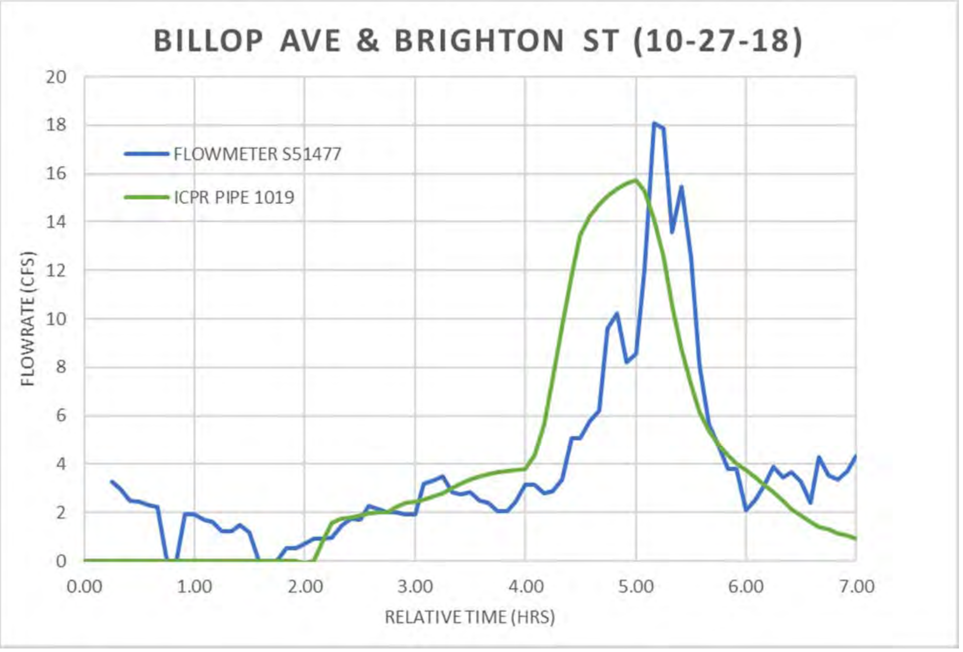
Model Methodology

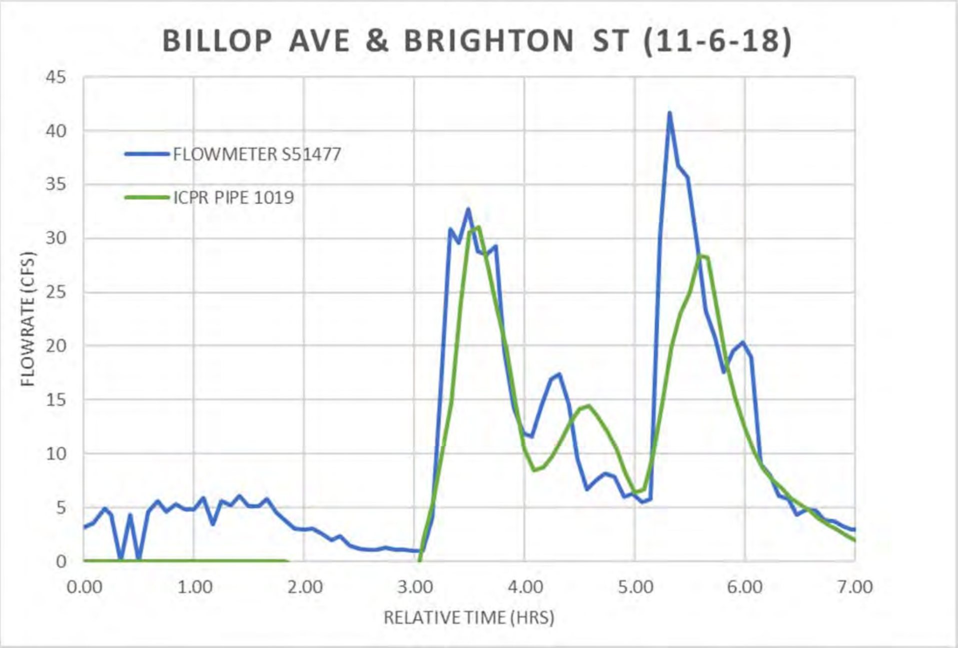
Existing Conditions - Calibration

- Calibration
  - Flow Meters
  - Rainfall Gauges
  - Tailwater
  - Adjustments to model parameters

Model Methodology

Existing Conditions – Calibration Results





Model Methodology

Proposed Conditions

Earthen Berm

Dune System

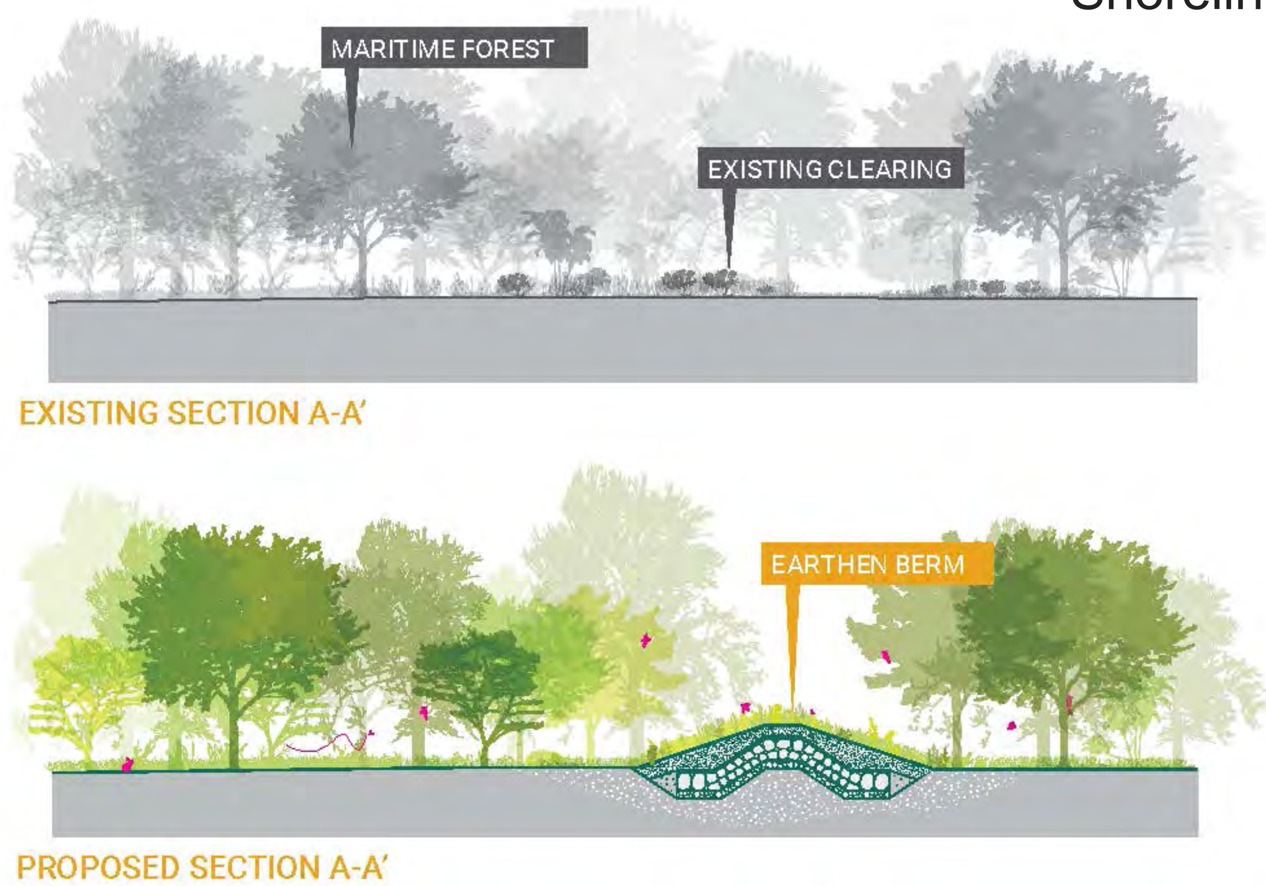
Eco-Revetment

Raised Pathway

Model Methodology

Proposed Conditions

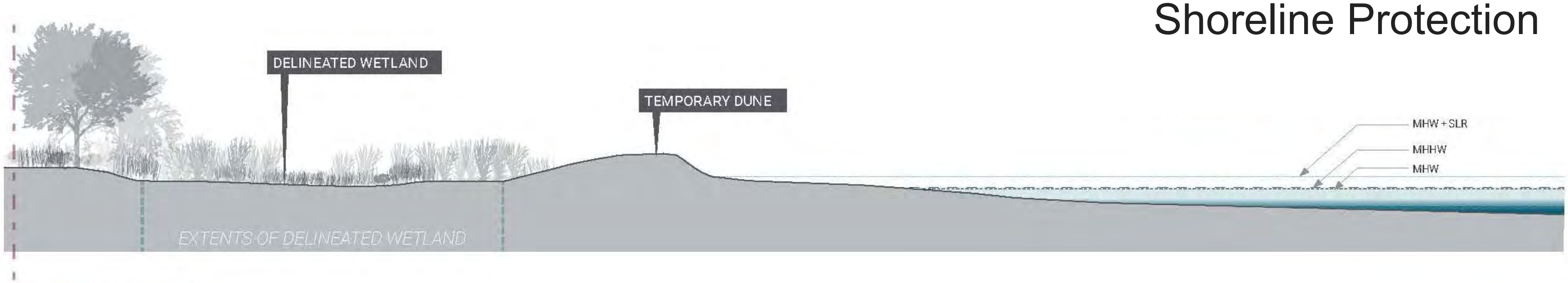
Shoreline Protection



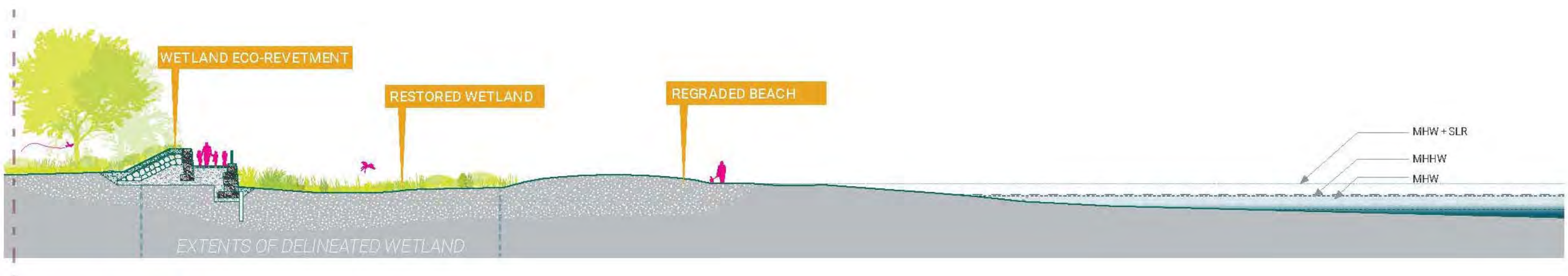
Model Methodology

Proposed Conditions

Shoreline Protection



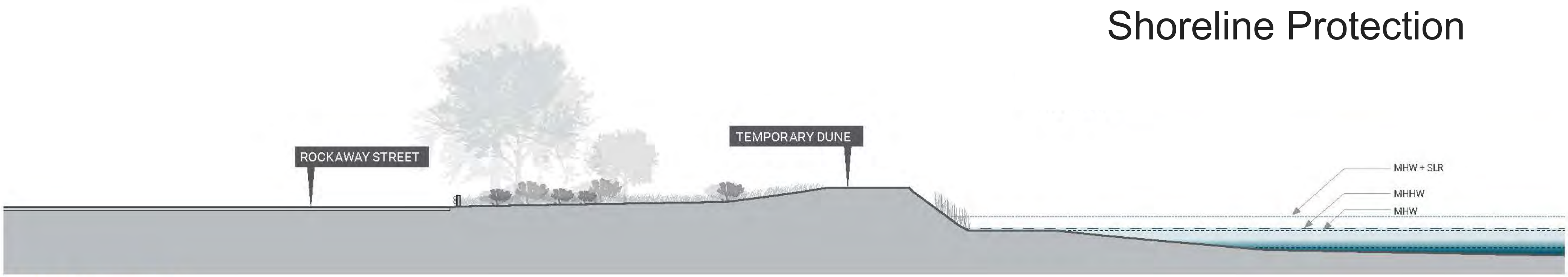
EXISTING SECTION A-A'



PROPOSED SECTION A-A'

Proposed Conditions

Shoreline Protection



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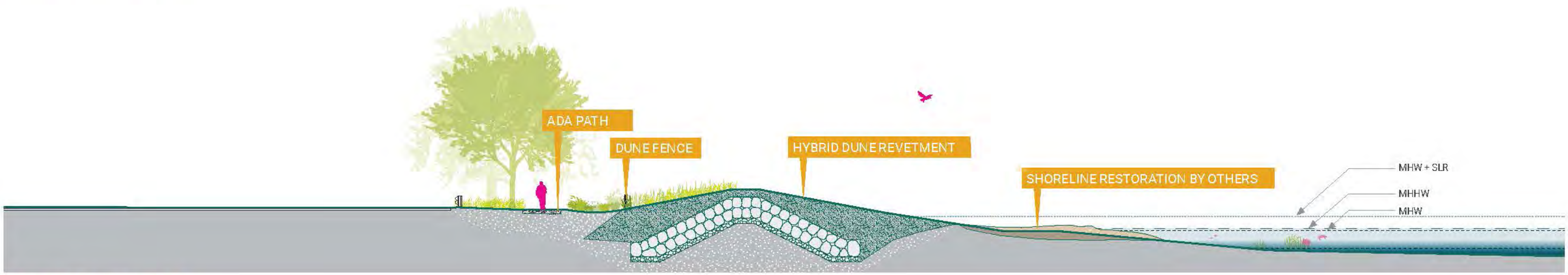
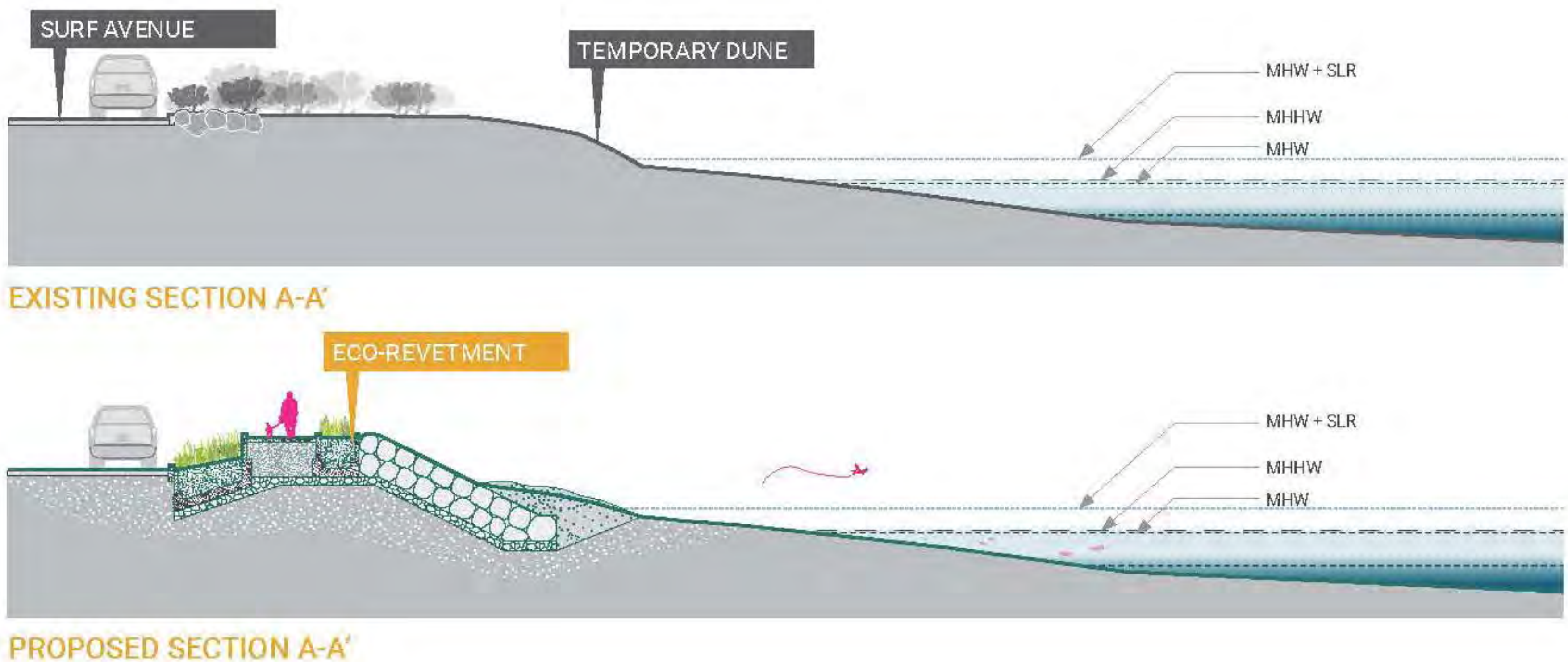


Model Methodology

Proposed Conditions

Shoreline Protection

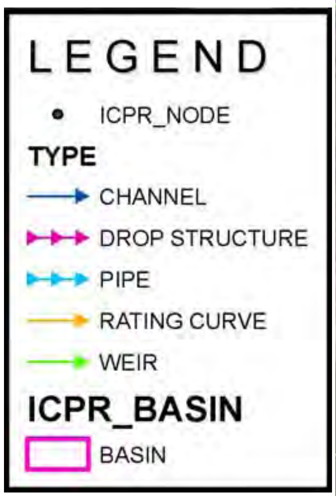


Model
Methodology

Existing Conditions Flow path

Proposed Conditions Model

Proposed Conditions



Analysis

Simulations / Comparisons

Table of Hydrologic Scenarios

Case	Storm Sewer	Shoreline Protection	Tide Gates	High Tide tailwater peak = 6.26 ft	10yr Storm Surge peak =10.6 ft	100yr Storm Surge peak = 15.4 ft
1	Existing	Existing Temp Berm	No	Yes	No	No
2				No	Yes	No
3				No	No	Yes
4			Yes	Yes	No	No
5				No	Yes	No
6				No	No	Yes
7		Proposed Berm	No	Yes	No	No
8				No	Yes	No
9				No	No	Yes
10			Yes	Yes	No	No
11				No	Yes	No
12				No	No	Yes
13	Maintained/ Improved	Existing Temp Berm	No	Yes	No	No
14				No	Yes	No
15				No	No	Yes
16			Yes	Yes	No	No
17				No	Yes	No
18				No	No	Yes
19		Proposed Berm	No	Yes	No	No
20				No	Yes	No
21				No	No	Yes
22			Yes	Yes	No	No
23				No	Yes	No
24				No	No	Yes

Existing Storm Sewer System		
Existing Shoreline Conditions vs. Proposed Shoreline Improvements		
High Tide	6.26 ft	Case01 v. Case07
10 Year Storm Surge	10.6 ft	Case02 v. Case08
100 Year Storm Surge	15.4 ft	Case03 v. Case09
Existing Shoreline Conditions Tide Gate Analysis		
High Tide	6.26 ft	Case01 v. Case04
10 Year Storm Surge	10.6 ft	Case02 v. Case05
100 Year Storm Surge	15.4 ft	Case03 v. Case06
Proposed Shoreline Conditions Tide Gate Analysis		
High Tide	6.26 ft	Case07 v. Case10
10 Year Storm Surge	10.6 ft	Case08 v. Case11
100 Year Storm Surge	15.4 ft	Case09 v. Case12
Maintained/Improved Storm Sewer System		
Existing Shoreline Conditions vs. Proposed Shoreline Improvements		
High Tide	6.26 ft	Case13 v. Case19
10 Year Storm Surge	10.6 ft	Case14 v. Case20
100 Year Storm Surge	15.4 ft	Case15 v. Case21
Existing Shoreline Conditions Tide Gate Analysis		
High Tide	6.26 ft	Case13 v. Case16
10 Year Storm Surge	10.6 ft	Case14 v. Case17
100 Year Storm Surge	15.4 ft	Case15 v. Case18
Proposed Shoreline Conditions Tide Gate Analysis		
High Tide	6.26 ft	Case19 v. Case22
10 Year Storm Surge	10.6 ft	Case20 v. Case23
100 Year Storm Surge	15.4 ft	Case21 v. Case24

Results &
Recommendations

Results & Recommendations


Stormwater Improvements

- Storage
- Shallow Swales
- Grate Inlets
- Pipes
- Tide Gate Valves



Results & Recommendations

Results pending final reviews

60% Plan Submittal

Additional Work