Wastewater Treatment Facility

CLIMATE RESILIENCE ASSESSMENT

Town of Seabrook, NH

July 2021

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EXECUTIVE SUMMARY

Weston & Sampson, in partnership with the Town of Seabrook, was selected to receive funding from the New Hampshire Department of Environmental Services Coastal Program's competitive Coastal Resilience Grant opportunity in 2019.

The project team advanced the goals of Seabrook's existing Coastal Hazards and Adaptation master plan chapter by conducting a wastewater treatment facility (WWTF) vulnerability assessment and developing conceptual options for increasing resiliency at the facility and at a nearby wastewater pump station.

To evaluate future flood risk in the project locations a step-by-step approach was followed in accordance with the 2019 New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections (CFR Guidance). This seven-step approach provides a framework for selecting and assessing the impacts of sea level rise, coastal storms, groundwater rise, precipitation and freshwater flooding projections based on the project planning horizon and tolerance for flood risk. Cumulative flood risk of the project area was evaluated and multiple adaptation options to mitigate the flood risk were recommended.

Figure ES-1 shows the seven-step approach that was adapted from the CFR Guidance and implemented in this project.

A total of six flood scenarios were selected for present, 2050, and 2100 scenarios using the methodology mentioned above (Table ES-1). For each planning horizon, Mean Higher High Water (MHHW) tide level and MHHW plus 100-year Storm Surge (SS) levels were considered. All the elevations were represented in NAVD88 datum. Projected MHHW elevations include the relative sea level rise (RSLR) estimate for the specified time horizon. A 100-year storm surge value of 4.9 feet was added to MHHW to obtain the MHHW+100-year storm surge value. The 100-year storm surge value of 4.9 feet was the storm surge at the NH coast embayment, and was estimated using a 93% dissipation factor to the North Atlantic Coast Comprehensive Study Report (NACCS) storm surge value of 5.3 feet.

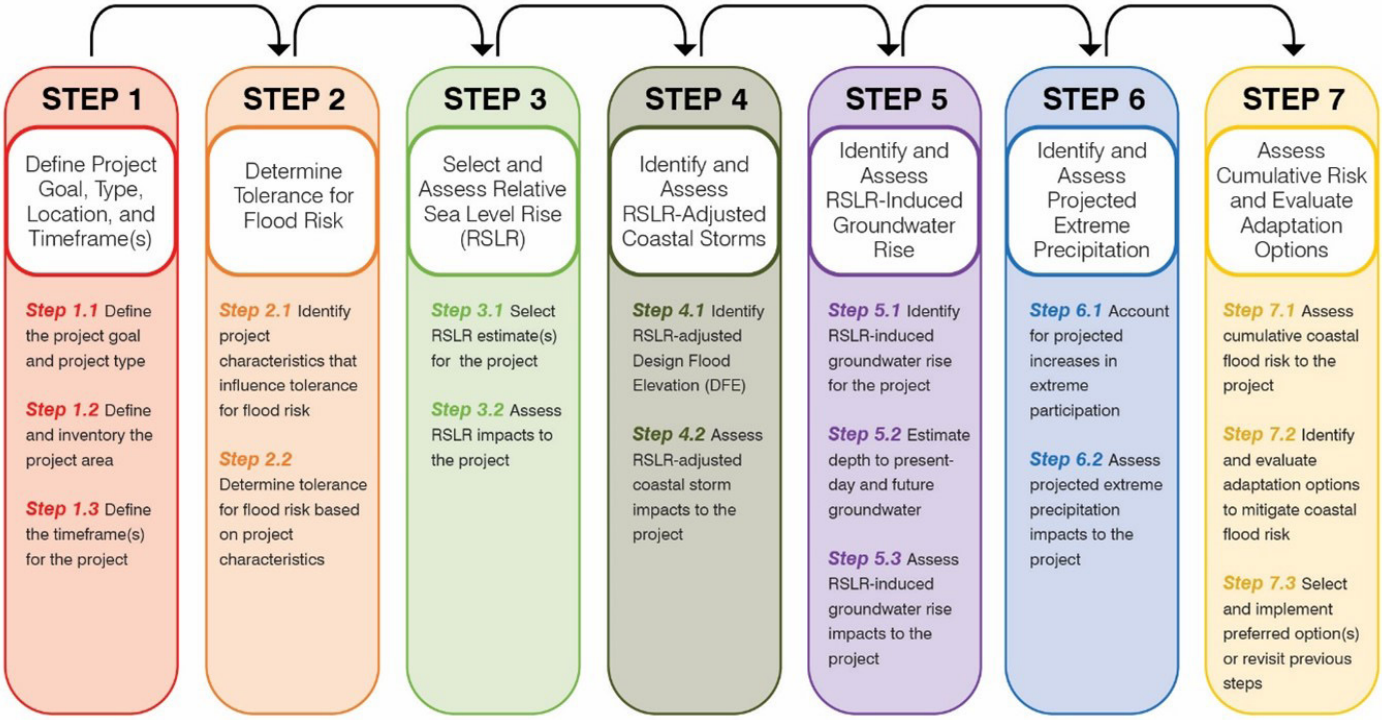


Figure ES-1. Seven-Step Approach for Assessing Coastal Flood Risk

Table ES-1. Mapped Flood Scenarios

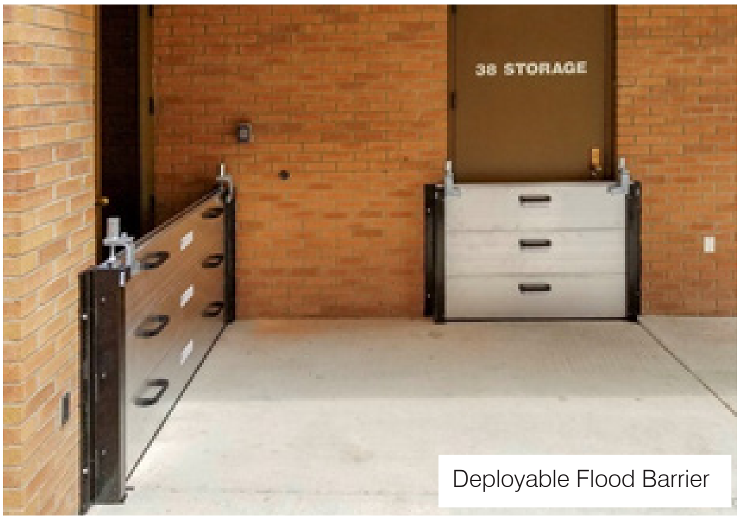
Flood Scenarios	Water Level Elevation (ft-NAVD88)
FEMA 100-year Base Flood Elevation (BFE)	9
2020 MHHW	4.4
2020 MHHW + 100-year SS[1]	9.3
2050 MHHW[2]	6.9
2050 MHHW[2] + 100-year SS[1]	11.8
2050 DFE[3]	13.8
2100 MHHW[4]	11.9
2100 MHHW[4] + 100-year SS[1]	16.8

[1]100-year SS is 4.9 feet
[2]Includes 2.5 feet of RSLR plus present day MHHW
[3]Includes freeboard of 2 feet on 2050 MHHW[2]+100-year SS
[4]Includes 7.5 feet of RSLR plus present day MHHW

Using LiDAR data, aerial imagery, and the projected flood elevations, "bathtub" models of the inundation of the WWTF and pump station campuses were produced for each flood scenario. Generally, the WWTF and pump station were at low risk of flooding until 2050. After this time, storm surge conditions could cause disastrous flooding. Based on a review of the projected flood elevations, record drawings, and GPS-survey elevations, high-risk assets at the WWTF and pump station were identified, such as the influent building (left) and access road (right), pictured above.

When evaluating potential climate resilience options, the project team concentrated on maintaining the functionality of critical assets during flooding conditions due to major storm events and sea level rise throughout the remaining useful life of the WWTF and pump station. The useful life of both facilities was expected to extend to approximately 2050, meaning the 2050 sea level rise and storm surge projections became key planning criteria. The design flood elevation for climate resilience options was therefore identified as the projected 2050 100-year storm surge depth plus two feet of freeboard, or 13.8 feet NAVD88.

Using the CFR Guidance, several climate adaptation options were identified and categorized based on the five action categories: No Action, Avoid, Accommodate, Resist, and Relocate. No Action was not recommended for the pump station, as one component was already at high risk of flooding. Given that the WWTF was not at high risk of flooding until 2050, there was time to further plan and evaluate resilience options. It was recommended that Seabrook avoid installing new infrastructure anywhere in the coastal region of Town, given the high risk of flooding to most areas in the future.



Deployable Flood Barrier


Flood Door

The project team evaluated several accommodation options that would protect critical assets from flood damage in the event the WWTF and pump station grounds were to flood:

- Raise the grade of the access road
- Widen the culverts underneath the access road
- Raise the entry points of underground vaults and tanks
- Construct barriers around vaults and tanks
- Install flood-proof doors and access hatches
- Install deployable flood barriers around building entryways
- Raise critical equipment and controls
- Improve waterproofing of below grade structures

The project team also evaluated multiple resistance options that would prevent the WWTF grounds from flooding:

- Construct a vegetated berm around the perimeter of the WWTF
- Develop living shorelines around the perimeter of the WWTF
- Install permanent vinyl sheet pile barrier around the perimeter of the WWTF
- Install deployable flood barriers around the perimeter of the WWTF

All climate resilience options were compared based on their respective permitting requirements, environmental impact, construction cost, and effectiveness. Raising the access road and installing permanent flood barriers around the perimeter of the WWTF campus would have had substantial environmental impact and would have been incredibly expensive. A few options were identified as being the most cost-effective, most environmentally friendly, and relatively low maintenance. It was recommended that the Town of Seabrook consider the following adaptation measures:

- Raise critical vaults above the design flood elevation
- Install deployable flood barriers and flood doors (pictured above) around all building entryways
- Raise specific equipment and controls above the design flood elevation

The recommended coastal flood adaptation strategy aimed to minimize the impacts of flooding at the WWTF and pump station campuses but not to eliminate flooding during a storm surge event. The strategies were designed to protect critical equipment and buildings within.

Depending on the degree of flooding, staff may not be able to access the WWTF during a storm surge event, in which case they would have to operate the facilities remotely. It was therefore recommended that Seabrook further investigates the redundancy of WWTF equipment, controls, automation, and communication.

Implementing these adaptation strategies will allow Seabrook to continue safe and efficient operation of the WWTF and pump station for the remainder of their useful lives. After 2050, it was recommended that the Town of Seabrook consider investing in a new WWTF at an upland location or look for regional wastewater treatment solutions. These solutions require years of planning and permitting, and it was therefore recommended that the next step of this process be to develop a facilities plan for the future of Seabrook's wastewater collection and treatment system.

1.0 INTRODUCTION

The Town of Seabrook (the Town) is a coastal community located in the Southeastern corner of New Hampshire in Rockingham County. The Town is comprised of approximately 3,970 acres of dry land and 2,190 acres of water and wetlands. The coastal area of Seabrook is a mix of permanent and seasonal residents, commercial and recreational development, beaches, and the Hampton-Seabrook Estuary. Seabrook is highly vulnerable to flooding from sea-level rise (SLR) and coastal surge as a result of extensive tidal wetlands, the Blackwater River, and the Atlantic Ocean surrounding much of the Town's low-lying properties. As recently documented in the Town's 2015 Vulnerability Assessment[1], several key roadways and municipal facilities were projected to be impacted by SLR and coastal surge under projected future climate scenarios. Among these facilities were the elementary-middle school, the NextEra power plant, multiple sewage pump stations, and the wastewater treatment facility (WWTF). Weston & Sampson, in partnership with the Town of Seabrook, received funding from the New Hampshire Department of Environmental Services Coastal Program (NHCP), Coastal Resilience Grant to further evaluate the conditions at the Town's most critical wastewater component, the WWTF.

The facility collects and treats domestic, commercial, and industrial wastewater from most of the town. The WWTF and other system treatment components are all located on Wright's Island, a small upland area within the salt marsh that straddles the New Hampshire/Massachusetts border south of Route 286. Vehicular access to Wright's Island is a man-made, single-lane causeway from Route 286. The isolated nature of the WWTF makes it particularly susceptible to sea level rise and coastal surge, and any disruptions to WWTF operations quickly becomes a public health risk.

In addition to the WWTF components located on Wright's Island, this project evaluated the vulnerability of the Route 286 Pump Station (pump station). This station is located approximately 4,000 feet east of the WWTF down Route 286. The station is at a slightly lower elevation than the WWTF and is already experiencing flooding during extreme storm events. This station was included in the scope of this project because it not only transports all of the coastal neighborhoods' wastewater to the WWTF but contains a metering vault where WWTF effluent is monitored and dechlorinated.

1.1 Project Goal

The goal of this project was to better understand the specific impacts of climate change to the Seabrook WWTF and Route 286 Pump Station, identify potential climate adaptation solutions for increasing resilience of critical facilities, and develop and implement an equitable public engagement strategy that was both project specific and broad to meet the actions outlined in the Town of Seabrook Coastal

[1] Rockingham Planning Commission. (2015). Tides to Storms, Preparing for New Hampshire's Future Coast. Town Of Seabrook, New Hampshire Vulnerability Assessment Report of Sea-Level Rise and Coastal Storm Surge Flooding.

Hazards and Adaptation Master Plan chapter[1]. This project addressed three of the goals outlined in the Town Master Plan chapter on Coastal Hazards and Adaptation:

- "Critical facilities are protected against impacts from flooding and other coastal hazards."
- "Private property owners are allowed to take protective measures to reduce flood risks."
- "Residents and businesses are aware of and better prepared to respond and adapt to coastal hazards."

WWTF Access Road and Surrounding Salt Marsh

Nearly all homes and businesses in Seabrook are served by municipal wastewater services. For this reason, maintaining wastewater services is critical to the health and safety of the community. Over time, improvements to the WWTF system will be necessary to adapt to rising seas, storm-related flooding, and power outages. This project served to proactively address this concern and identify specific improvements and adaptation strategies to protect the WWTF and the health of the public. The outreach and engagement component of this project served to provide information to residents on the impacts of climate change and how municipal facilities may be affected by SLR and future projected groundwater rise. Residents need to be engaged and informed about how their community can increase resiliency in the face of rising seas, coastal storms, and increased precipitation during extreme weather events. Being proactive about planning to responding to these changing conditions is the best course of action and one that deserves attention.

1.2 Project Scope

Weston & Sampson, in partnership with the Town, assessed the specific vulnerabilities at the site and evaluated multiple options for improving resiliency. Effective communication and outreach methods were also evaluated to continue the conversation about climate change in Seabrook and to engage the public in the results of the WWTF assessment. The project work was divided into four tasks:

Task 1 – WWTF Climate Vulnerability Assessment and Sea Level Rise Investigation

The project team compiled existing SLR, storm surge (SS), groundwater rise, and historic extreme precipitation data to produce maps showing the vulnerability of the WWTF and pump station. For the climate vulnerability assessment, a planning horizon of 2050 was used, as approximately 25 years from now can be considered the end of the design useful life of the WWTF infrastructure. A planning horizon of 2100 was also used. The project team utilized the coastal flood risk projections for New Hampshire recently published in *New Hampshire Coastal Flood Risk Summary – Part I: Science*[2]. The North Atlantic Coastal Comprehensive Study (NACCS) storm modeling was used to produce storm surge depths.

[1] Mettee Planning Consultants & Seabrook Master Plan Steering Committee. (2016). Town of Seabrook 2011-20 Master Plan. Chapter 9 – Coastal Hazards and Adaption. https://seabrooknh.info/boards-and-committeesplanning-boardseabrook-master-plan/9-final-coastal-hazards-and-adaptation/.

[2] Wake, C., Knott, J., Lippmann, T., Stampone, M., Ballestero, T., Bjerklie, D., Burakowski, E., Glidden, S., Hosseini-Shakib, I., Jacobs, J. (2019). New Hampshire Coastal Flood Risk Summary – Part I: Science. Prepared for the New Hampshire Coastal Flood Risk Science and Technical Advisory Panel. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/210.

Based on projections and guidance published in the recent reports, and data from NACCS modeling, the project team was able to estimate future flood elevations at the WWTF by 2050 and 2100 under different storm probabilities. These flood elevations were compared with the latest (2015) lidar ground elevation data to map the flood depths and flood extents in the area around the WWTF and pump station. These maps illustrate the overall flood risk at the WWTF and pump station at present day, 2050, and 2100 scenarios.

Task 2 – Public Engagement

A public engagement strategy was developed through a series of meetings and interviews with Town staff, DES, and the New Hampshire Costal Adaptation Workgroup (CAW). Informed by their input and additional research, the project team developed an Equitable Community Engagement Guide for Climate Resilient Projects. Subsequently, the Wastewater Treatment Facility (WWTF) Resiliency Opportunities Analysis project was used as a pilot to test the implementation of the Guide. This phase included a meeting with the Board of Selectmen, the creation of an educational video and comment form, and the development of promotional materials to get the word out to the community about these resources. Section 5 of this report provides more detailed information on this task. Appendix E contains all documentation of public engagement materials.

Task 3 – WWTF Climate Resilience Options

Based on the results of the sea level rise, storm surge, groundwater rise mapping, and extreme precipitation analysis, the project team identified climate adaptation options to increase the resiliency of the WWTF and pump station. These options included raising roads, living shorelines, deployable barriers, flood-proof entryways, other green infrastructure opportunities, and potential relocation and raising of critical infrastructure. Each option was evaluated based on permit requirements, design and construction constraints, cost, and history of success.

This report contains a detailed description of the methodology used to model groundwater rise, sea level rise, coastal surge, and extreme precipitation in the vicinity of the WWTF; an overview of the WWTF and the vulnerability of its most critical components; a comparison of potential climate change adaptation strategies; a summary of the community outreach methods; and an outline of recommendations for improving resilience and implementing adaptation measures.

Figure 1-1: WWTF and Pump Station Locus Plan

2.0 STUDY APPROACH AND METHODOLOGY

Based on the New Hampshire Coastal Flood Risk Summary Report; Part II: Guidance for Using Scientific Projections[1], a seven-step approach was applied to assess the flood risk under current and future climate scenarios.

2.1 Step 1. Define Project Goal, Type, Location, and Timeframe(s)

The goal of this project was to evaluate potential present and future climate threats at the most critically important Wastewater Treatment Facility (WWTF) in the Town of Seabrook, NH. As part of the project, the Weston & Sampson team evaluated coastal flood risk from sea level rise and storm surge, as well as inland flood risk due to groundwater rise and extreme precipitation in the area. The results of these analyses are summarized in this section along with the details on the methodology and approach. The results of these analyses were used to assess the specific vulnerabilities at the site and assess options for improving resiliency.

The facility and other treatment system components are all located on Wright's Island, a small upland area within the salt marsh that straddles the New Hampshire/ Massachusetts border south of Route 286. Vehicular access to Wright's Island is via a man-made, single-lane causeway from Route 286. The isolated nature of the WWTF makes it particularly susceptible to sea level rise and coastal surge, and any disruptions to WWTF operation quickly becomes a public health risk.

The "useful life" i.e., the extended service life of the treatment plant, is 50 years from the date the facility was constructed. The facility was constructed in the mid-1990s, meaning the end of its useful life would be just before the year 2050. Considering regular maintenance or upgrades of structural, mechanical, and ancillary or support (e.g., electrical, plumbing, HVAC) components to be around 25 years, the following planning timeframes were considered for the project:

- Present,
- Mid-century (2050)
- Late-century (2100)

2.2 Step 2. Determine Tolerance for Flood Risk

Step 2.1 | Identify project characteristics that influence tolerance for flood risk

The WWTF is critical to public function, has high replacement costs, is highly sensitive to inundation, and does not have any redundancy in the likelihood of its failure.

Step 2.2 | Determine tolerance for flood risk based on project characteristics

Tolerance for flood risk was decided based on *Step 2 Table* in the CFR Guidance[1] (Figure 2-1 below). The lack of redundancy in the likelihood of its failure along with the characteristics identified above indicate that the tolerance for flood risk was Very Low for this project. The project falls under the Class

[1] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

4 of the American Society of Civil Engineers (ASCE) 24-14 flood design and therefore should be treated as a higher magnitude, lower probability project and follow the flood design standard proposed by ASCE guidelines.

STEP 2 TABLE. FRAMEWORK FOR DETERMINING PROJECT TOLERANCE FOR FLOOD RISK.

		HIGH TOLERANCE FOR FLOOD RISK	MEDIUM TOLERANCE FOR FLOOD RISK	LOW TOLERANCE FOR FLOOD RISK	VERY LOW TOLERANCE FOR FLOOD RISK
DESCRIPTION		Decision makers have a High tolerance for flood risk to the project	Decision makers have a Medium tolerance for flood risk to the project	Decision makers have a Low tolerance for flood risk to the project	Decision makers have a Very Low tolerance for flood risk to the project
POSSIBLE PROJECT CHARACTERISTICS *Tolerance for flood risk will depend on the mix and importance of these project characteristics.*		Low value or cost	Medium value or cost	High value or cost	Very high value or cost
		Easy or likely to adapt	Moderately easy or somewhat likely to adapt	Difficult or unlikely to adapt	Very difficult or very unlikely to adapt
		Little to no implications for public function and/or safety	Moderate implications for public function and/or safety	Substantial implications for public function and/or safety	Critical implications for public function and/or safety
		Low sensitivity to inundation	Moderate sensitivity to inundation	High sensitivity to inundation	Very high sensitivity to inundation
PROJECT EXAMPLES	PLANNING	Updating a local master plan Developing a capital improvement plan			
	REGULATORY	Updating a floodplain zoning ordinance Updating a subdivision site plan regulation Updating state alteration of terrain rules			
	SITE-SPECIFIC	Designing a walking path; Siting a temporary or accessory structure; Upgrading a minor storage facility	Replacing a local culvert; Constructing a residential, commercial, or industrial building	Maintaining a school; Siting a community center or recreational facility; Upgrading a wastewater treatment plant	Renovating a hospital or police/fire station; Siting an emergency shelter or response center; Repairing a power station
CORRESPONDING ASCE 24-14[14,15] FLOOD DESIGN CLASS		1	2	3	4
RECOMMENDED COASTAL FLOOD RISK PROJECTIONS		Lower magnitude, Higher probability	⟷		Higher magnitude, Lower probability

Figure 2-1: Framework for Determining Project Tolerance for Flood Risk (Source: CFR Guidance Document[1])

2.3 Step 3. Select and Assess Relative Sea-Level Rise (RSLR)

Step 3.1 | Select RSLR estimate(s) for the project

The timeframes/planning horizons proposed for this analysis were 2050 and 2100. The treatment plant was built in the mid-1990s and considering a useful life of 50 years, the choice of 2050 seems appropriate. The year 2100 provides a long-range estimate of what climate impacts can be experienced at the WWTF site by then. The greenhouse gas emission scenario selected for this analysis was RCP 8.5. Table 2-1 show a comparison between RCP 4.5 and RCP 8.5 RSLR values by 2050 and 2100 for projects with very low tolerance for flood risk. The difference in RSLR between RCP 4.5 and RCP 8.5 is relatively minor (0.2 ft) for 2050. For this analysis, the RCP 8.5 scenario was selected to simulate more extreme RSLR estimates by 2100, given the criticality of the treatment plant and the pump station for Seabrook. Using the RCP 8.5 scenario for 2100 represents a plausible worst-case scenario for long-range planning of flooding impacts at the WWTF site from sea level rise and storm surge. Therefore, a RSLR estimate of 2.5 feet by 2050 and 7.5 feet by 2100 was used, per *Step 3 Table B* below from the CFR Guidance[1] (Figure 2-2).

[1] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

Table 2-1: Comparison of RSLR (ft) Estimates Under Different RCP Scenarios (Source: CFR Guidance Document[1])		
Timeframe	RSLR estimate (ft) under RCP4.5	RSLR estimate (ft) under RCP8.5
2050	2.3	2.5
2100	6.2	7.5

STEP 3 TABLE B. DECADAL RSLR ESTIMATES (IN FEET ABOVE 2000 LEVELS) BASED ON RCP 8.5, TIMEFRAME, AND TOLERANCE FOR FLOOD RISK.

	HIGH TOLERANCE FOR FLOOD RISK	MEDIUM TOLERANCE FOR FLOOD RISK	LOW TOLERANCE FOR FLOOD RISK	VERY LOW TOLERANCE FOR FLOOD RISK
	Plan for the following RSLR estimate (ft)* *compared to sea level in the year 2000*			
TIMEFRAME	Lower magnitude, Higher probability			Higher magnitude, Lower probability
2030	0.8	1.0	1.2	1.3
2040	1.1	1.3	1.7	1.8
2050	1.4	1.8	2.2	2.5
2060	1.8	2.3	2.9	3.3
2070	2.3	2.9	3.7	4.2
2080	2.8	3.5	4.5	5.2
2090	3.3	4.2	5.5	6.3
2100	3.8	4.9	6.5	7.5
2110	3.8	4.8	6.9	7.9
2120	4.3	5.5	8.0	9.3
2130	4.8	6.2	9.0	10.6
2140	5.2	6.9	10.1	11.9
2150	5.8	7.6	11.4	13.4

*Adapted from Appendix A in *Part I: Science*.[17] RSLR estimates for High tolerance for flood risk projects correspond with K14 upper end of "likely" estimates for RCP 8.5. RSLR estimates for Medium tolerance for flood risk projects correspond with the K14 1-in-20 chance estimates for RCP 8.5. RSLR estimates for Low tolerance for flood risk projects correspond with the K14 1-in-100 chance estimates for RCP 8.5. RSLR estimates for Very Low tolerance for flood risk projects correspond with the K14 1-in-200 chance estimates for RCP 8.5.

Figure 2-2: Decadal RSLR Estimates
(Source: CFR Guidance Document[1])

[1] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

Step 3.2 | Assess RSLR impacts to the project

RSLR-adjusted water level was visualized in the project area using available tools, including the New Hampshire Sea-level Rise, Storm Surge, and Groundwater Rise Mapper (Sea-Level Rise Mapper), and site plans. The evaluated impacts over the range of RLSR estimates were identified in Step 3.2 for both the project locations. As noted in CFR Guidance[1], surface water levels, groundwater levels, waves, and current velocities will increase, and sediment erosion and deposition are expected to change in conjunction with RSLR-adjusted water levels. Due to absence of surrounding flood-barrier infrastructure that will restrict the water flow, the WWTF is at further risk of flooding due to RSLR. In addition, lack of redundancy will have significant public health impact in the surrounding communities if the WWTF undergoes flooding. The resulting inundation scenarios are discussed in Section 3 and the maps are included in Appendix A of the report.

2.4 Step 4. Identify and Assess RSLR-Adjusted Coastal Storms

Step 4.1 | Identify RSLR-adjusted Design Flood Elevation (DFE)

The RLSR adjusted design flood elevation (DFE) estimate was adapted from the information provided in *Step 4 Table* of the CFR Guidance[1] (Figure 2-3). DFE is the total flood elevation that a project is designed to provide protection from. DFE is typically at least the BFE with freeboard, as required by building codes. RSLR-adjusted DFE is typically at least the BFE with required freeboard and RSLR[1] (Figure 2-3).

The project area is located in the FEMA AE flood zone with an elevation of 9 feet (BFE). However, for this project the higher value of 9.3 feet was chosen over FEMA 100-year flood zone elevation to design under a more conservative scenario. The chosen BFE was the sum of 2020 Mean Higher High Water (MHHW) elevation (4.4 feet-NAVD88) and the 100-year Storm Surge height (4.9 feet). The RSLR adjusted DFE was then estimated for 2050 planning horizon with a freeboard height of 2 feet.

STEP 4 TABLE. RSLR-ADJUSTED DESIGN FLOOD ELEVATIONS (DFE) BASED ON TOLERANCE FOR FLOOD RISK.

	HIGH TOLERANCE FOR FLOOD RISK	MEDIUM TOLERANCE FOR FLOOD RISK	LOW TOLERANCE FOR FLOOD RISK	VERY LOW TOLERANCE FOR FLOOD RISK
IF PROJECT AREA IS LOCATED IN:	RSLR-ADJUSTED DESIGN FLOOD ELEVATION (DFE) =			
A, AO, OR AE ZONE* NOT IDENTIFIED AS COASTAL A ZONE**	[BFE] + RSLR	[BFE + (required freeboard ≥ 1 ft)] + RSLR	[BFE + (required freeboard ≥ 1 ft)] + RSLR	Whichever is greater: [BFE + (required freeboard ≥ 2ft)] + RSLR OR 0.2% annual chance flood elevation + RSLR
VE ZONE*** AND COASTAL A ZONE			[BFE + (required freeboard ≥ 2 ft)] + RSLR	

Figure 2-3: RSLR-Adjusted Design Flood Elevations
(Source: CFR Guidance Document[1])

Step 4.2 | Assess RSLR-adjusted coastal storm impacts to the project

Since the project has a very low risk tolerance, it was crucial to understand the effect of additional factors such as coastal storms. RSLR-adjusted coastal storm water levels in the project area were estimated using available tools, such as the Sea-Level Rise Mapper. The results are discussed in Section 3 and

[1] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

the maps are included in Appendix A of the report.

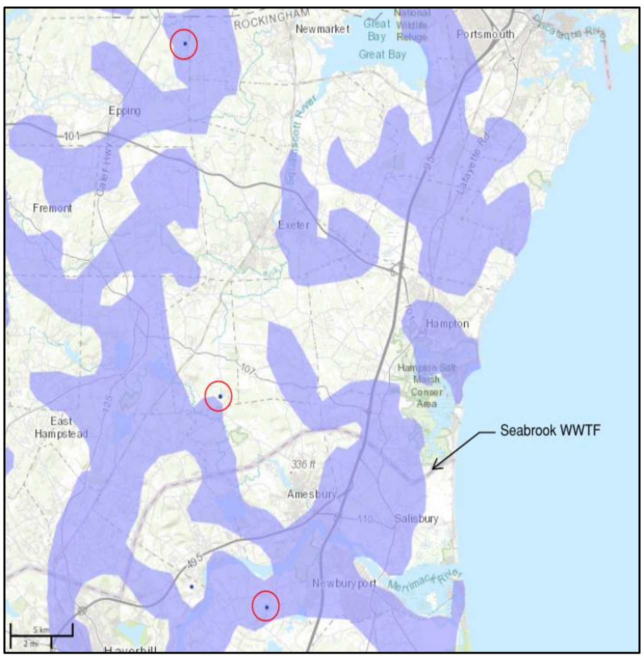
2.5 Step 5. Identify and Assess RSLR-Induced Groundwater Rise

Step 5.1 | Identify RSLR-induced groundwater rise for the project

Seabrook was one of the communities where RSLR induced groundwater rise has been mapped as stated in the CFR Guidance[1]. Therefore, RSLR induced groundwater rise has been accounted for in the project area.

Step 5.2 | Estimate depth to present-day and future groundwater

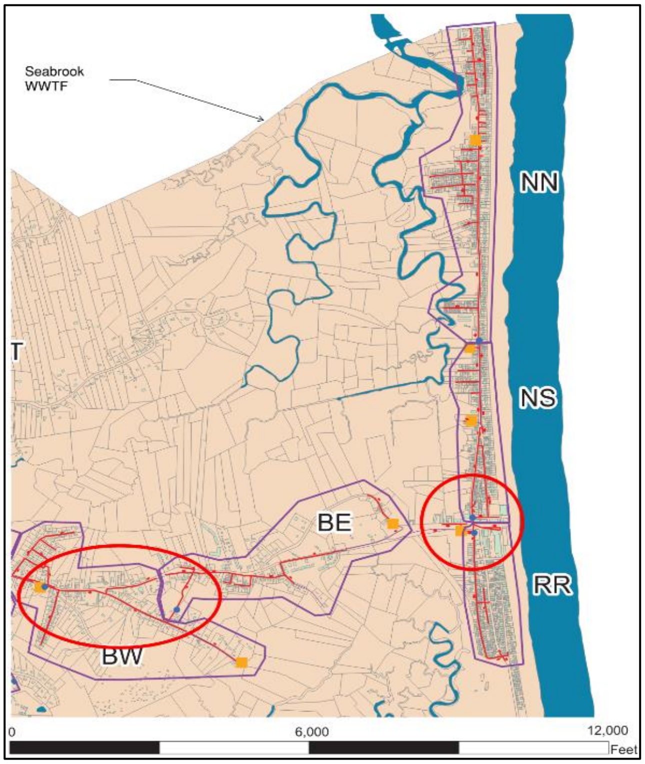
As a basepoint for the mapping, the mean seasonal high groundwater table needed to be determined. Therefore, multiple sources of groundwater monitoring data were evaluated.



USGS National Ground-Water Monitoring Network

This database contains groundwater quality and elevation data from monitoring wells across the country, dating back over 10 years. Three water level specific groundwater monitoring wells local to the WWTF were evaluated. The wells, located in Epping NH, East Kingston NH, and Newburyport MA, are shown in Figure 2-4. The shallowest groundwater level (depth to water, feet below ground elevation) from each well was compared. The shallowest groundwater table was observed in the Newburyport well, at 15.4 feet below ground elevation (seasonal high water table).

Figure 2-4: Locations of the three monitoring wells in relation to the WWTF. The closest well, located in Newburyport, is 6.8 miles from the WWTF.



WSE Salisbury, MA Flow Metering Project, 2017

Flow Assessment Services, working as a subconsultant for Weston & Sampson during the 2017 Salisbury, MA Town-Wide Flow Metering Program, installed four temporary piezometer groundwater gauges in manholes throughout the town. Each gauge was installed by inserting a PVC pipe through the manhole wall and attaching flexible tubing to the pipe. The tubing was extended up the manhole so that groundwater levels could be determined. Weekly readings were taken throughout the 10-week monitoring program at each location.

Figure 2-5. Approximate locations of the two closest groundwater monitoring gauges in relation to the WWTF. The gauges in subareas RR and BW were approximately 1.8 miles and 2 miles from the WWTF respectively.

The two gauges closest to the WWTF, located in subareas BW and RR shown in Figure 2-5, were evaluated. Rainfall events were also recorded during the flow metering period, and these events were compared to the dates of groundwater gauge recordings. Post-rainfall groundwater measurements were not considered in this analysis, as to avoid using groundwater levels influenced by wet weather events. The RR gauge recorded the shallowest average groundwater level at 1.6 feet below ground elevation. The average groundwater level from the BW gauge was 8.5 feet below ground elevation.

The Salisbury monitoring gauge data was selected for the groundwater rise analysis, rather than the USGS monitoring wells, given the proximity to the WWTF site. The BW gauge was understood to resemble the characteristics of the WWTF site more closely, as it was approximately the same distance inland as the WWTF. The extremely shallow groundwater table recorded from the RR gauge was understood to be a result of its proximity to the shoreline, which was not representative of the WWTF site. The water table depth below ground elevation of 8.5 feet was used as the baseline elevation for the RSLR-induced groundwater rise analysis.

STEP 5 TABLE. APPROACHES FOR CALCULATING DEPTH TO RSLR-ADJUSTED GROUNDWATER.

	PREFERRED APPROACH (MAPPED COASTAL COMMUNITY)	ALTERNATE APPROACH (UNMAPPED COASTAL COMMUNITY)
	IF PROJECT AREA IS LOCATED IN A MAPPED COASTAL COMMUNITY:	IF PROJECT AREA IS LOCATED WITHIN 3 MILES OF TIDAL SHORELINE IN AN UNMAPPED COASTAL COMMUNITY:
RSLR-INDUCED GROUNDWATER RISE =	Refer to Sea-Level Rise Mapper[38] to estimate RSLR-induced groundwater rise	Commit to manage = (RSLR) x (0.33) Be prepared to manage = (RSLR) x (0.66)
DEPTH TO RSLR-ADJUSTED GROUNDWATER =	(Present-day depth to groundwater) - (RSLR-induced groundwater rise)	

Figure 2-6: Approaches for Calculating Depth to RSLR-Adjusted Groundwater (Source: CFR Guidance Document[1])

Step 5.3 | Assess RSLR-induced groundwater rise impacts to the project

To determine the extent of groundwater rise, the Sea-Level Rise Mapper was utilized. The proposed RSLR estimates of 2.5 feet by 2050 and 7.5 feet by 2100 were used in this analysis. However, the closest corresponding layers on the online mapper consider 2-foot and 8-foot RSLR scenarios. According to the "Groundwater Rise Caused by 2-ft SLR (ft)" layer on the mapper, the expected groundwater rise at the WWTF could range from 0.2 – 0.7 feet with a 2-foot RSLR scenario in 2050. According to the "Groundwater Rise Caused by 8-ft SLR (ft)" layer on the mapper, the expected groundwater rise at the WWTF could range from 1.2 – 2.2 feet for a large portion of the site with an 8-foot RSLR scenario in 2100. The groundwater rise predictions based on 2-foot and 8-foot RSLR were subtracted from the baseline groundwater depth below ground elevation of 8.5 feet. This resulted in the expected groundwater depths resulting from RSLR scenarios:

- 2050 depth to groundwater: 7.8 – 8.3 feet
- 2100 depth to groundwater: 6.3 –7.3 feet

The RSLR induced groundwater rise was further assessed in the project area, as described in Section 3 of the report. Mapping of the groundwater rise in the project area is included in Appendix B of the report. It is recommended that further investigation be performed to confirm groundwater elevations by drilling and installing groundwater monitoring wells, as discussed in Section 6.

2.6 Step 6. Identify and Assess Projected Extreme Precipitation

Step 6.1 | Account for projected increases in extreme precipitation

Rainfall depths associated with the 24-hour duration design storms were evaluated under both present and future climate planning horizons as listed in Table 2-2. Several recurrence intervals were selected for this purpose.

[1] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

Table 2-2: Summary of Climate Scenarios Used in the Project Area (Source: CFR Science Document[1])			
Climate Parameter	Flood Risk	Planning Horizons	Recurrence Intervals
Extreme Precipitation	Inland Flooding	• Present • 2050 • 2100	• 2-year • 5-year • 10-year • 25-year • 100-year

The design storms' rainfall depths under present climate conditions (baseline) were derived from the NOAA Atlas 14 Point Precipitation Frequency Estimates (NOAA 14). For the 24-hour design storms for the 1-, 2-, 5-, 10-, 25- year recurrence intervals, the NOAA Atlas 14 estimates are marginally higher than the NRCC estimates. For the 100-, 200- and 500-year storms, the NRCC estimates are significantly higher compared to the NOAA Atlas 14 estimates (Table 2-3). Since CFR Guidance does not provide any explicit guidance on whether to use NRCC or NOAA atlas 14, the NOAA Atlas 14 numbers were selected for the WWTF site. This was because Atlas 14 was more recently published (2015) compared to NRCC (2010).

Table 2-3: Present-Day Baseline Precipitation for Different Recurrence Intervals from NRCC and NOAA Atlas14		
Recurrence Interval (Years)	NRCC Present Baseline (in.)	NOAA Atlas 14 Present Baseline (in.)
1-year	2.7	2.7
2-year	3.3	3.4
5-year	4.1	4.4
10-year	5.0	5.3
25-year	6.4	6.6
50-year	7.6	7.5
100-year	9.2	8.5
200-year	11.1	9.7
500-year	14.1	11.6

Design storms' rainfall depths under future climate conditions were calculated for each design storm as a percent increase over these baseline values. Assuming percent increases do not change significantly within a state, the values were adapted from the analysis previously done for Portsmouth, NH. The percent increase values used in the Portsmouth, NH study were determined using a statistical analysis of annual maximum daily precipitation depths from an ensemble of global climate models (GCMs), which were part of the CFR Guidance document[2]. The design storm rainfall depths for present, 2050 (using a 20-year averaging period from 2040-2059) and 2100 (using a 20-year averaging period from 2080-2099) are summarized in Table 2-4 and Figure 2-7.

[1] Wake, C., Knott, J., Lippmann, T., Stampone, M., Ballestero, T., Bjerklie, D., Burakowski, E., Glidden, S., Hosseini-Shakib, I., Jacobs, J. (2019). New Hampshire Coastal Flood Risk Summary – Part I: Science. Prepwered for the New Hampshire Coastal Flood Risk Science and Technical Advisory Panel. Report published by the University of New Hampshire, Durham, NH. https://scholar1s.unh.edu/ersc/210.

[2] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

Table 2-4: Present and Projected 24-Hour Design Rainfall Depths for Seabrook, NH					
Recurrence Interval (Years)	NOAA Atlas 14 Present Baseline (in.)	Estimated 2050 (2040-2059) Values (in.)	Estimated 2100 (2080-2099) Values (in.)	Percent Increase 2050* (%)	Percent Increase 2100* (%)
2-year	3.4	3.8	4.0	12%	20%
5-year	4.4	5.1	5.4	15%	22%
10-year	5.3	6.3	6.6	18%	24%
25-year	6.6	8.1	8.4	23%	28%
100-year	8.5	11.0	11.3	30%	34%

*Percent increase values were taken from Portsmouth, NH

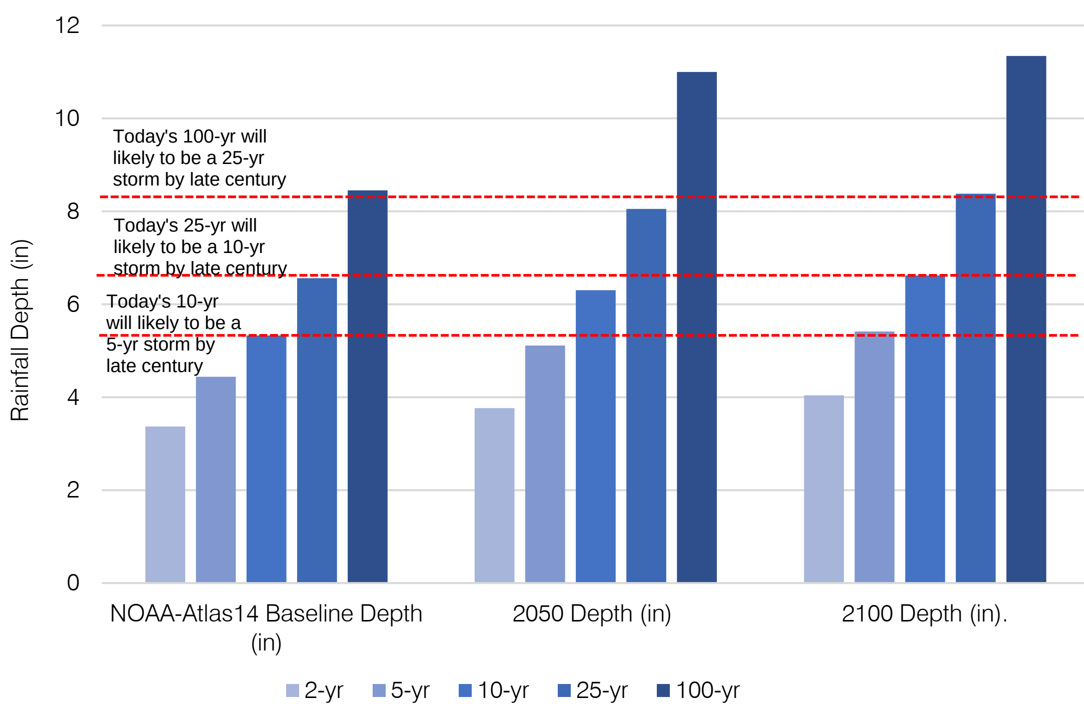


Figure 2-7: Stormwater Flooding Impacts Due to Changes in Extreme Rainfall Events in Seabrook, NH

Freshwater instream flow and floodplain extent were expected to increase with increasing precipitation and impervious cover. Higher relative sea levels may reduce seaward drainage capacity during and following precipitation events, which could cause additional flooding. To include these anticipated changes in the risk estimates, the more in-depth analysis was chosen over the *at least 15% increase* suggested in the CFR Guidance *Step 6 Table* (Fig. 2-8). This analysis was chosen for the following reasons:

- Considers localized rainfall depths specific to the NH region using GCM data from the CFR Science Document[1]
- Considers change in percent increase for each recurrence interval
- Considers change in rainfall depths for different planning horizons (2050, 2100)

STEP 6 TABLE. APPROACH FOR CALCULATING PROJECTED EXTREME PRECIPITATION ESTIMATES BASED ON TOLERANCE FOR FLOOD RISK.

	HIGH TOLERANCE FOR FLOOD RISK	MEDIUM TOLERANCE FOR FLOOD RISK	LOW TOLERANCE FOR FLOOD RISK	VERY LOW TOLERANCE FOR FLOOD RISK
PROJECTED EXTREME PRECIPITATION ESTIMATE =	(Best available precipitation data) x (1.15)		(Best available precipitation data) x (>1.15)	

Figure 2-8: Approach for Calculating Projected Extreme Precipitation Estimates
(Source: CFR Guidance Document[2])

Step 6.2 | Assess projected extreme precipitation impacts to the project

Based on the analysis conducted in Step 6.1, it appears that extreme precipitation will impact the WWTF and the pump station significantly, and rainfall depth will increase up to 2.5 inches for the 100-year storm. Therefore, it is important to consider extreme precipitation in the design parameters and guidelines.

2.7 Step 7. Assess Cumulative Risk and Evaluate Adaptation Options

Step 7.1 | Assess cumulative coastal flood risk to the project

It is important to consider possible compound impacts to the project area as a result of coastal flood risk from RSLR, coastal storms, RSLR-induced groundwater rise, extreme precipitation, and/or freshwater flooding occurring together. The cumulative risk of these factors was considered in Sections 3 and 4 of this report. It should be noted that further investigation is required to quantitatively evaluate the risk of these compounding flood factors.

Step 7.2 | Identify and evaluate adaptation options to mitigate coastal flood risk

Adaptation options were categorized within a framework of five action categories: no action, avoid, accommodate, resist, and relocate. The adaptation options identified based on the flood risk in the project area are discussed in Section 4. This section also discusses the degree to which each of the possible action alternatives reduces vulnerability to flooding and exacerbates or minimizes negative environmental impacts. Section 4 also discusses the cost effectiveness of each alternative.

Step 7.3 | Select and implement preferred option(s) or revisit previous steps

The most viable adaptation options chosen for the project location are discussed in Section 6. Multiple public engagements methods were used by the Town and project team to disclose assessed flood risk, implemented actions, and any future actions that may be necessary to further mitigate flood risk and to

[1] Wake, C., Knott, J., Lippmann, T., Stampone, M., Ballestero, T., Bjerklie, D., Burakowski, E., Glidden, S., Hosseini-Shakib, I., Jacobs, J. (2019). New Hampshire Coastal Flood Risk Summary – Part I: Science. Prepwered for the New Hampshire Coastal Flood Risk Science and Technical Advisory Panel. Report published by the University of New Hampshire, Durham, NH. https://scholar1s.unh.edu/ersc/210.

[2] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

educate the community. The details of the public engagement strategies adapted for the project are discussed in Section 5.

3.0 WASTEWATER TREATMENT FACILITY VULNERABILITY

The following section presents the results of the SLR and storm surge inundation mapping and the subsequent WWTF and pump station vulnerability assessment. Section 3.2 provides a summary description of the WWTF and pump station to provide context for the vulnerability assessment. It was important to understand how flooding may impact each asset individually and how damage to each component may impact the operation of the facility as a whole. Section 3.3 details the function and makeup of each asset, the point at which critical assets become vulnerable to flooding, and the consequences of flood damage. The specific vulnerability of different components at the WWTF and pump station were evaluated based on the projected flood elevations shown in Table 3-1 below, a review of record drawings, and on-site GPS survey.

3.1 Inundation Mapping Overview

As detailed in Section 2 of this report, three planning horizons were assessed: present day (2020), 2050, and 2100. At the 2050 planning horizon, the WWTF and pump station will be just over 50 years old, which was the end of their estimated useful life. For each horizon, the water level during dry weather mean higher-high water (MHHW) conditions was mapped. For the 2050 and 2100 horizons, this water level was adjusted for projected SLR. A 100-year (1% chance) storm surge event was also mapped for each of the planning horizons. The additional projected depth of storm surge was added to the MHHW and SLR water levels. In total, six scenarios were assessed:

Table 3-1: Mapped Flood Scenarios

Flood Scenarios	Water Level Elevation (ft-NAVD88)
2020 MHHW	4.4
2020 MHHW + 100-year SS[3]	9.3
2050 MHHW[1]	6.9
2050 MHHW[1] + 100-year SS[3]	11.8
2100 MHHW[2]	11.9
2100 MHHW[2] + 100-year SS[3]	16.8

[1]Includes 2.5ft of RSLR plus present day MHHW
[2]Includes 7.5ft of RSLR plus present day MHHW
[3]100-year SS is 4.9 feet

All six scenarios were mapped at both the WWTF and pump station project areas (separate maps for each facility). Appendix A contains all inundation maps. The maps represent a "bathtub model" of the flooding that can be expected to occur given the projected flood elevations and existing topographic characteristics of the facilities. The maps provide a visualization of the depth of flooding that may occur around buildings and process tanks, but do not represent which structures and buildings will be fully submerged in the given flood scenario. Buildings may appear to be fully submerged based on the colored graphical representation of flooding, however, this should not be interpreted as flood waters overtopping the rooves of the buildings. For example, as shown on the 2050 storm surge map, the flood graphic was superimposed on the roof of the influent building, operations building, and others. Given the 2050 storm surge depth of 11.8 feet, these buildings will not be fully submerged. However, the ground levels (and basements) of the buildings may be severely flooded, as water was projected to rise approximately 1 foot above the elevation of the building entryways. If a building or structure was not superimposed by the colored flood graphic, that was an indication that the component was not expected to experience flood damage in that particular scenario.

3.2 Overview of Wastewater Treatment Facility and Pump Station Vulnerability

Weston & Sampson has developed a sophisticated understanding of the WWTF process areas and building systems through multiple site visits and previous comprehensive evaluation work at the WWTF and pump station. The Town of Seabrook owns and operates an extended aeration wastewater treatment facility that has been in continuous service since the mid-1990s. Municipal wastewater is transported to the facility via the Town's collection system, which consists of approximately 50 miles of sewer mains and several pump stations. The collection system extends to all parts of town, including businesses and residences in Seabrook's shoreline neighborhoods. On average, 0.7 million gallons per day (MGD) of wastewater is processed at the WWTF, although the plant was designed to treat a peak flow of 2.4 MGD. The treatment process consists of screening, grit removal, secondary treatment via oxidation ditches, secondary clarification, disinfection via chlorination, and dechlorination. Treated wastewater is pumped off-site and discharged through an outfall in the Atlantic Ocean. The Seabrook WWTF also contains a sludge processing building, where sludge that is removed from the process is dewatered before being trucked offsite. Figure 3-1 below provides a layout of the WWTF's treatment processes and operational assets.

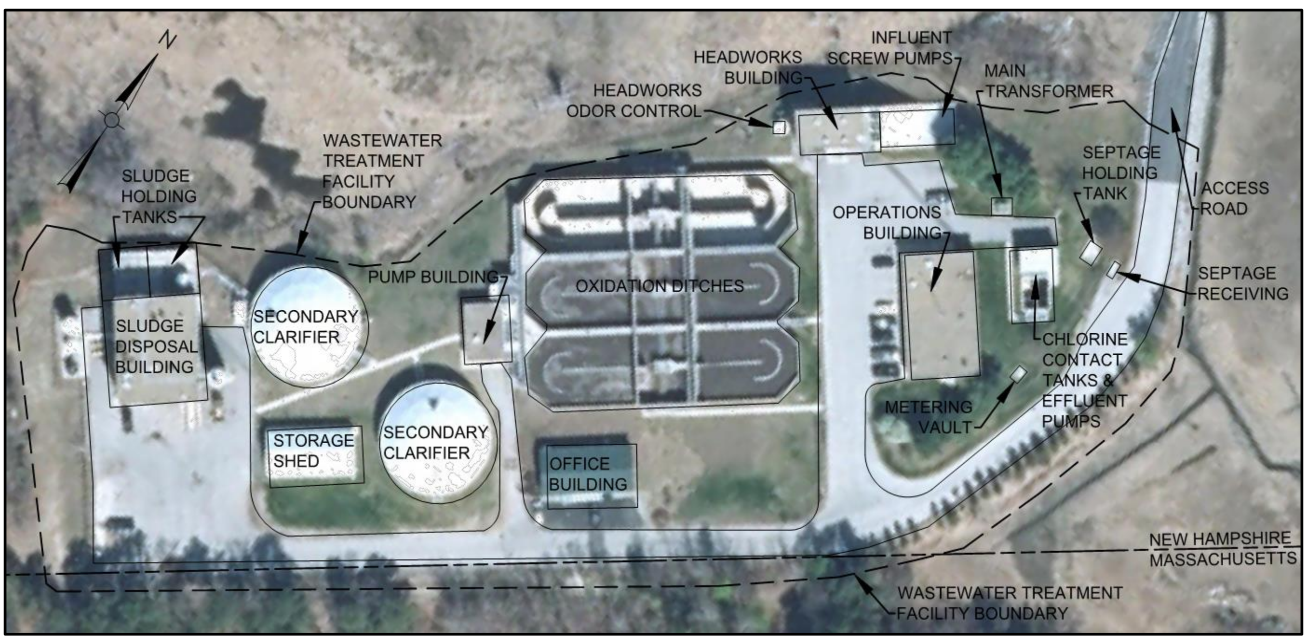


Figure 3-1: WWTF Overview

Three figures depicting the site layout of the WWTF and pump station are included in Appendix C. These figures indicate the location, elevation, and accuracies of the GPS survey points. The elevations sourced from record drawings of buildings, tanks, etc. are also indicated on these figures. All elevations on these figures are in reference to the NAVD88 datum.

The original record drawings for the pump station and WWTF referenced the NGVD29 datum. Since Lidar data and flood maps referenced NAVD88, elevations from the record drawings were converted to the NAVD88 vertical datum using the NOAA VERTCON tool. As directed by the VERTCON tool output, 0.78 feet was subtracted from all NGVD29 elevations to convert them to NAVD88. All elevations referenced below in Section 3.3 are in the NAVD88 datum.

In general, the model showed that the WWTF is currently at low risk of flooding and will not experience significant flooding until a 100-year storm surge event in 2050. Historically, no flooding has occurred during MHHW, non-storm, conditions at the WWTF or pump station. The modeling suggested that present day, 100-year, storm surge at an elevation of 9.3 feet has the potential to flood the pump station metering vault. The Town has reported that flooding to the pump station metering vault has already occurred during extreme wet weather events. The projected MHHW and SLR elevation in 2050 of 6.9 feet was less than the projected 2020 storm surge depth of 9.3 feet. The only asset that would be impacted by this scenario is the pump station metering vault. At the projected depth of 6.9 feet, the vault would be submerged by 1-2 inches.

The modeling results demonstrated that by 2050, under 100-year storm surge conditions, the WWTF could experience disastrous flooding. Figure 3-2 below provides a visual comparison of 2050 dry weather, MHHW conditions at the WWTF versus the conditions during a 100-year SS.

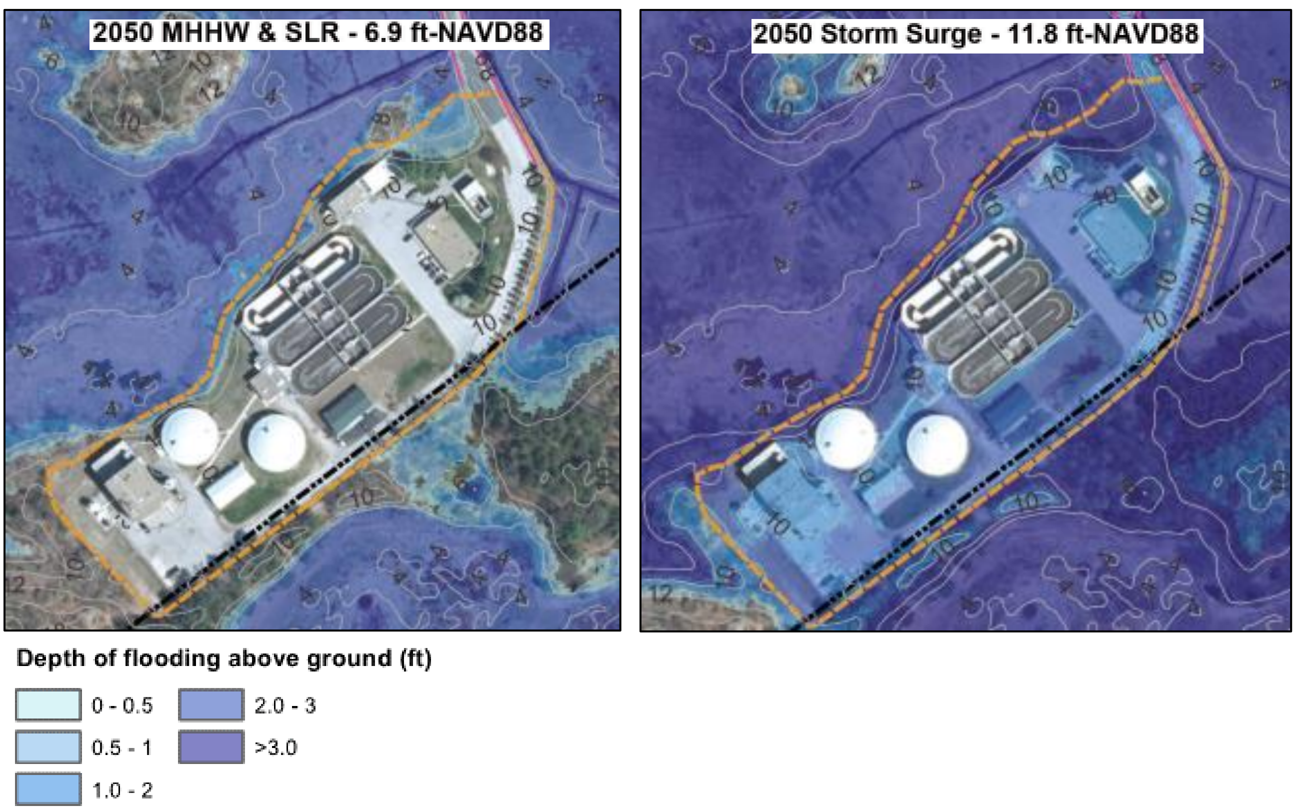


Figure 3-2: Storm surge Conditions at the WWTF in 2050

As depicted above, a 100-year storm surge in 2050 may flood several WWTF components, including the:

- Access Road
- Main Transformer
- Operations Building
- Influent Building and Influent Screw Pumps
- Septage Receiving and Holding Tanks
- Sludge Pump Building
- Flow Metering Vault
- Sludge Dewatering Building
- Storage/Maintenance Garage

The modeling projected that the pump station would also experience disastrous flooding during 2050, 100-year storm surge conditions. Not only would the pump station and metering vault flood, but the surrounding roads, homes, and businesses would likely experience severe flooding. Figure 3-3 below provides a visual comparison of 2050 dry weather, MHHW conditions at the pump station versus the conditions during a 100-year SS.

Figure 3-3: Storm surge Conditions at the Pump Station in 2050

For 2100, the projected MHHW and SLR elevation was 0.1 feet greater than the projected 2050 storm surge elevation. The additional 0.1 feet would result in the flooding of the same assets that were affected by the projected 2050 storm surge scenario. However, 2100 MHHW conditions would occur much more frequently than a 100-year SS. Unlike the 2050 storm surge scenario (where flood conditions would only be temporary and the operation of the facility may return to normal after a short period of time), the campus-wide flooding would be a daily reality. During the projected 2100 storm surge conditions, several more assets will experience flooding, including the secondary clarifiers, chlorine contact tanks, and effluent pumps.

Although not within the study area, the modeling suggested that the large portions of Town east of the WWTF may be significantly affected by SLR and storm surge flooding as early as 2050. By 2100, the majority of the area serviced by the pump station may be underwater due to a projected MHHW elevation of 11.9 feet (roughly a 7.5-foot increase). As discussed further in this report, the planning horizon of climate resilience options for the pump station need not exceed the projected lifespan of its service area. Furthermore, it is recommended that a facilities plan be developed to evaluate the future of Seabrook's wastewater collection system assets, including all 17 primary pump stations, approximately 100 grinder pump stations, and associated low pressure sewers, as a result of climate impacts.

Freshwater contributions from precipitation-driven flooding was not quantified as part of this assessment. Flood impacts from extreme precipitation can be evaluated using a site-specific hydrologic/hydraulic (H/H) model for the WWTF site and the surrounding areas. To better understand the joint flood risks from coastal flooding and freshwater flooding, an integrated hydrodynamic model will need to be developed as discussed in Section 7.

Groundwater rise impacts from this analysis suggests that flooding will not be significantly exacerbated by groundwater rise. The majority of buildings and process tanks are above the depth to groundwater projected for 2050. The basement of the sludge storage building, WWTF pump building, and pump station buildings are the only rooms below the projected depth. Multiple other structures, including the influent vault and sludge storage tanks, are also at or below the 2050 projected depth to groundwater. While groundwater rise does not pose a significant threat to these assets, it is recommended that these structures receive updated waterproofing and concrete crack sealing to prevent groundwater infiltration. Furthermore, it is recommended that additional investigation be performed to confirm groundwater elevations by drilling and installing groundwater monitoring wells at or in the vicinity of the WWTF site. This higher accuracy data can be used to perform buoyancy calculations on existing structures such as tanks and vaults. These calculations are necessary to confirm structures will not be under the influence of hydrostatic uplift.

3.3 Vulnerability of Critical WWTF and Pump Station Components

As described in the previous section, the WWTF contains multiple buildings and extensive process equipment. To determine optimal coastal flood adaptation strategies, it was important to identify the assets most critical to the operation of the WWTF and the point at which floodwaters would likely damage those assets. Critical assets were classified in this report as those that were essential to the effective movement, treatment, and discharge of wastewater. It should be noted that not all of these assets were vulnerable to flooding in the SLR and storm surge scenarios considered in this report. The following sub-sections: provide a comprehensive description of the identified critical assets at the WWTF and pump station; identify when and how each asset will experience flooding; qualitatively identify the flood risk in reference to the six flood models; and explain what the consequences of flood damage may be.

3.3.1 Access Road

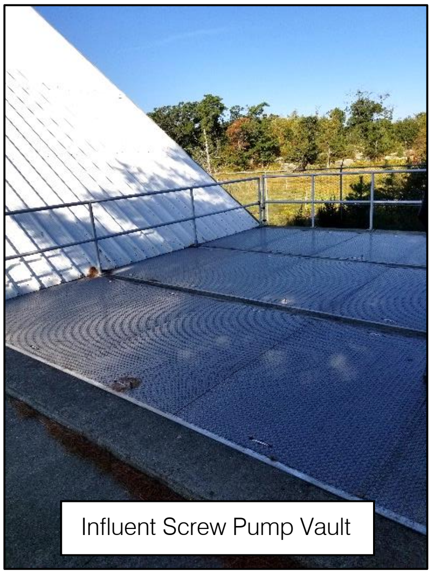
The sole means of access to the wastewater treatment facility is Wright's Island Road, a causeway connecting Wright's Island to Route 286. The causeway is critical to the operation of the WWTF, as it is the access way for operators, maintenance personnel, septage trucks and sludge hauling trucks to enter the facility. Traffic across the one-lane causeway is controlled via stoplights at each end, and there are guardrails on either side of the road. The causeway is approximately 700 feet long and graded to an average crown elevation of 10.2 feet. Underneath the road there are multiple utilities: an 8-inch water main that services the WWTF; a 36-inch sewer interceptor that conveys all wastewater flow to Wright's Island; a 24-inch force main that conveys treated wastewater off Wright's Island (and eventually to the outfall); and underground electrical service. There are two (2) 5x8-foot concrete box culverts located underneath the roadway providing a conduit for the tidally influenced marsh surrounding Wright's Island. The banks of the causeway are beginning to settle, which is evident by the sagging of guardrails and lamp-posts.

If this access point is severely flooded it may become non-functional, meaning operators, maintenance staff, sludge hauling trucks, etc. would not be able to access the plant. Given the average grade of 10.2 feet, the causeway will experience severe flooding during the projected 2050 100-year storm surge conditions. By 2100, the roadway will be submerged daily by over a foot of water. This asset was considered at high risk of flooding by 2050.

3.3.2 Influent Pumping and Headworks

The treatment process begins in the headworks building. Influent wastewater is pumped up to the second floor of the concrete building by three (3) screw pumps. The hydraulic head provided by the pumps allows wastewater to flow by gravity through headworks, secondary treatment, and disinfection. The second floor of the building contains screening, grit removal, and HVAC equipment. The second-floor elevations are high enough that it will not flood in any of the modeled scenarios.

The base of the screw pumps are located in a below ground vault next to the building. The vault is accessible by aluminum hatches that are raised slightly above surrounding grade. If flood waters reach the top of the vault, water may leak through the aluminum access hatches, and the vault may begin to flood. This will prevent operators from accessing the influent sluice gate controls within the vault. Flood waters entering the vault would essentially become unsanitary wastewater flow and be pumped up to the headworks equipment. Depending on the volume of water within the vaults, the incoming gravity sewer may begin to backup, causing overflows of upstream manholes and sewer services. The top of


Influent Screw Pump Vault

the vault is at an elevation of 10.6 feet and is at high risk of flooding through the 2050 storm surge projection and beyond.

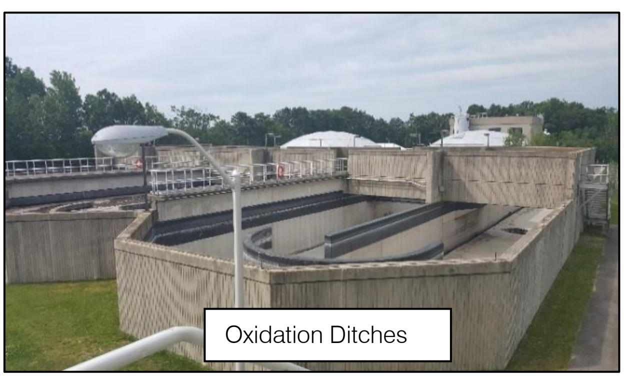
The ground floor of the influent building has three rooms, enclosing an oil storage tank, hot water boiler, and operation & maintenance equipment. Sitting next to the influent building is an odor control system on a concrete pad. The odor control system was not considered critical to the operation of the WWTF. Flood waters that enter through the ground floor doors of the influent building may damage the plant hot water boiler and oil storage tank. The first flood entry points are at an elevation of 10.6 feet and were projected to begin flooding during 2050 storm surge conditions.

Located behind the chlorine contact tanks are concrete septage receiving and septage storage tanks. The receiving tank collects influent flow from septage trucks that enter and exit the facility by the access road. Influent septage moves by gravity into the septage holding tank and then into the influent screw pump vault. If flood waters were to rise above the tank entry points, the tanks would begin to flood, and floodwaters may enter the influent vault downstream of the tanks. The access points to the septage receiving and storage tanks sit at a grade of 11.6 feet and 10.5 feet, respectively. Just like the influent building and screw pumps, these tanks should be considered at high risk of flooding in 2050 and are expected to begin flooding during 2050 storm surge conditions.


Septage Receiving Tank

3.3.3 Secondary Treatment and Sludge Pumping

Following headworks, wastewater flows by gravity to the three (3) concrete oxidation ditches for biological treatment. The top of the oxidation ditch tanks is at an elevation of 22 feet, which is over 10 feet above grade. The oxidation ditches were one of the only assets that are not vulnerable to flooding in any of the projected flood scenarios.


Oxidation Ditches

Following the oxidation ditches are the secondary clarifiers. The secondary clarifiers serve as a key step in the biological treatment process. If flood waters were to reach the lowest point of the top of the tank and mix with the wastewater, the treatment process would become non-operational. Both 70-foot diameter, concrete clarifiers are raised above grade, with the lowest point of the tank walls at an elevation of 16.3 feet. The clarifiers are at low risk of flooding until 2100 storm surge conditions.

Clarifiers (Bottom Left & Right) and Pump Building (Center)

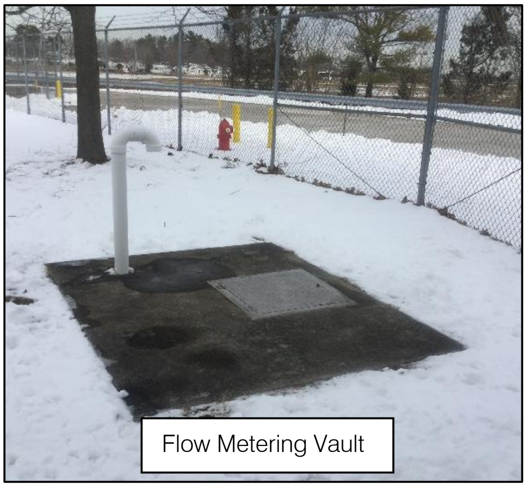
Adjacent to the oxidation ditches is the concrete pump building, which houses two (2) sludge wasting pumps, three (3) return activated sludge (RAS) pumps, and two (2) plunger scum pumps. The first floor of the building houses the control panels and motor control center for the 15 horsepower (hp) return activated sludge (RAS), 7.5 hp waste sludge, and 15 hp scum pumps. All mechanical pumping equipment is located in the basement. The array of sludge pumps is critical to recycling and wasting sludge removed from the secondary treatment process. If flood waters reach the elevation of the sludge building doorway, and the first floor and basement flood, the pumps, motors, and controls may be damaged and become non-operational. This would prevent sludge recycle in secondary treatment and complicate the entire treatment process. The pump building ground floor is at an elevation of 10.7 feet and is therefore at high risk of flooding after 2050.

3.3.4 Disinfection and Effluent Pumping

The secondary clarifier effluent flows by gravity through a flow metering vault and into two (2) concrete chlorine contact tanks. Liquid sodium hypochlorite is added and mixed with the effluent to achieve disinfection. Chemical dosing is based on the reading from the flow meter. Disinfection is a critical process in wastewater treatment as it serves to inactivate and destroy disease-causing organisms present in the wastewater. If flood waters reach the top of the disinfection tanks and mix with the wastewater, it would render the disinfection system non-functional. The top of the tanks are at an elevation of 13.7 feet, which means the system is not at risk of flooding until after 2050. The tanks are at high risk of flooding during 2100 storm surge conditions.

Chlorine Contact Tanks

Following disinfection, three (3) vertical turbine pumps discharge effluent twice per day to the outfall during high tide periods. The pumps were covered by a modular building that provides protection from the elements. The effluent pumps are critical to the operation of the WWTF because they facilitate the movement of all effluent flow off of Wright's Island and to the outfall in the ocean. If the pumps were to be put out of service from flood waters rising to the grade of the pumps, the pumps may be damaged. In this scenario, effluent could not be removed from the WWTF and the plant would eventually experience an overflow of wastewater from process tanks. These pumps are positioned on a concrete slab next to the chlorine tanks, which sits at an elevation of 11.92 feet. The pumps are not at high risk of flooding through 2050. As SLR intensifies after 2050, the pumps will quickly become vulnerable to flooding during storm surge events.

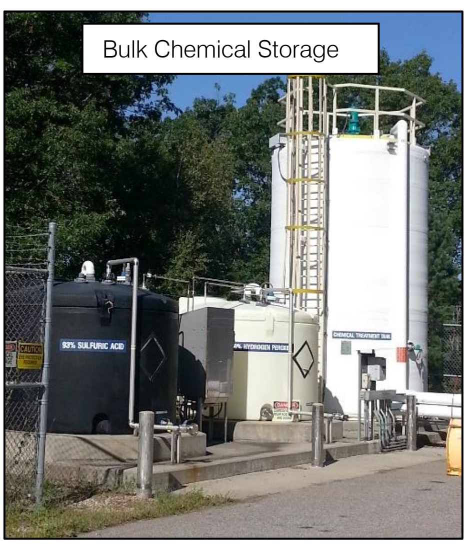

Flow Metering Vault

The flow metering vault was identified as a critical asset because it houses the flow meter that controls the chlorine dosing system. If the vault were to flood and the flow meter became non-operational, the disinfection system would need to be manually controlled. Also, there would be no indication of flow to properly dose chlorine to the disinfection tanks. The top of the metering vault is at an elevation of 9.7 feet, which is lower than the average grade of the facility. This vault may experience up to two (2) feet of flooding during 2050, 100-year storm surge conditions. The vault sits at the same elevation as the present day, 100-year storm surge and was therefore already at risk of flooding.

3.3.5 Sludge Storage and Processing


Sludge Processing Building

Waste sludge is routinely removed from the treatment process and pumped to two (2) aerated sludge storage tanks which are located directly behind the concrete sludge processing building (also referred to as the sludge disposal building or dewatering building). The top of these concrete tanks are elevated above grade and were not found to be vulnerable to flooding in any of the modeled flood scenarios. On the ground floor of the sludge processing building sits a storage area and dried-sludge collection area. The second floor of the building holds all critical sludge processing equipment, including the belt-filter presses, storage tank blowers, and lime mixing system. The basement of the building contains the belt belt-filter press feed pumps, polymer storage and dosing system, and an oil storage tank. Directly next to the building there is a silo containing lime which is used for sludge stabilization and odor control. Also neighboring the building is a bulk chemical storage area that contains three storage tanks elevated on concrete pads.


Bulk Chemical Storage

The sludge dewatering system is critical to the operation of the WWTF because it allows sludge to be partially dried, reducing the volume of sludge requiring vehicular transportation off Wright's Island. While most sludge dewatering equipment is located on the second floor, floodwaters may still cause system interruptions if it were to enter the first floor of the sludge processing building through various entryways. Floodwaters may interfere with the dried sludge collection process, as well as enter the basement of the building, potentially damaging the sludge feed pumps and other equipment. The exterior doors of this floor were at an elevation of 10.8 feet. Therefore, the building becomes susceptible to flooding during the projected 2050 storm surge conditions.

3.3.6 Operations Building and Related Assets

The operations building contains multiple critical components of the WWTF, including an office room, lunch/break room, bathrooms, laboratory, mechanical equipment room, generator room, chemical storage room, and motor control center (MCC) room. If flood waters enter the building though the front door, the entire building may flood, and equipment may become damaged and non-operational. The concrete building consists of a single floor which sits at an elevation of 10.7 feet. The building is at high risk of flooding from 2050 storm surge conditions.

Operations Building (Right) and Effluent Pumps Shed (Left)

Main Transformer

Outside the operations building is the main transformer. This piece of electrical equipment is critical for sustainable power supply to the facility. If flood waters exceed the height of the concrete pad and interfere with the equipment, the asset may become non-functional. In this case, the voltage of the incoming electrical service (provided by Unitil) cannot be processed, and the facility would need to rely on its standby generator. The transformer sits on a concrete pad at an elevation of 9.6 feet. While the transformer will become increasingly vulnerable as SLR and storm surge intensifies, it may currently be considered at low risk of flooding. By 2050, it will be at high risk of flooding.

An office building is also situated on Wright's Island. This building is raised above grade to a currently unknown elevation. The office building does not contain any equipment that is required for the WWTF to function and was therefore not considered a critical asset.

Wright's Island also contains a garage used for equipment/vehicle storage and maintenance. Although no record elevations or survey data exist for this asset, the entrance appears to be level with surrounding grade of 10.2 feet. This asset is vulnerable to flooding during 2050 storm surge conditions.

Storage/Maintenance Garage

3.3.7 Route 286 Pump Station and Metering Vault

After disinfection, the WWTF effluent is pumped off Wright's Island, approximately a mile down the road, where it passes through a metering vault outside the Route 286 Pump Station. This structure contains equipment that monitors flow and chlorine residual and injects sodium bisulfide to dechlorinate and achieve a desired chlorine residual in the treated effluent. The equipment inside the vault is vital to the monitoring and dechlorination of effluent. If water overtops the vault entrance and floods the vault, the equipment may be damaged. It is critical that operations staff can access this vault daily, and this would not be possible if the vault floods. The top of this vault is at a grade of 6.8 feet. In a present-day, 100-year event, flood waters could submerge the vault by as much as 2.9 feet. The Town has reported that this vault already experiences minor flooding during extreme wet weather events. Currently, this asset should currently be considered at high risk of flooding.

Route 286 Pump Station (Top Left) and Metering Vault (Bottom Right)

The brick pump station building, located upgrade and approximately 150 feet back from Route 286, pumps all the Town's wastewater originating east of Blackwater River to the WWTF. This station has three levels: one above ground and two below ground. The first floor/ground floor, at an elevation of 10.2 feet, contains an emergency generator. The mid-level of the station contains the motor control center, control panel, and influent comminutor. The third level is divided into two separate spaces: one half of the floor contains two 20-hp flooded-suction centrifugal wastewater pumps; the second half contains two wetwells. The building is at very high-risk of 2050 storm surge flooding.

Directly behind the pump station building is the dechlorination building. This building is architecturally similar to the pump station building and is also at a grade of 10.2 feet. However, this building only has one level, which contains the bisulfide storage tanks and chlorine residual analyzers. The building is also projected to flood during 2050 storm surge conditions.

Table 3-2 summarizes the vulnerability of critical WWTF and pump station components. The table indicates the elevation of critical assets and the depths of flooding that would result in all six of the modeled flood scenarios. Elevations represent the point at which flood water will cause the asset to cease to function as intended. Flood pathways and elevations of equipment and structures were informed from previous site visits, Lidar elevation data used in the mapping, and review of record drawings. The elevations of many assets were also confirmed by on-site GPS survey. Where record and GPS elevations differed, the lowest elevation was referenced.

Prior to the design of any flood protection measures (discussed in Section 4), the elevations of flood pathways should be confirmed with additional survey work. None of the building entryways were measured with GPS survey, as GPS accuracy is reduced by the unit being in close proximity to buildings. There is a need for further survey to confirm many structure elevations that are currently only informed by record drawings.

Table 3-2: Depth of Flooding at Critical WWTF and Pump Station Components							
WWTF Asset	Elevation (ft)	Depth of Flooding Above Asset Elevation (ft)					
		2020 MHHW (4.4 ft-NVD88)	2020 Storm Surge (9.3 ft-NAVD88)	2050 MHHW & SLR (6.9 ft-NAVD88)	2050 Storm Surge (11.8 ft-NAVD88)	2100 MHHW & SLR (11.9 ft-NAVD88)	2100 Storm Surge (16.8 ft-NAVD88)
Access Road/Causeway	10.2	N/A	N/A	N/A	1.6	1.7	6.6
Septage Receiving Station	11.6	N/A	N/A	N/A	0.2	0.3	5.2
Septage Holding Tank	10.5	N/A	N/A	N/A	1.3	1.4	6.3
Main Transformer	9.6	N/A	N/A	N/A	2.2	2.3	7.2
Operations Building (Ground Floor)	10.7	N/A	N/A	N/A	1.1	1.2	6.1
Influent Building (Ground Floor)	10.6	N/A	N/A	N/A	1.1	1.2	6.1
Influent Screw Pump Vault	10.6	N/A	N/A	N/A	1.1	1.2	6.1
Oxidation Ditch (Top of Tank)	22.0	N/A	N/A	N/A	N/A	N/A	N/A
Pump Building (Ground Floor)	10.7	N/A	N/A	N/A	1.1	1.2	6.1
Secondary Clarifiers (Top of Tank, Lowest Point)	16.3	N/A	N/A	N/A	N/A	N/A	0.5
Chlorine Contact Tanks (Top of Tank)	13.7	N/A	N/A	N/A	N/A	N/A	3.1
Effluent Pumps	11.9	N/A	N/A	N/A	N/A	N/A	4.9
Effluent Metering Vault	9.7	N/A	N/A	N/A	2.1	2.2	7.1
Sludge Disposal Building (Ground Floor)	10.8	N/A	N/A	N/A	1.0	1.1	6.0
Rt. 286 Pump Station Dechlorination/Metering Vault	6.8	N/A	2.5	0.1	5	5.1	10.0
Rt. 286 Pump Station (Ground Floor)	10.2	N/A	N/A	N/A	1.6	1.7	6.6

4.0 WASTEWATER TREATMENT FACILITY CLIMATE RESILIENCE OPTIONS

A preliminary evaluation of climate resilience options was conducted based on the assessment of coastal flood risk to the WWTF and pump station. Multiple adaptation options were identified that may minimize the coastal flood impacts to the facilities and keep the WWTF and pump station operational during future SLR and storm surge conditions. According to the CFR Guidance[1], all climate resilience options may fall into the framework of five action categories:

- No Action
- Avoid
- Accommodate
- Resist
- Relocate

Given the size and complexity of the WWTF and pump station project areas, a combination of adaptation options from each of the categories may be the optimal solution for reducing flood risk, protecting equipment, and ensuring service is not interrupted during coastal flooding events. Several specific accommodation and resistance options were identified and were conceptually evaluated based on permitting requirements, effectiveness, and cost.

It is important to note that the flood resilience options presented in this section are primarily selected to mitigate coastal flooding impacts from sea level rise and storm surge. Additional flood resilience strategies may need to be implemented to mitigate flooding impacts from extreme precipitation, both for high-intensity short-duration events, as well as longer-duration heavy rainfall events.

4.1 Design Flood Scenario for Climate Resilience Options

The vulnerability assessment conducted at the WWTF and pump station indicated that the majority of components were at little to no risk of flooding until 2050. Given the projected SLR in 2050, a 100-year storm surge coupled with MHHW conditions could result in disastrous flooding across Wright's Island and the pump station campus. Given the substantial capital investment into the WWTF and pump station, it would be in the Town's best interest to continue utilizing these facilities for the remainder of their useful lives. Both facilities were constructed in the mid-1990s. Assuming a useful life of 50-years, the Town should invest in keeping these facilities operational until at least 2050. Therefore, the following accommodation and resistance strategies for the Seabrook WWTF and pump station were proposed as means to keep the facilities functional through 2050.

After 2050, not only will the facilities have exceeded their useful lives, but the service area and collection system downgrade and east of the WWTF will likely be suffering from extensive flooding. While not in the direct study area, the flood modeling provided insight on how roadways, homes, and businesses may be impacted by SLR and SS. By 2100, the entire coastal region of Town may be underwater. To keep the pump station and WWTF operational, coastal flooding adaptation measures will likely become technically and financially unrealistic. Therefore, the project team did not consider accommodation or

[1] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

resistance strategies intended to keep the WWTF and pump station operational past 2050. After 2050, it is recommended that the Town relocate the WWTF or evaluate inter-community wastewater treatment options. This is discussed further in Section 4.6.

To properly accommodate the 2050 100-year storm surge floodwaters, the climate resilience measures should be designed based on the 2050 design flood elevation (DFE) of 13.8 feet. This DFE is a combination of the existing MHHW level, projected 2050 SLR, projected 100-year storm surge depth in 2050, and 2 feet of additional freeboard.

It is important to note that there are several limitations to the modeling approach that was used to project the 2050 DFE. Section 7 describes these limitations and the need for a more advanced hydrodynamic model to assist in the planning, design, and implementation of adaptation options.

4.2 No Action

No action is only recommended when coastal flood risk is very low and the tolerance for flood risk is high. The coastal flood risk assessment indicated that the flood risk to the pump station is high even in a present-day storm surge scenario. The flood risk to the WWTF is generally low until 2050, where with SLR paired with storm surge may cause flooding to multiple critical assets. During an extreme 100-year SS, the flooding would be disastrous. Both the WWTF and pump station are critical to the collection and treatment of all or a significant portion of the Town's wastewater so the tolerance for flood risk is considered low.

A "No Action" approach is not recommended to address the effects of SLR and storm surge at the pump station, given the metering vault is already at high risk of flooding. It is recommended that the entrance to the vault is raised to the DFE and critical internal components (some of which have already sustained flood damage) are replaced. This project should be implemented as soon as possible. Given the low flood risk that currently exists at the WWTF, the implementation of physical accommodation and/or protection measures may not occur immediately. However, as discussed later in Section 6, there is additional investigation work that should be conducted prior to the construction of the recommended climate adaptation alternatives. This work should be conducted over the next few years in preparation for the design and construction of physical adaptation measures.

4.3 Avoid

The CFR Guidance[1] recommends that investment into future assets should be avoided if the location presents any potential flood risk and there was a moderate to low tolerance for flooding. The location of both the WWTF and pump station are at high risk of flooding by 2050. Given the low tolerance for flooding in those areas, stakeholders should avoid investing heavily into new infrastructure in these areas. This does not include investments into existing infrastructure repairs and replacement of failing equipment. Reasonable investments should be made to keep the existing facilities operational for the remainder of their useful lives, or until 2050. Also, it is recommended that the Town does invest in protection and accommodation measures to safeguard existing critical infrastructure from temporary flooding.

[1] NH Coastal Flood Risk Science and Technical Advisory Panel. (2020). New Hampshire Coastal Flood Risk Summary, Part II: Guidance for Using Scientific Projections. Report published by the University of New Hampshire, Durham, NH. https://scholars.unh.edu/ersc/211/

4.4 Accommodate

Accommodation measures are recommended when the risk of coastal flooding is moderate and the tolerance for flood risk is also moderate. Generally, the goal of accommodation strategies is not to prevent flooding entirely, but rather to control the damage done by flooding, maintain functionality of key assets, and prevent unsafe conditions. Typically, accommodation measures are less costly and require less environmental disturbance than resistance measures. Example accommodation strategies may include raising equipment above projected flood elevations, improving floodproofing of buildings and structures, or improving emergency operation and evacuation procedures.

For the purpose of this evaluation, some resistance measures (defined in Section 4.5) were considered accommodation strategies when applied to individual buildings or structures. These protection options, such as deployable flood barriers, are designed to keep flood waters out of certain areas. They were evaluated as accommodation options in this section because they would be used to keep floodwaters out of buildings once the WWTF has already fallen victim to flooding. Protection measures that would extend the perimeter of the facility and keep floodwaters from entering the WWTF campus entirely are discussed in Section 4.5.

Potential accommodation options that were considered include:

- Raise the grade of the access road.
- Widen the culverts underneath the access road.
- Raise the entry points of underground vaults and tanks.
- Construct barriers around vaults and tanks.
- Install flood-proof doors and access hatches.
- Install deployable flood barriers around building entryways.
- Raise critical equipment and controls.
- Improve waterproofing of below grade structures.

4.4.1 Road Raising and Culvert Widening

Raising the causeway above future flood elevations is one potential way to maintain access to the facility under future flood conditions. The basis of this design would be raising the road to the DFE of 13.8 feet to accommodate the 2050 100-year storm surge flood elevations. Additionally, the culverts underneath the roadway may be widened as part of the same project. A hydraulic analysis would need to be conducted to confirm the effects of culvert widening. Several alternative methods of raising the roadway have been considered. Road raising alternatives were only considered for the access road and not for roads and driveways within the WWTF site boundary.

One alternative for raising the causeway or access road to the WWTF would require elevating the roadway utilizing a raised berm strategy with a 2:1 to 3:1 slope which would extend into the wetlands. While likely the least costly alternative to raise the roadway, it would have the greatest impact on wetlands, in particular salt marsh. One benefit of this approach is it would be possible to incorporate a living shoreline into the project, which would help to offset environmental impact and reduce erosion of the berm.

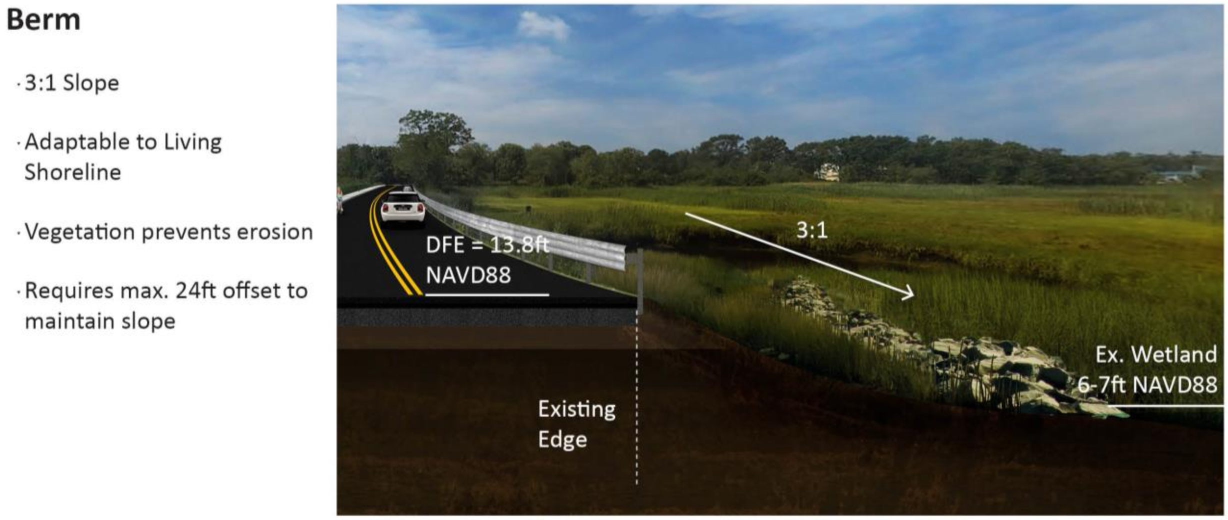


Figure 4-1: Conceptual Cross-Section of Raised Access Road with Berm

Similar to the berm, the causeway could be raised utilizing driven sheet piles into the ground at the edge of the access road to support the reconstructed elevated roadway. This would limit the impact to environmental resources and abutting wetland resource areas. An in-depth geotechnical analysis would need to be performed to identify if this alternative were feasible.

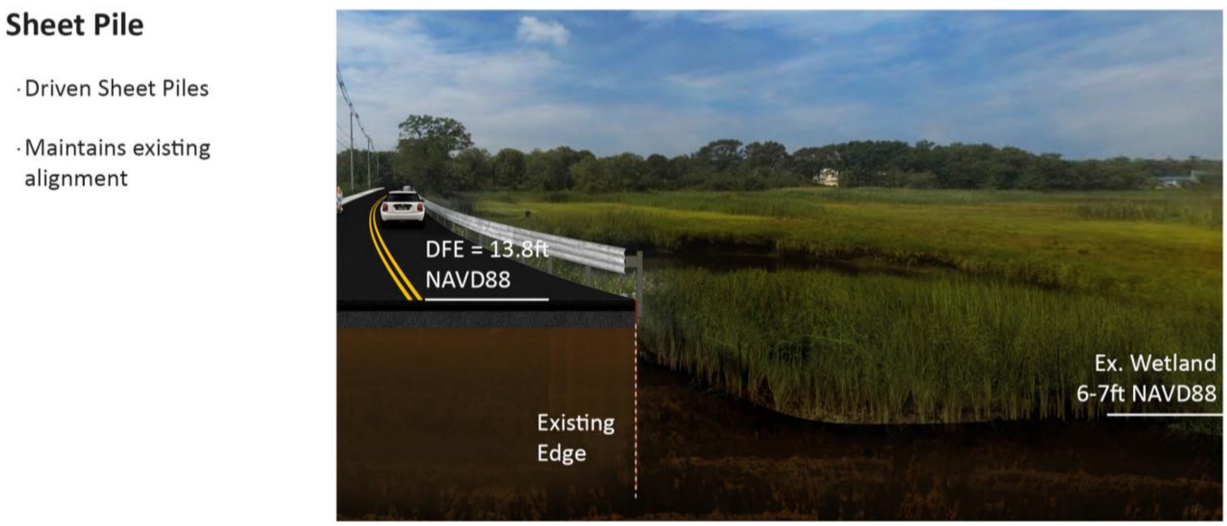


Figure 4-2: Conceptual Cross-Section of Raised Access Road with Sheet Pile

If the geotechnical analysis finds that the soft, organic, clay and silty soils cannot support steel or vinyl sheet piles, a precast or rock wall could be investigated. The precast wall would also limit wetland impacts but may require additional ground improvement to support the weight of the wall. This approach achieves the revised causeway elevations and has the least permanent impact to the surrounding wetlands.

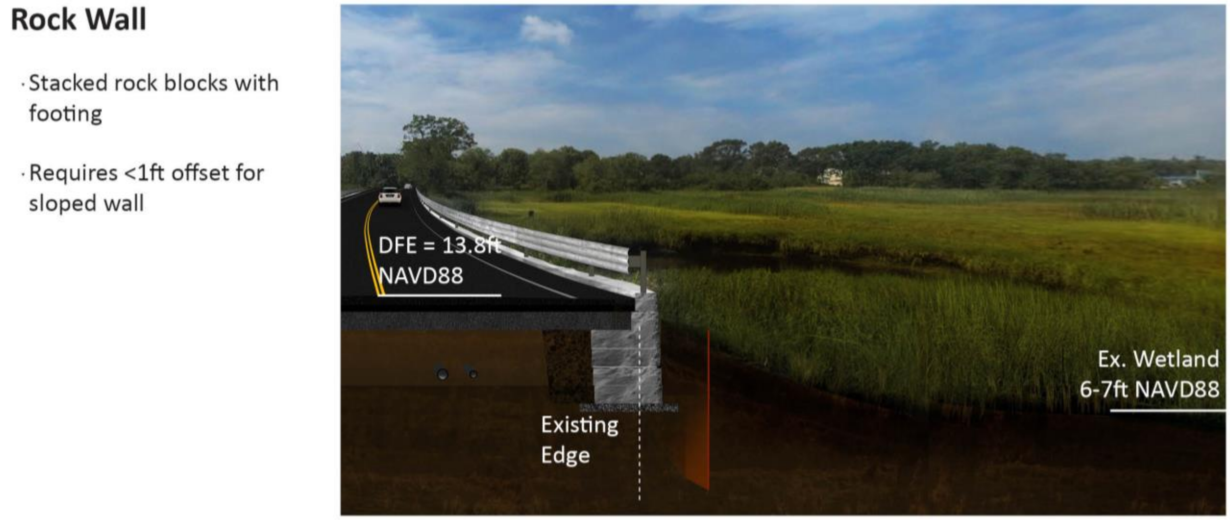


Figure 4-3: Conceptual Cross-Section of Raised Access Road with Rock Wall

<u>Permitting Requirements:</u>

Potential permits required for raising the causeway include the following:

- NHDES Wastewater Engineering Design Review
- Shoreland Permit:
  - Shoreland Application to the NH Department of Environmental Services (NH DES) Shoreland Program. This permit is anticipated because the subject property is located within 250ft of the Protected Shoreland which includes coastal waters and rivers, all land located within 250 feet of the reference line of public waters per RSA 483.B.4. XV.
- Standard Dredge and Fill Wetlands Permit Application – Major:
  - Major Impact Wetland Application to the NH Department of Environmental Services (NH DES) Wetlands Bureau. This project classification is based on Env-Wt 610.17 "a major project shall be (1) (1) Any dredging, filling, or construction activity, or any combination thereof, that is proposed to (a) occur within 100 feet of the HOTL; and (b) Alter any tidal shoreline bank, tidal flat, wetlands, surface water, or undeveloped uplands".
- Alteration of Terrain:
  - Alteration of Terrain Bureau Permit Application to the NH Department of Environmental Services (NH DES) Alteration of Terrain Bureau. This permit is anticipated because an AOT permit is needed when a project proposes to disturb more than 50,000 square feet of area within the Protected Shoreland. (May not be required if the only earthwork necessary is located at the causeway, if coupled with earthwork at WWTF the Permit will be necessary).

- 401 Water Quality Certification:
    - Water Quality Certification Application to the NH Department of Environmental Services (NH DES) Watershed Management Bureau. This permit is anticipated because Water Quality Certification under §401 of the federal Clean Water Act is required for any federally-licensed or permitted project that may result in a discharge into waters of the United States.

- Army Corps Permit ACOE IP:
    - An initial New Hampshire General Permits (GP's) Appendix B - Corps Secondary Impacts Checklist form will be submitted with the NHDES Major Impact Standard Dredge and Fill Application, at which time additional permitting requirements (e.g. Individual Permit) are anticipated from the ACOE based on the classification as a Major Impact project.

- Coastal Zone Management Act (CZMA) Federal Consistency Review with the New Hampshire Coastal Program:
    - This permit is anticipated because a Coastal Zone Management Act (CZMA) Federal Consistency Review is required for projects within the Coastal Zone of the New Hampshire Coastal Program when the proposed activity requires a non-federal applicant to obtain a federal license or permit (for example activities requiring U.S. Army Corps of Engineers Section 10 or 404 permits).

- Historic Properties- New Hampshire Division of Historic Resources. A Request for Project Review:
    - Section 106 Historical/Archaeological Resource Review with NH Division of Historical Resources (DHR). This review is required as part of a Major Impact project.

- Threatened and Endangered Species/ Biological Resources: The U.S. Fish and Wildlife Service's online tool, IPaC (Information for Planning and Consultation):
    - US Fish and Wildlife Service Information for Planning and Consultation (IPAC) Review. This review is required as part of a Major Impact project and because there is a federal nexus.
    - NH Natural Heritage Bureau (NHB) – Database Check. Complete an NHB database check to determine whether a proposed project could have potential impacts to rare species or critical habitat.

- National Marine Fisheries Service Coordination:
    - Based on the NHB database results and proposed project impact area, consultation with the National Marine Fisheries Service may be required per the Endangered Species Act and the Marine Mammal Protection Act.

- NH Fish & Game Coordination:
    - Based on the NHB database results coordination may be needed regarding construction timing restrictions.

Estimated Cost for Resiliency Option:

Conceptual level estimated costs for Permitting, Design and Construction of elevating the causeway roughly 3 feet in height for approximately 1,000 linear feet is as follows:

Table 4-1: Conceptual Costs for Raising Access Road

Option/Alternative	Estimated Cost
Vegetated Berm	$2.5M
Living Shoreline	$2.92M
Vinyl Sheet Pile	$3.68M
Block Wall	$3.1M

4.4.2 Flood-Proofing Vaults

Raising the entryways of vaults and/or constructing perimeter barriers is one practical way to accommodate flood waters at the WWTF and pump station site. There are three (3) vaults that have been identified as priority assets where accessibility must be maintained whenever possible: the influent screw pump vault, the WWTF flow metering vault, and the pump station metering vault.

Influent Screw Pump Vault:

The geometry of the influent screw pump channels must be considered when designing resiliency modifications to the influent vault. The three (3) screw pump channels, housing the screw pump augers, are directly connected to the influent vault. These channels begin below grade and extend to the headworks area of the influent building at a 45-degree angle. The channels are three sided, allowing access to the augers from the top side. The top sides are covered with fiberglass panels during operation. Given that the covers are not flood-proof, the lower portions of the channels (starting at grade up to the DFE) are vulnerable to flooding. Floodwaters entering the channels would have similar consequences to flood waters entering the vault itself (this was discussed further in Section 3.3.2). Raising the vault alone would not protect the influent channels.

Therefore, as an alternative to raising the vault, it is recommended that a concrete wall be built around the perimeter of the vulnerable areas. This wall would extend vertically to the DFE, and horizontally around the perimeter of the vault and bottom of the influent channels on both exterior sides of the structure. The wall would secure into the side of the influent channels, creating a flood-proof seal that will keep water up to the DFE out of both the channels and the vault.

During any modifications to the influent vault, it is recommended that the influent sluice gates are replaced, and controls are relocated above grade. The sluice gates are already outdated and in need of replacement. The controls are currently inside the vault and raising them above grade would prevent operators from entering the confined space. This would not only eliminate a safety hazard during flood conditions, but also during routine operation of the plant.

Flow Metering Vault and Pump Station Metering Vault:

Given the low grade of the top of these metering vaults, it is crucial that the structures are raised to prevent flooding. For both vaults, the concrete top slab and access hatch should be removed, and additional concrete sections should be cast (or precast sections may be added). The additional concrete sections should extend as necessary so the top slab will reach the DFE. A new top slab should be cast with a water-tight access hatch, as an extra precaution.

While conducting modifications to the vaults, existing joints and cracks should be sealed and select internal components should be replaced. Sealing joints and cracks will prevent groundwater from entering the vault, which has already begun to occur in the flow metering vault. This is due to groundwater following the path of least resistance through the bedding of the pipes and entering the annular space between the piping and the vault. If the structural concrete is not properly waterproofed, the vaults will continue to fill with water as groundwater rise intensifies in the future. There is a need for replacing equipment due to age, and due to water damage that has already occurred to some components.

Permitting Requirements:

There would be minimal permitting required for raising/modifying vaults. NHDES Wastewater Engineering Design Review would be required.

Estimated Cost for Resiliency Option:

Conceptual level estimated costs for Permitting, Design and Construction of vault modifications are as follows:

Table 4-2: Conceptual Costs for Vault Modifications

Option/Alternative	Estimated Cost
Influent Screw Pump Vault Modifications	**$132,500**
Flow Metering Vault (including new meter)	**$75,000**
Route 286 Pump Station Vault (including new internals)	**$75,000**

4.4.3 Raising of Critical Equipment and Controls

Several critical electrical components were identified as being at high risk of flooding during a 2050 storm surge scenario. If no campus-wide flood protection, or building specific flood prevention measures are implemented, there are possible ways to reduce the risk of flooding to these specific components:

Main Transformer:

The concrete equipment pad of the main transformer may be raised above the DFE. If implemented, this project should include replacement in-kind of the existing transformer, which was recently inspected and is in need of replacement in the near future. Additionally, the project would include the extension/waterproofing of local conduit as necessary.

Operations Building Electrical Components:

The operations building contains electrical equipment that is critical to the operation of the WWTF. The standby generator, the source of emergency plant power, may be raised to the DFE by modifying its concrete equipment pad, or casting a new pad. The MCC should also be raised above the DFE. For this to occur, all components would have to be temporarily taken offline and relocated while modifications are made to the existing electrical enclosure(s).

Sludge Building Electrical Components:

In the sludge disposal building, there are several low-lying components on the first floor and basement that could be damaged by floodwaters. These components could be raised, similarly to the components in the operations building.

Permitting Requirements:

There would be minimal permitting required for raising critical equipment and controls. Potential permits include:

- Building Permit
- NH State Electrical Permit
- NHDES Wastewater Engineering Design Review

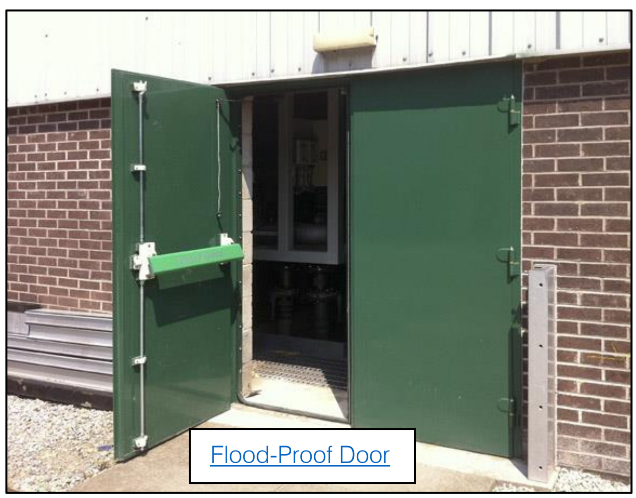
Estimated Cost for Resiliency Option:

Conceptual level estimated costs for Permitting, Design and Construction of raising critical equipment and controls are as follows:

Table 4-3: Conceptual Costs for Raising Controls and Equipment	
Option/Alternative	Estimated Cost
Raise Pad to Main Transformer (includes Transformer)	$61,000
Raise Generator, MCC & Electrical Equipment	$135,000
Raise Sludge Disposal Building Electrical	$67,500

4.4.4 *Flood-Proof Entryways*

One simple, yet effective way of accommodating 2050 storm surge flooding at the WWTF and pump station would be to flood-proof all building entryways. All critical buildings at the WWTF are constructed of concrete and are therefore essentially flood-proof, except for the entryways (doors, windows, vents, etc.). All doors and other entry points for floodwaters beneath the DFE may be sealed off to protect the entire building from flooding. If done properly, this would eliminate the need to raise internal components above grade in anticipation of internal flooding.



Flood-Proof Door

There are multiple solutions to floodproofing entryways that are both permanent and temporary. Flood-proof doors and hatches are a great permanent solution for protecting building and vault internals from temporary floodwaters. Flood-proof components can be sized to match the existing entryways, and little to no modification would be required. This strategy is easily the least intrusive and simplest way to protect the WWTF and pump station buildings. Appendix D includes additional information on flood-proof doors and water-tight hatches.

One limitation to flood-proof doors and hatches is that they cannot be opened while the exterior of the structures are flooded. To combat this limitation, flood proof doors could be used in conjunction with deployable/demountable flood barriers (discussed in Section 4.4.5). One select entryway of each building could be modified to open inwards and fitted with a demountable barrier. If there is an emergency reason to enter the building while the site is flooded, staff could climb over the demountable barrier and open the door inward to enter the building. It should be noted that flood-proof entryways currently do not meet the Americans with Disabilities Act (ADA) requirements for doorways. Therefore, modifications would be required to meet the current standards.

Permitting Requirements:

There would be minimal permitting required for installing flood proof entryways. Potential permits include:

- Building Permit
- NHDES Wastewater Engineering Design Review

Estimated Cost for Resiliency Option:

Conceptual level estimated costs for Permitting, Design and Construction of permanent flood-proof entryways are as follows:

Table 4-4: Conceptual Costs for Flood-Proof Entryways

Option/Alternative	Est. Cost Per EA	Estimated Cost
Flood-Proof Entry Ways Single Door	$27,000	$216,000
Flood-Proof Entry Ways Double Door	$40,500	$364,500
Total		**$580,500**

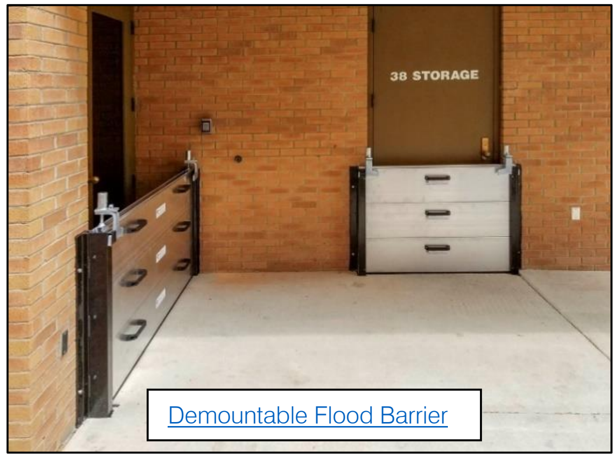
*Eight (8) Single Width Doors and Seven (7) Double Width Doors at WWTF
**Two (2) Double Width Doors at Pump Station

4.4.5 Deployable Flood Barriers

A great alternative to flood-proof doors are deployable barriers. Deployable flood barriers are defined as a barrier system that is deployed before and/or during a flood event and retracted after a flood event. Deployable barrier system types vary and include, but are not limited to, barriers that are:

- Pre-installed or partially pre-installed at the location of deployment.
- Mobile, i.e. units brought to the location of deployment, constructed, and then removed, such as sand bags;
- Passive systems that deploy and retract automatically based on flood levels without human intervention or electricity;
- Rigid hard structures (i.e. walls);
- Soft flexible structure (i.e. membranes);
- Stackable or with features to adjust height of flood protection during an event;
- Tubes filled with air or water;
- Containers filled with water or aggregate (soil or rock);
- Standalone flood defense systems; and/or connected to permanent flood protection barriers (such as reinforced walls and doors).

Demountable Barriers for Entryways:

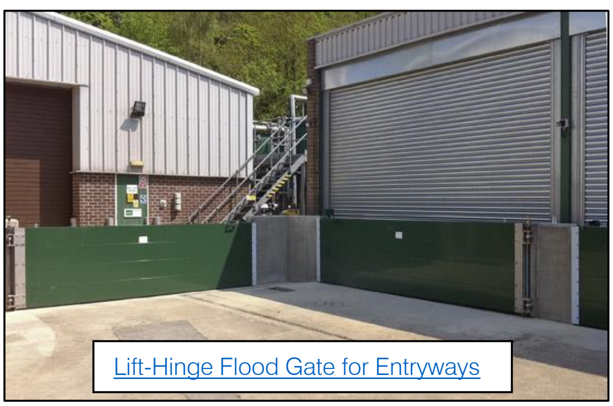


Demountable Flood Barrier

One simple and cost-effective deployable type is a demountable panel barrier. This is a partially pre-installed, rigid, and stackable type barrier consisting of watertight panels that are stacked vertically in front of building entryways. The barrier frames would be pre-installed with watertight seals on the exterior faces of the buildings. Before storm surge flooding is expected, staff can simply place the panels into the frames to create a barrier to flood waters. The panels come in a standard height of 12 inches. The system may be designed to accommodate the stacking of four panels, which would allow four feet of flood protection above the existing floor elevation. The top of the four-foot barriers would be at an approximate elevation of 14 feet (depending on the building), which is just over the DFE. Further investigation and review of the ADA requirements for doorways and barriers should be completed to confirm the demountable flood barriers meet ADA current standards and requirements.

Lift-Hinged Flood Gates:

The demountable panels are only available in spans up to 10 feet. For larger entryways, such as the roll-up garage doors at the sludge disposal buildings, lift-hinged flood gates may be used instead. These gates would mount to the building exterior in a similar fashion to the demountable flood barriers. The gates would be completely pre-installed. Before an expected flood event, staff would only need to swing the gate over and latch it shut. The lift-hinge flood barrier system could also be used for individual pieces of equipment throughout the facility, such as the main transformer.



Lift-Hinge Flood Gate for Entryways

Lift-Hinge Flood Gate for Equipment

It should be noted that flood proof doors and/or barricading entryways with flood gates/deployables will not work for every building on site. These strategies only work for buildings that are constructed of cast concrete or masonry blocks. Certain structures, like the steel-frame maintenance/storage garage, will be susceptible to flood damage even if the building entrance is protected. Rather than protect the contents of the maintenance garage, it is recommended that all vehicles, equipment, etc. are moved to a safe location prior to projected flood events.

Permitting Requirements:

There would be minimal permitting required for the installation of temporary or deployable flood barriers. Potential permits include:

- Building Permit
- NHDES Wastewater Engineering Design Review

Estimated Cost for Resiliency Option:

Conceptual level estimated costs for Permitting, Design and Construction of temporary or deployable barriers are as follows:

Table 4-5: Conceptual Costs for Deployable Flood Barriers		
Option/Alternative	Est. Cost Per EA	Estimated Cost
Deployable Flood Barriers- Single Door	$7,425	$59,400
Deployable Flood Barriers- Double Door	$12,825	$115,425
Total		**$174,825**

*Eight (8) Single Width Doors and Seven (7) Double Width Doors at WWTF
**Two (2) Double Width Doors at Pump Station

4.5 Resist

Resist strategies, also referred to as protection strategies in this report, are recommended when the risk from coastal flooding is high and the tolerance for flooding is low. Resistance measures involve the addition of a physical barrier between flood waters and vulnerable assets with the goal of keeping water out. Example flood protection measures include deployable flood barriers, sea walls, flood protection berms, or concrete gravity walls.

Potential protection options that were evaluated include:

- Develop living shorelines around the perimeter of the WWTF.
- Construct a vegetated berm around the perimeter of the WWTF.
- Install permanent vinyl sheet pile barrier around the perimeter of the WWTF.
- Install deployable flood barriers around the perimeter of the WWTF.

The approach to flood protection would be the same for each of the resistance measures considered. Each alternative shall: establish a perimeter around Wright's Island that is structurally resilient enough to withstand a 100-year storm surge; satisfy the height requirements for the DFE; and prevent floodwaters from inundating the WWTF campus. These alternatives may be implemented in conjunction with accommodation measures for the access road, such as raising the road with a vegetated berm or sheet piling. Figure 4-4 depicts the alignment around the facility perimeter where protection measures would be constructed to protect the facility from flooding.

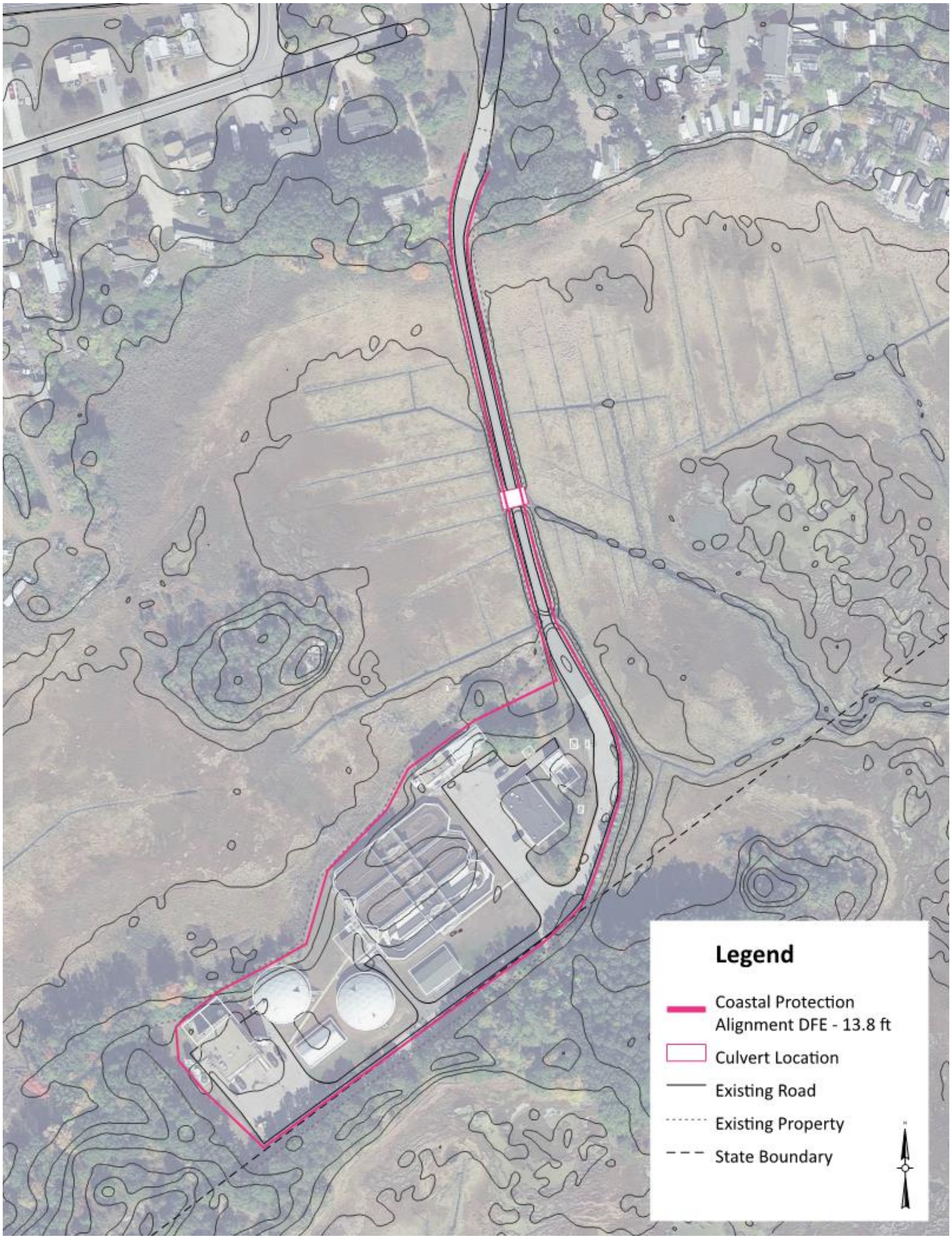


Figure 4-4: Coastal Protection Alignment for Resistance Measures

This climate resilience approach has both benefits and drawbacks. One benefit is that the WWTF could operate as usual during an extreme storm event, provided barriers are properly and prematurely deployed (this step could be avoided if the Town were to implement a permanent flood barrier system). Resisting flood waters entirely would also eliminate a substantial safety hazard for operators who need to move about the facility. Furthermore, if this strategy were utilized in addition to or instead of accommodation measures, it would eliminate the risks associated with using accommodation measures alone. Accommodation measures were designed to serve select assets, and therefore not all WWTF components may be equally protected, and some may not be protected at all. The negative aspects of permanent full-site flood resistance include substantial capital costs and permitting requirements. Depending on the alternative, the environmental impact to the surrounding salt marsh may be severe.

It should be noted that the cost and permitting requirements for the following protection options were evaluated for the WWTF site only. However, these options may be adapted to the pump station campus as well.

4.5.1 Vegetated Berm

A vegetated berm is a type of earthen embankment or levee designed and constructed to prevent flood waters from reaching downstream areas. The berm would be constructed at a 3:1 slope which would extend into the wetlands. The construction of a permanent berm would require extensive cut and fill, extending into the adjacent wetland. Not only would this flood protection option be extremely costly, but it would have the greatest impact on wetlands, in particular salt marsh. Additionally, the berm would be susceptible to erosion and would require regular maintenance. Vegetation should be planted across the berm to combat erosion and scour. Alternatively, riprap may be installed across the slopes. One benefit of this approach is it would be possible to incorporate a living shoreline into the project, which would help to offset environmental impact and reduce erosion of the berm.


Construction of a Vegetated Berm

Prior to the construction of a vegetated berm, a geotechnical investigation should be conducted to evaluate slope stability, potential for settlement, seepage, and scour. The berm should be designed in accordance with the United States Army Corps of Engineers (USACOE) guidance provided in EM 1110-2-1913, Design and Construction of Levees. Design of a berm should account for the estimated settlement by providing additional freeboard. Design considerations would also need to be made to prevent seepage underneath the berm (underseepage). Underseepage control may be accomplished by cutoff walls such as steel sheeting or an impervious trench, flood-side or dry-side blankets, dry-side seepage berms, pressure relief wells, and/or pervious toe trenches as described in EM 1110-2-1913 and EM 1110-2-2502.

4.5.2 Living Shoreline

A living shoreline is an optional protection measure that may be incorporated into the implementation of a vegetated berm. Living Shorelines are a means of controlling coastal erosion and wave action by mimicking natural coastal habitats. In addition to native vegetation, shorelines may be fitted with low-profile rock structures, biodegradable organic materials, stone containment, oyster castles, and reef balls. Living shorelines reduce energy of coastal storm surge while allowing for the continuation of important natural processes that maintain the health of the broader coastal system.

Living Shoreline

A living shoreline could be developed along the exterior slope of the vegetated berm and extend beyond the berm into the adjacent wetlands. It is estimated that approximately 50 feet of land would be required to build the living shoreline at a gradual slope (in addition to the area required for the berm).

While the shoreline would likely aid in erosion control of the berm (if implemented properly), there are a few complications that must be considered. Vegetation across the entire living shoreline would not be maintainable until SLR conditions occur. Additionally, the effectiveness of living shorelines is not proven.

4.5.3 Vinyl Sheet Pile Barrier

Vinyl Sheet pile barriers are a low-impact, cost-effective option for permanent site perimeter flood protection. The modular sheet piles were low-maintenance, lightweight, and relatively easy to install. The sheet piles would be driven into the ground along the perimeter alignment. The depth of driving would be determined during a thorough geotechnical investigation. The geotechnical investigation may determine that this approach was entirely infeasible due to soft, organic clay or silty soils. Significant earthwork would be required, but substantially less than for a full levee. Wetland impacts would also be limited, as this option requires no permanent wetlands footprint.

Vinyl Sheet Pile Barrier

4.5.4 Permitting Requirements for Permanent Flood Barriers

Potential permits required for installing permanent barriers around the WWTF include the following:

- Shoreland Permit:
    - Shoreland Application to the NH Department of Environmental Services (NH DES) Shoreland Program. This permit is anticipated because the subject property is located

within 250ft of the Protected Shoreland which includes coastal waters and rivers, all land located within 250 feet of the reference line of public waters per RSA 483.B.4. XV.

- Standard Dredge and Fill Wetlands Permit Application – Major:
  - Major Impact Wetland Application to the NH Department of Environmental Services (NH DES) Wetlands Bureau. This project classification is based on Env-Wt 610.17 "a major project shall be (1) (1) Any dredging, filling, or construction activity, or any combination thereof, that is proposed to (a) occur within 100 feet of the HOTL; and (b) Alter any tidal shoreline bank, tidal flat, wetlands, surface water, or undeveloped uplands".

- Alteration of Terrain:
  - Alteration of Terrain Bureau Permit Application to the NH Department of Environmental Services (NH DES) Alteration of Terrain Bureau. This permit is anticipated because an AOT permit is needed when a project proposes to disturb more than 50,000 square feet of area within the Protected Shoreland.

- 401 Water Quality Certification:
  - Water Quality Certification Application to the NH Department of Environmental Services (NH DES) Watershed Management Bureau. This permit is anticipated because Water Quality Certification under §401 of the federal Clean Water Act is required for any federally-licensed or permitted project that may result in a discharge into waters of the United States.

- Army Corps Permit ACOE IP:
  - An initial New Hampshire General Permits (GP's) Appendix B - Corps Secondary Impacts Checklist form will be submitted with the NHDES Major Impact Standard Dredge and Fill Application, at which time additional permitting requirements (e.g. Individual Permit) are anticipated from the ACOE based on the classification as a Major Impact project.

- Coastal Zone Management Act (CZMA) Federal Consistency Review with the New Hampshire Coastal Program:
  - This permit is anticipated because a Coastal Zone Management Act (CZMA) Federal Consistency Review is required for projects within the Coastal Zone of the New Hampshire Coastal Program when the proposed activity requires a non-federal applicant to obtain a federal license or permit (for example activities requiring U.S. Army Corps of Engineers Section 10 or 404 permits).

- Historic Properties- New Hampshire Division of Historic Resources. A Request for Project Review:
  - Section 106 Historical/Archaeological Resource Review with NH Division of Historical Resources (DHR). This review is required as part of a Major Impact project.

- Threatened and Endangered Species/ Biological Resources: The U.S. Fish and Wildlife Service's online tool, IPaC (Information for Planning and Consultation:

  - US Fish and Wildlife Service Information for Planning and Consultation (IPAC) Review. This review is required as part of a Major Impact project and because there is a federal nexus.
  - NH Natural Heritage Bureau (NHB) – Database Check. Complete an NHB database check to determine whether a proposed project could have potential impacts to rare species or critical habitat.

- National Marine Fisheries Service Coordination:
  - Based on the NHB database results and proposed project impact area, consultation with the National Marine Fisheries Service may be required per the Endangered Species Act and the Marine Mammal Protection Act.

- NH Fish & Game Coordination:
  - Based on the NHB database results coordination may be needed regarding construction timing restrictions.

- NHDES Wastewater Engineering Design Review

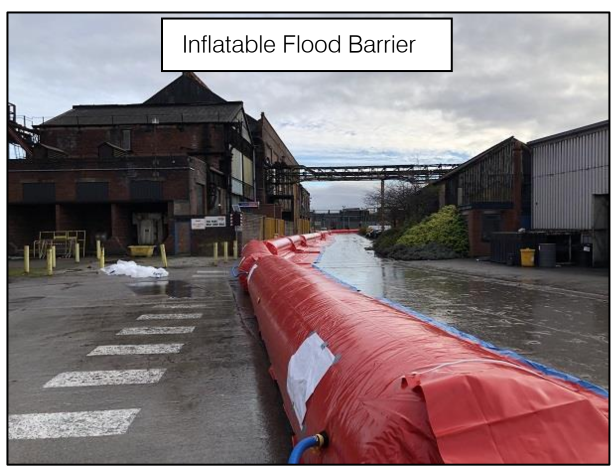
Estimated Cost for Resiliency Option:

Conceptual level estimated costs for the Permitting, Design and Construction of roughly 2,000 linear feet of permanent barriers are as follows:

Table 4-6: Conceptual Costs for Permanent Flood Protection Options		
Option/Alternative	Est. Cost Per LF	Estimated Cost
Vegetated Berm	$1,350	**$2.7M**
Living Shoreline	$1,550	**$3.1M**
Vinyl Sheet Pile	$750	**$1.5M**

*Costs include implementation of options around the perimeter of Wright's Island, not including the access road.

4.5.5 Deployable Flood Barriers



There are multiple types of deployable flood barriers that are suitable for deployment across the perimeter of the WWTF campus to provide resistance to flooding. The three variations that were considered were membrane flood barriers, modular flood barriers, and inflatable flood barriers. These barriers are intended to be deployed only during storm events and should not remain deployed once flood waters have receded.

Membrane Flood Barriers:

This type of deployable barrier is a passive system that uses floodwater to seal and stabilize the flexible structure. They are reusable and often cheaper than other deployable solutions. One advantage of membrane barriers over rigid barriers is they can be used on various surfaces and do not require site modifications. They can be deployed across the perimeter alignment without modifying the existing grade. Proper planning and preparation should be conducted prior to storm events to ensure there is a clear deployment path across the perimeter that is unobstructed from rocks, debris, and/or large vegetation. Although membrane barriers are relatively simple to deploy and clean up, the process may be very time consuming. This variety of barrier does not offer much protection from high-velocity flooding and wave action.

Figure 4-5: Before and After Photographs of Membrane Flood Barriers

Modular Flood Barriers:

Modular flood barriers are rigid, yet passive, structures that can be constructed of a wide range of materials. Similarly to membrane barriers, modular barriers use the energy of floodwaters to deploy. No fastening or fill material is required, as each panel is individually self-stabilized by the weight of the water.

Creating a suitable perimeter surface for the deployment of modular barriers may be more labor intensive than the process for a flexible barrier. Modular barriers, such as the AquaFence product pictured in figure 4-6, require a relatively flat surface to allow for proper stabilization of the rigid structure. The site perimeter may need to be leveled in some areas, in addition to removing rocks, debris, and large vegetation. One advantage of modular flood barriers is that they are typically more resilient than flexible barriers and may be reused dozens of times. Additionally, the deployment and storage of the barrier panels may be more efficient than flexible barriers.

Figure 4-6: Before and After Photographs of Modular Flood Barriers

<u>Inflatable Flood Barriers:</u>

Inflatable barriers are flexible tubes that are inflated with water to form a barrier from flood waters. To inflate the barriers, staff may pump water from the marsh into the tube before a storm event. Similarly to the other deployable options, inflatable barriers would require a path around the site perimeter that is relatively flat and cleared from rocks and large vegetation. The size of available products would need to be evaluated to ensure a barrier is large enough to provide protection to the DFE around the entire perimeter of the site. Modifications to existing grade may be required. Additionally, installation of an inflatable barrier would likely require a forklift for proper positioning and adjustments after inflation.

Figure 4-7: Before and After Photographs of Inflatable Flood Barriers

Regardless of the type of deployable barrier, seepage through the ground into the protected area is to be expected. Seepage control pumps should be placed at low points throughout the facility to remove seepage water as it accumulates. Alternatively, one main seepage pump station could be constructed, along with a network of catch basins and seepage collection sewers. The existing catch basins and drainage piping on Wright's Island could possible be utilized, although further investigation would be required.

It is important to consider the risk of improper deployment and damage that exists for all types of deployable barriers. This risk is exacerbated by lengthy perimeter of the site. Additionally, it is important to consider the lengthy and intensive site preparation and deployment effort that would be required to protect the entire project area. It is recommended that further hydrodynamic analysis be performed to better understand the timing of when staff would initiate installation of the deployable barriers. The benefits of a hydrodynamic model are described in Section 7.

<u>Permitting Requirements:</u>

Permitting required for installation of temporary or deployable flood barriers would be minimal, and would depend on the type of deployable barrier, location and setbacks. NHDES Wastewater Engineering Design Review would likely be required.

<u>Estimated Cost for Resiliency Option:</u>

The conceptual level estimated cost for the Permitting, Design and Construction/Implementation of temporary or deployable barriers is roughly **$500,000-$600,000** or roughly $250-$300 per linear foot of temporary barrier. In addition, seepage pumps and/or seepage pump stations will be necessary to pump out seepage water within the deployable barrier perimeter. Costs for seepage pumps could range from $25,000 each for several remote seepage pumps or up to $350,000 for a main seepage pump station with collector basins and pumps.

Table 4-7: Conceptual Costs for Deployable Flood Protection Options		
Option/Alternative	Est. Cost Per LF	Estimated Cost
Deployable Flood Barrier	$250-$300	$500,00-$600,000
Seepage Pump Stations	-	$150,000-$350,000
Total		$650,000-$950,000

*Estimated costs include a range of $150,000 for 6 remote seepage stations or one main seepage pump station, including electrical, controls, and piping.

4.6 Relocate

Relocation, also referred to as retreat, is an acceptable strategy when the risk of coastal flooding is high and the tolerance for flooding is low. Relocation strategies accept that accommodation or protection measures may not be technically, financially, or politically possible, and instead aim to remove and/or relocate assets from vulnerable areas. Retreat strategies typically require a greater degree of planning and coordination than other protection and accommodation strategies. Examples of retreat strategies include the relocation of individual assets or entire facilities to low-risk areas.

Again, it is recommended that the existing WWTF and pump station facilities are protected and kept operational up through 2050 (the remainder of their useful lives). After this point in time, further investment into keeping the facilities operational is not recommended. After 2050, not only will the facilities have exceeded their useful lives, but much of the collection system and service area east of the WWTF will be underwater. Also, significant construction costs may be warranted to keep the plant operational due to the age of the facility. Furthermore, new more stringent Permit Limits will likely be required and may necessitate advanced technologies that are not currently operating at the WWTF.

As the plant nears the end of its useful life the Town should consider relocating the WWTF and abandoning Wright's Island. The new plant would be constructed on a new parcel, upland from the existing WWTF. The piping connections to the existing outfall could likely be reused. Given the modeled results for years beyond 2050 and looking toward 2100, the new WWTF may not be required to support the beach area as the homes in low lying areas will be inundated frequently and likely underwater.

Because the cost is significantly expensive and a major capital investment for the Town, it makes sense to plan for the relocation and plant overhaul together. Given the modeling results to 2050, the Town has adequate time to investigate the relocation and begin planning for and appropriating funds for this long-term project. It is not uncommon for a new WWTF to take 10-15 years from planning stages to operation. With this in mind, Table 4-8 outlines the recommended implementation schedule:

Table 4-8: Conceptual WWTF Relocation Schedule

Proposed Action	Approximate Schedule/Recommended Completion Dates
Submit for CWSRF Funding	2030
Facility Planning	2033
Facility Planning/ Public Approval	2034
Finalize Facility Planning	2035
Land Acquisitions/Easements	2040
Preliminary Design	2042
Final Design and Permitting	2045
Submit for CWSRF Funding	2045
Advertise & Commence Construction	2046
Complete Construction	2050

It is recommended that further hydrodynamic analysis be performed to better understand the timing of when the WWTF relocation would be required to allow ample time for the long-term relocation of the facility. The benefits of a hydrodynamic model are described in Section 7.

Permitting Requirements:

Potential permits required for relocating the WWTF include the following:

- NHDES WW Engineering Design Review
- Sewer Connection Permit
- Various other Permits based on technology, footprint and location of new WWTF

Estimated Cost for Resiliency Option:

Conceptual level estimated costs for Permitting, Design and Construction of a new WWTF may be in the range of roughly **$30-40M** in today's dollars (2021) and roughly **$60-80M** in 2050 dollars. Cost will be determined by the technology required for upcoming more stringent permit limits and the capacity of the WWTF. This estimate does not include the cost for land acquisition or easements. Assumptions have been made during cost estimating based on Weston & Sampson's experience on similar projects and recent local bids.

As an alternative to constructing another Town owned WWTF, Seabrook should consider regional solutions to wastewater treatment. There are several communities along the seacoast that will experience similar SLR and storm surge flooding and will need to invest in climate adaptation measures. Alternatively, these communities should look to regionalize wastewater infrastructure and wastewater treatment plants. This will lessen the financial burden on each community and provide cost-sharing opportunities for the operation and maintenance of the facilities.

4.7 Comparison of Climate Resilience Options

Table 4-7 contains a matrix that compares all the climate resilience options that were evaluated. The most preferable options (highest scoring) have a combination of low cost, low maintenance, effectiveness, and environmentally friendly aspects.

It is important to note that this matrix has certain limitations, and the indicated scores should not be the sole deciding factor when implementing adaptation options. While all five categories of adaptation options were included in the matrix, not all aspects of these options are directly comparable. For example, the retreat strategy, which received a below average score in the matrix, should not be ruled out purely due to other options having higher scores. This matrix does not take into account that the relocation strategy becomes much more attractive in the longer term, after the year 2050. In the shorter-term, prior to 2050, simpler options such as deployable flood barriers are the clear choice. After 2050, when other factors such as town-wide flooding become significant, the retreat alternative is clearly the best strategy.

Table 4-9. Comparison of Climate Resilience Options					
Resilience Option	Environmental Impact and Permitting	Construction Cost	Maintenance	Evidence of Success	Total Score
No Action	5	5	5	1	16
Avoid	5	5	5	1	16
Accommodate					
Road Raising - Berm	1	2	3	3	9
Road Raising - Berm with Living Shoreline	3	2	2	2	9
Road Raising - Sheet Pile	3	1	5	4	13
Road Raising - Rock Wall	2	2	5	3	12
Raising Vaults	5	5	5	5	20
Flood-Proof Entryways	5	4	5	4	18
Deployable Flood Barriers - Building Entryways	5	5	3	4	17
Raising of Equipment and Controls	5	5	4	3	17
Resist					
Vegetated Berm	1	2	3	3	9
Berm and Living Shoreline	3	2	2	2	9
Sheet Pile Permanent Barrier	3	3	5	4	15
Deployable Flood Barriers - Site Perimeter	4	4	1	3	12
Retreat	1	1	1	5	8

Lower score = less preferred
Higher score= more preferred

5.0 PUBLIC ENGAGEMENT

The Town of Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP) identified community engagement as a top priority and recommended providing informational materials about flood risk reduction to the public. Community outreach and engagement was also identified as a need in the 2015 Tides to Storms Vulnerability Assessment.

Informed by this context, a public engagement strategy was developed through a series of meetings and interviews with Town staff, DES, and the New Hampshire Costal Adaptation Workgroup (CAW). Informed by their input and additional research, the project team developed an Equitable Community Engagement Guide for Climate Resilient Projects. The Guide was intended to assist with conducting both equitable community outreach and engagement in Seabrook based on previous experiences, local and regional expertise, and existing resources. The Guide includes a summary of key target audiences, specific messaging about climate resilience, available communication and distribution channels, and steps to implement engagement efforts. This local playbook can be applied across project types and could inform the development of similar equitable engagement guides in other communities. Appendix E contains a copy of the Guide.

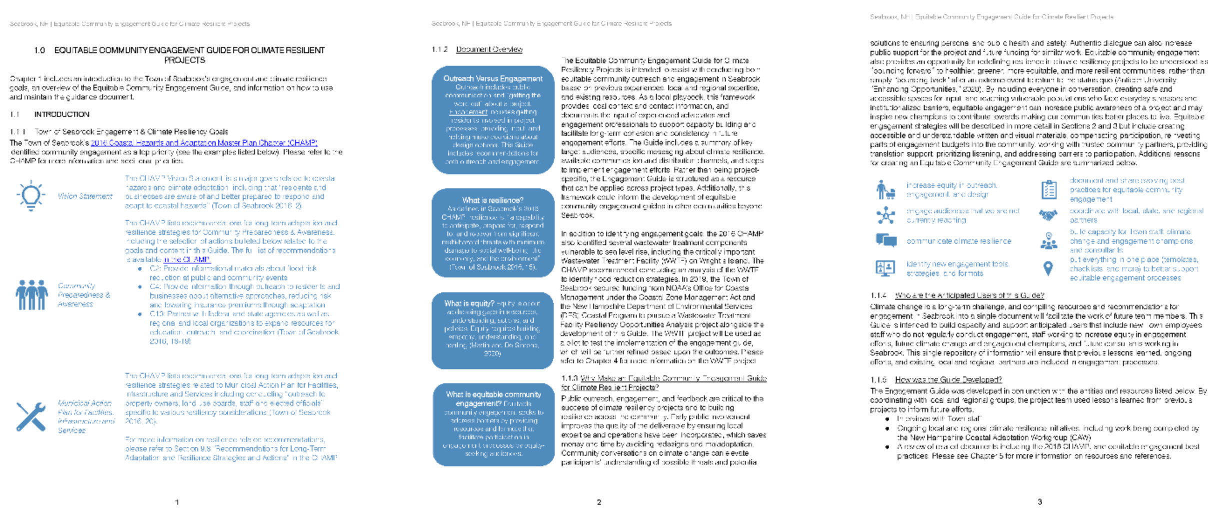


Figure 5-1: Pages from the Equitable Community Engagement Guide for Climate Resilient Projects

The Wastewater Treatment Facility Climate Resilience Assessment project was used as a pilot to test the implementation of the Guide. Through a series of calls and iterative review with the Town and DES, the project team created an educational video defining key terms and summarizing climate risks to the WWTF, conceptual resiliency strategies for flood mitigation, and next steps. The video was paired with an online comment form where residents could submit questions. The video was shared through the Town website, social media, and Channel 22. The video and comment form were advertised through social media posts, a press release, and direct outreach to key partners listed in the Engagement Guide. The video was posted on June 23, 2021, and the online comment form was active until July 7, 2021. No comments from the general public were received.

The video can be used as a tool during future meetings to introduce information about local climate risks and critical infrastructure. As part of the public engagement task for this project, the Town also gave a verbal presentation and overview of the project to the Board of Selectmen on April 19, 2021, supported by Weston & Sampson. Appendix E contains documentation of these engagement formats, including copies of meeting materials, social media posts, video stills, the comment form, and more.

Figure 5-2: Left: a frame from the educational video. Right: the online comment form.

6.0 CONCLUSION

The comparison of climate adaptation alternatives showed that the most cost-effective, environmentally friendly, and low-maintenance strategy would be to pursue accommodation measures in lieu of permanent or deployable full-campus protection measures. It is recommended that the Town pursue the design and implementation of measures that seal-off building and structure entryways and prevent floodwaters from entering, such as demountable flood barriers, flood-proof doors, and watertight hatches. The critical buildings and tanks on the WWTF campus are all constructed of concrete, and they are essentially waterproof except for the existing entryways. It would be feasible to create a flood-proof space and protect all internal components by flood-proofing all entryways. This individual accommodation approach is not only substantially cheaper than full campus flood protection measures, but it would prevent any environmental impact on the surrounding salt marsh. Table 6-1 below provides a compiled list of the recommended climate resilience options with their associated costs.

Table 6-1: Recommended Climate Resilience Options

Resilience Option	Total Score from Table 4-7	Description of Resilience Option		Conceptual Level Estimated Costs
Raising Vaults	20	Influent Screw Pump Vault Modifications: $132,500 Flow Metering Vault (including new meter): $75,000 Route 286 Pump Station Vault (including new internals): $75,000		$282,500
Deployable Flood Barriers - Building Entryways	17	Deployable Flood Barriers – Single Doors: $59,400 Deployable Flood Barriers – Double Doors: $115,425		$174,825
Raising of Equipment and Controls*	17	Raise Pad to Main Transformer (includes Transformer): $61,000		$61,000
			Subtotal	$518,325
			10% Contingency	$51,832
			Total	**$570,157**

*Raising of Generator, MCC, Electrical Equipment and Sludge Disposal Building Electrical would not be required if flood barriers are installed or deployed in front of building accessways and doors.

It should be noted that deployable flood barriers were recommended to flood-proof building entryways instead of water-tight doors even though deployable barriers scored lower on the comparison matrix. This was because flood-proof doors were substantially more expensive than the deployable barrier alternative, and the operational benefits of the doors do not offset the cost difference. Additionally, the recommended demountable barriers offer the benefit of allowing access to buildings while the site is actively flooded.

If this approach is implemented, it will be necessary to further investigate redundant and remote equipment and controls to be operated off-site from the WWTF and pump station. By not installing perimeter flood barriers, Wright's Island and the pump station campus would be allowed to flood. Depending on the extent of flooding, staff may not be able to access the treatment facility and pump station. To keep the facilities operational, fully redundant equipment, controls, automation, and communication would be required. It the Town were to pursue this recommendation, a thorough review and testing of plant redundant systems should be conducted. The cost for this investigation was not included in this report.

Raising vaults, raising the transformer, and installing deployable flood barriers at doorways will not be effective at reducing flood risk forever. After 2050, the most effective way of reducing flood risk to the WWTF and pump station would be to relocate the WWTF. It is important to consider that relocation of the WWTF would require substantially more time and effort to implement than the short-term climate resilience options. Figure 6-1 below provides an overview of when planning and implementation efforts for these projects should begin. The figure also indicates how long these resilience strategies will be effective at reducing flood risk once implemented. Refer to Table 4-8 and Section 4.6 for a detailed breakdown of the implementation process for relocating the WWTF.

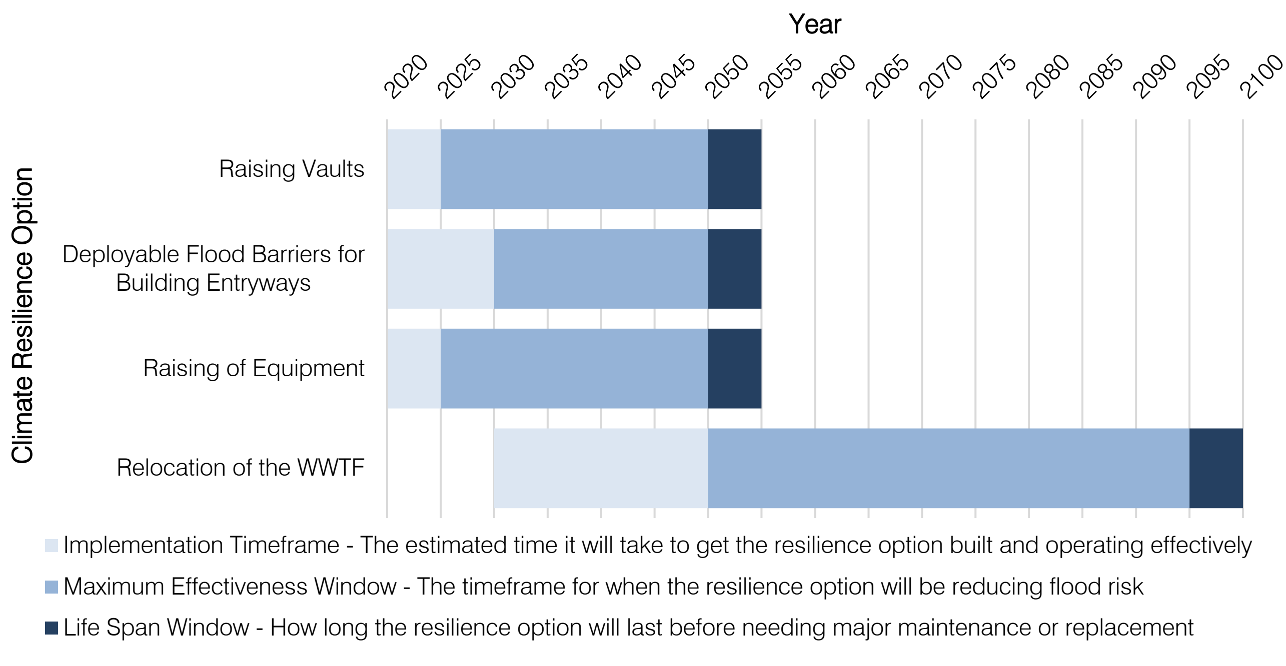


Figure 6-1: Implementation and Effectiveness Timeline for Climate Resilience Options

The next steps for implementing the recommended climate resilience options include:

1. Present project findings to the Town of Seabrook Board of Selectmen.

2. Develop a hydrodynamic coastal flood model to further quantify flood timing/duration, freshwater inputs, and other dynamic factors, as discussed in Section 7 below.

3. Preferred conceptual adaptation options should be studied further in a preliminary design, which may include:

    a. Additional survey investigation to confirm the elevations of all potential flood pathways into buildings and structures prior to the design and implementation of climate resilience measures.

    b. Further investigation into buoyancy of existing structures at the WWTF and the influence of projected groundwater rise. It is recommended that further investigation be performed to confirm groundwater elevations by drilling and installing groundwater monitoring wells.

    c. Investigation into the redundancy of WWTF equipment, controls, automation, and communication.

4. Stakeholders should meet with regulatory agencies to determine what projects were permittable.

5. Develop a budget that meets the spending goals set in the Town's capital improvement plan. This may include implementing smaller projects to satisfy budget requirements.

6. Apply for low-interest loans and grant funding to support.

7. Final design, permitting, and construction.

8. Develop a wastewater facilities plan for 2050 and beyond.

This climate resilience study has allowed the Town of Seabrook to look further into the vulnerability of their most critical wastewater, and public health, asset, the WWTF. The findings of this study should be considered when construction and repair is undertaken at the WWTF and Route 286 Pump Station. Furthermore, NHDES has funded and administered an asset management program, an energy audit, and now a climate resilience assessment for the Town of Seabrook. Further discussion is warranted to review methods for incorporating the data collected during the energy audit and climate resilience assessment efforts into their asset management program to enable data-driven decision making.

7.0 LIMITATIONS

The modeling approach used in this project to understand the impacts of sea level rise and storm surge impacts at the WWTF site is primarily a bathtub approach. While this approach provides a planning level estimate of flooding impacts at the site from sea level rise and storm surge, it has limitations in terms of accurately predicting flood impacts and variability of these impacts at the WWTF site and in the surrounding areas. This section briefly describes five key limitations of the bathtub modeling approach and how these can be overcome by developing a hydrodynamic model for the larger study area.

1. The water surface elevation projected by simply adding storm surge to mean higher high water is a static approach and does not consider the dynamic interaction of storm surge, tides, waves, wind speeds and wind directions, which can be simulated using a hydrodynamic model.

2. The bathtub approach results in maximum static water surface elevations for the study area and does not factor the spatial variations in bathymetry, topography, waves, tide, and surge conditions that may result in spatially variable maximum water surface elevations at the WWTF site and surrounding areas. This implies that a hydrodynamic model can simulate more accurate different flood elevations at different locations within the WWTF site, the pump station and surrounding areas. These spatially variable water surface elevations from a hydrodynamic model may result in flood elevations that are different from the values used in this project and can inform more accurate flood resilience design standards that need to be adopted for the WWTF site and the surrounding areas.

3. The water surface elevations estimated from the bathtub approach are based on single deterministic values from a single event corresponding to a 100-year storm surge event and does not consider the probabilistic nature of water surface elevations that can result from a range or ensemble of flood events. The 100-year storm surge is an approximation and is not an accurate representation of the future 1% annual flood elevation in the study area. True probabilistic based water surface elevations for present and future climate scenarios can be determined by developing a probabilistic hydrodynamic coastal flood model that simulates several thousands of historical and hypothetical storms to estimate percent probabilities over a range (e.g. 2050 and 2100 water surface elevations for 20%, 10%, 1%, 0.2% percent probabilities).

4. The bathtub modeling approach does not have the ability to account for combined flood risks from extreme precipitation and sea level rise and storm surge. Flood impacts from extreme precipitation can be evaluated using a site-specific hydrologic/hydraulic (H/H) model for the WWTF site and the surrounding areas. To better understand the joint flood risks from coastal flooding and freshwater flooding, an integrated hydrodynamic model will need to be developed, which can factor peak flows from the H/H model coupled with dynamic tide and storm surge conditions simulated from the hydrodynamic coastal flood model.

5. Finally, and most importantly, a static bathtub model does not provide any indication in terms of duration of flooding. Understanding flood duration in terms of parameters, such as how long it takes for peak storm surge to reach a site, how long the flood waters persist at specific elevation thresholds, and how long it takes for flood waters to recede below a particular threshold are

critical considerations for flood resilience operations and response planning efforts. For example, deploying temporary flood barriers at the WWTF site or the pump station will need to be accompanied by a robust flood response plan that will track the advancement of a storm in terms of flood elevation and timing of when the flood barriers need to be brought out from storage, tested and deployed to mitigate flood impacts. This type of flood response planning can only be conducted using a hydrodynamic coastal flood model.

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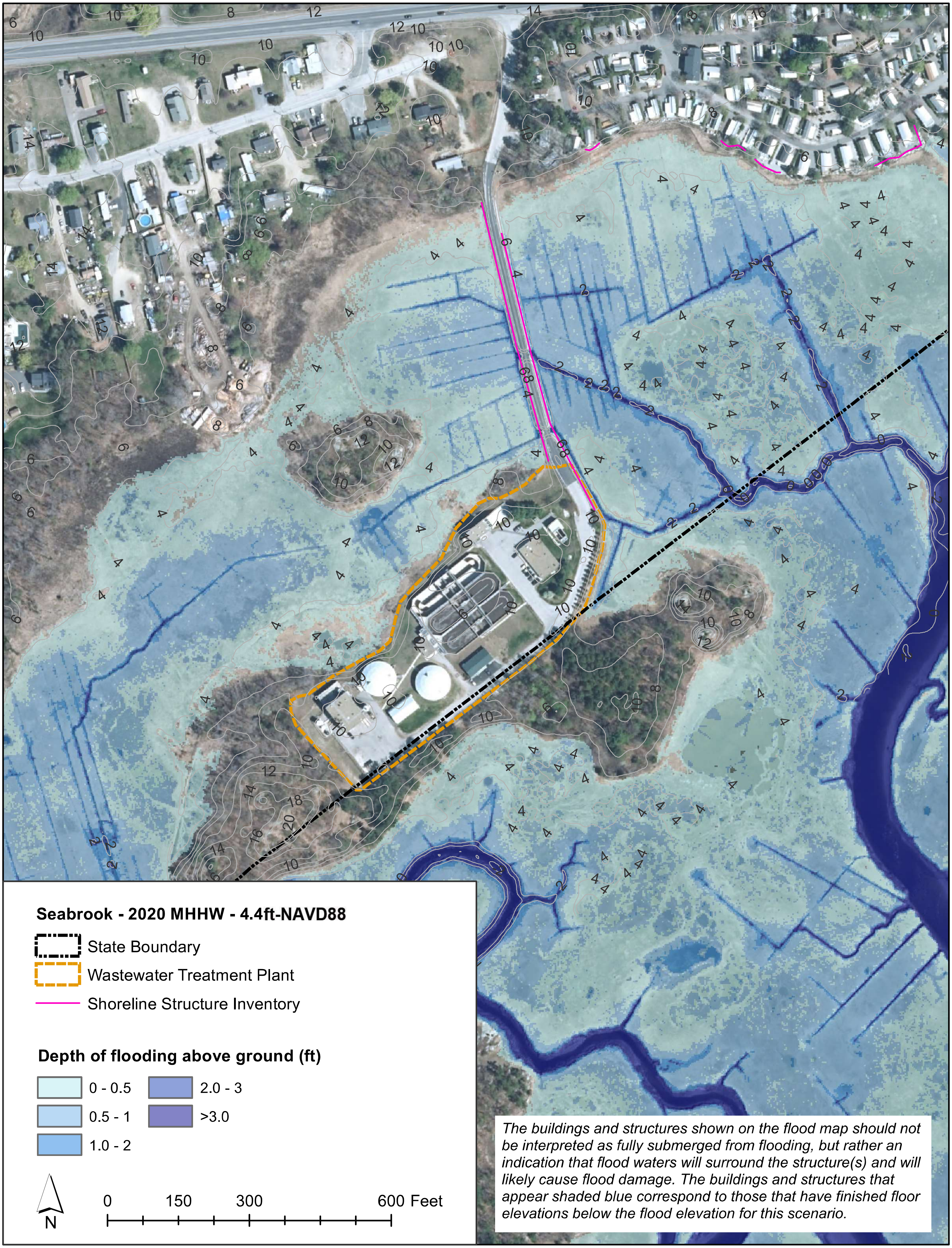
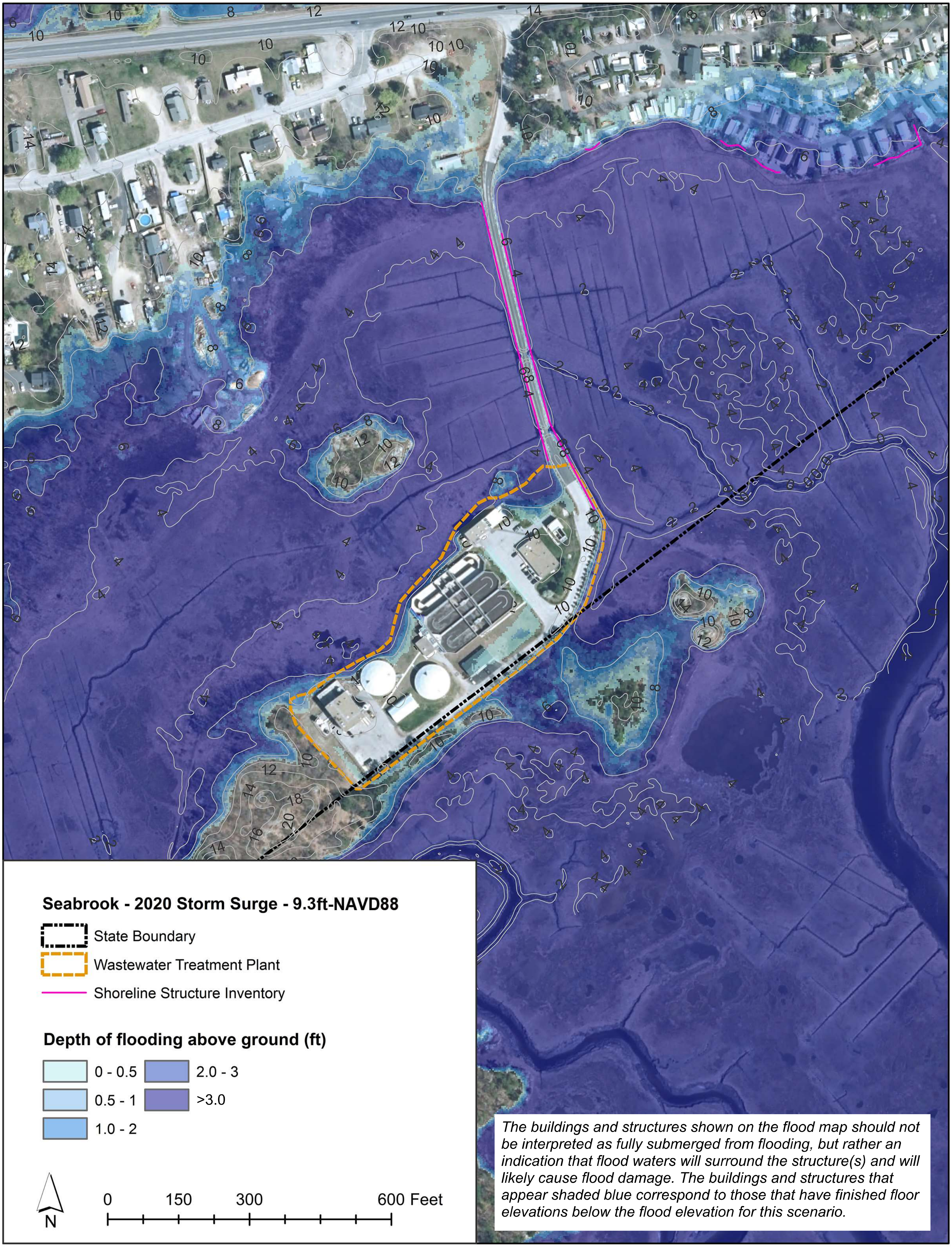
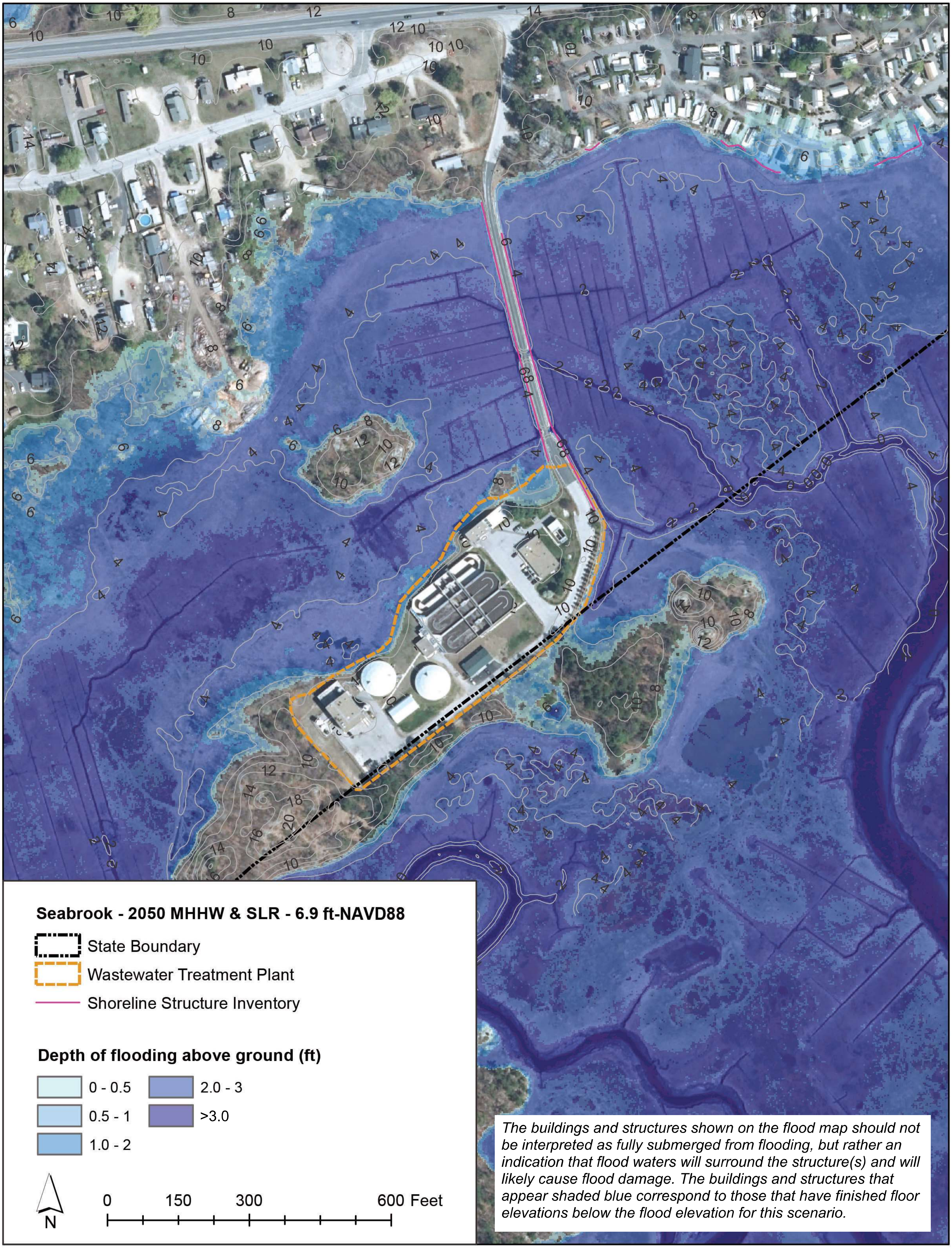
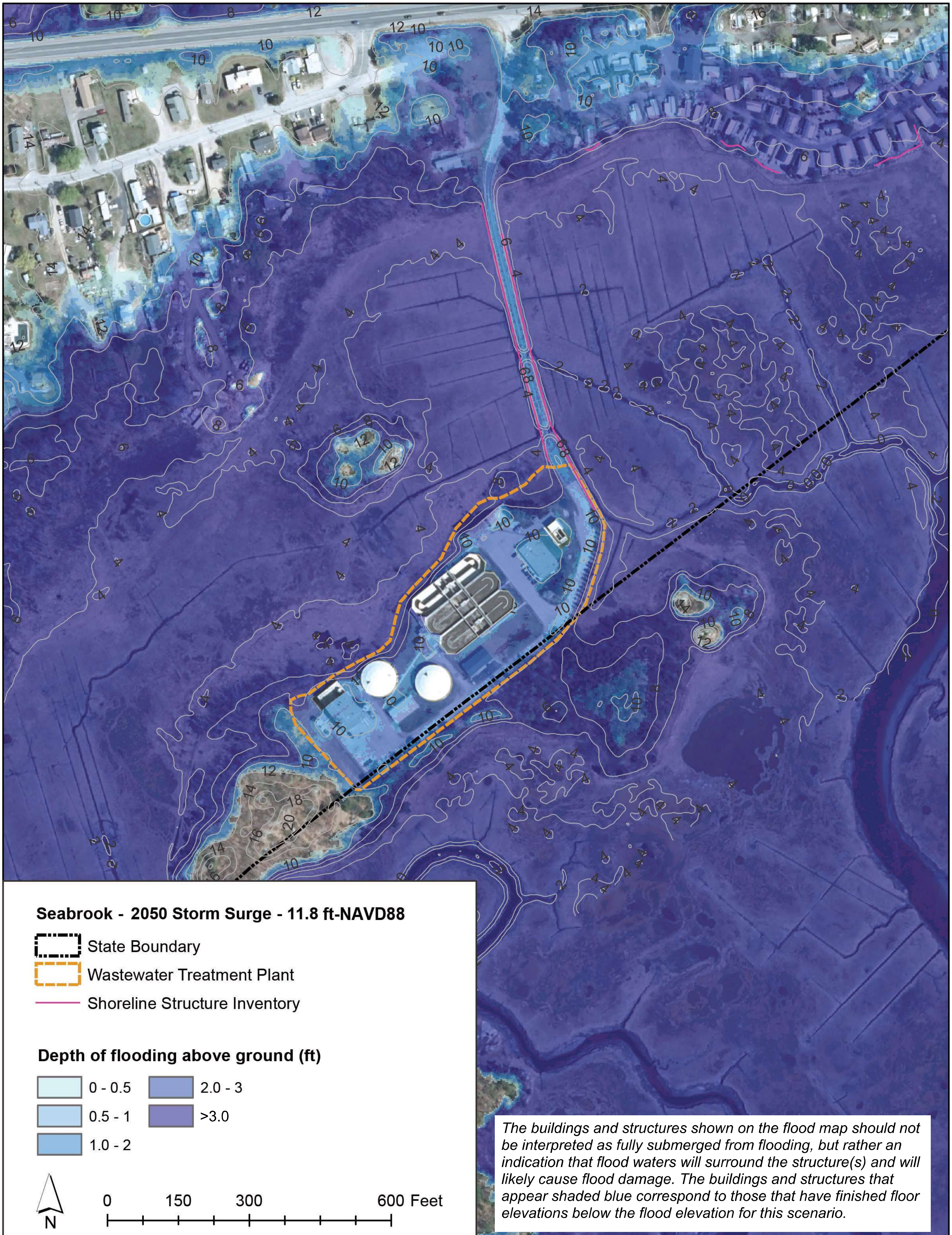
APPENDIX A

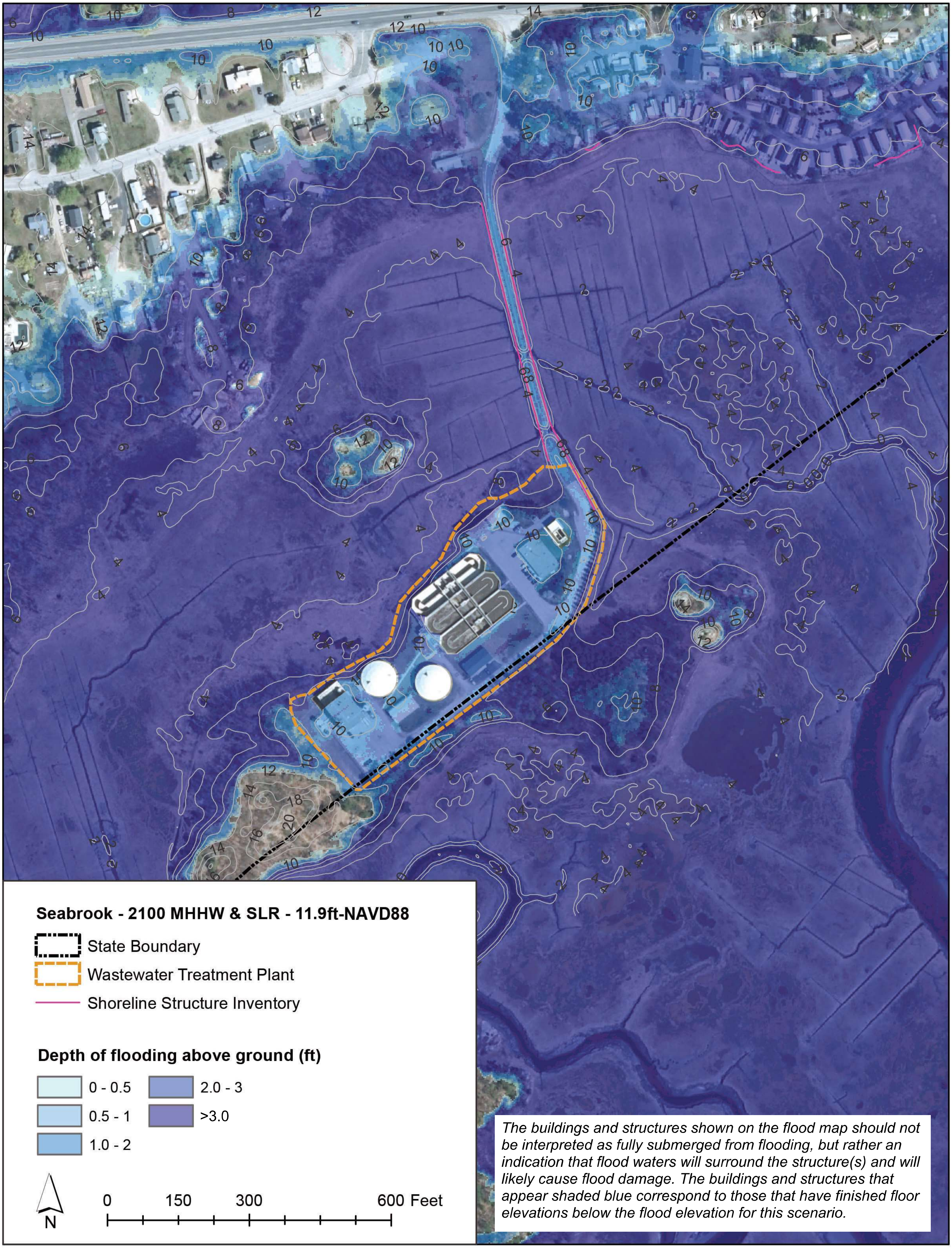
WWTF and Pump Station Inundation Maps

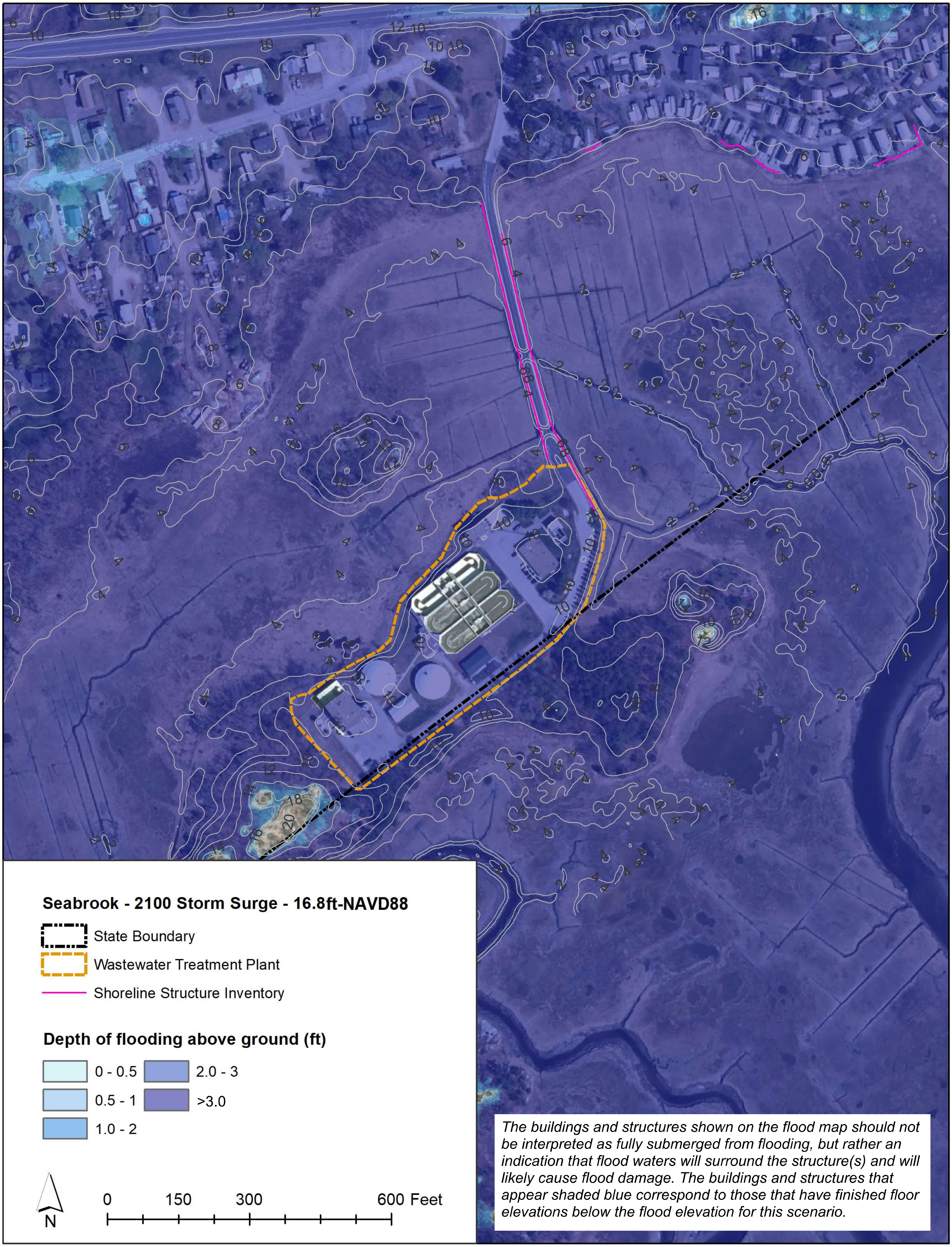

Seabrook - 2020 MHHW - 4.4ft-NAVD88
State Boundary
Wastewater Treatment Plant
Shoreline Structure Inventory
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
150
300
600 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.


Seabrook - 2020 Storm Surge - 9.3ft-NAVD88
State Boundary
Wastewater Treatment Plant
Shoreline Structure Inventory
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0 150 300 600 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.


Seabrook - 2050 MHHW & SLR - 6.9 ft-NAVD88
State Boundary
Wastewater Treatment Plant
Shoreline Structure Inventory
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0 150 300 600 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.

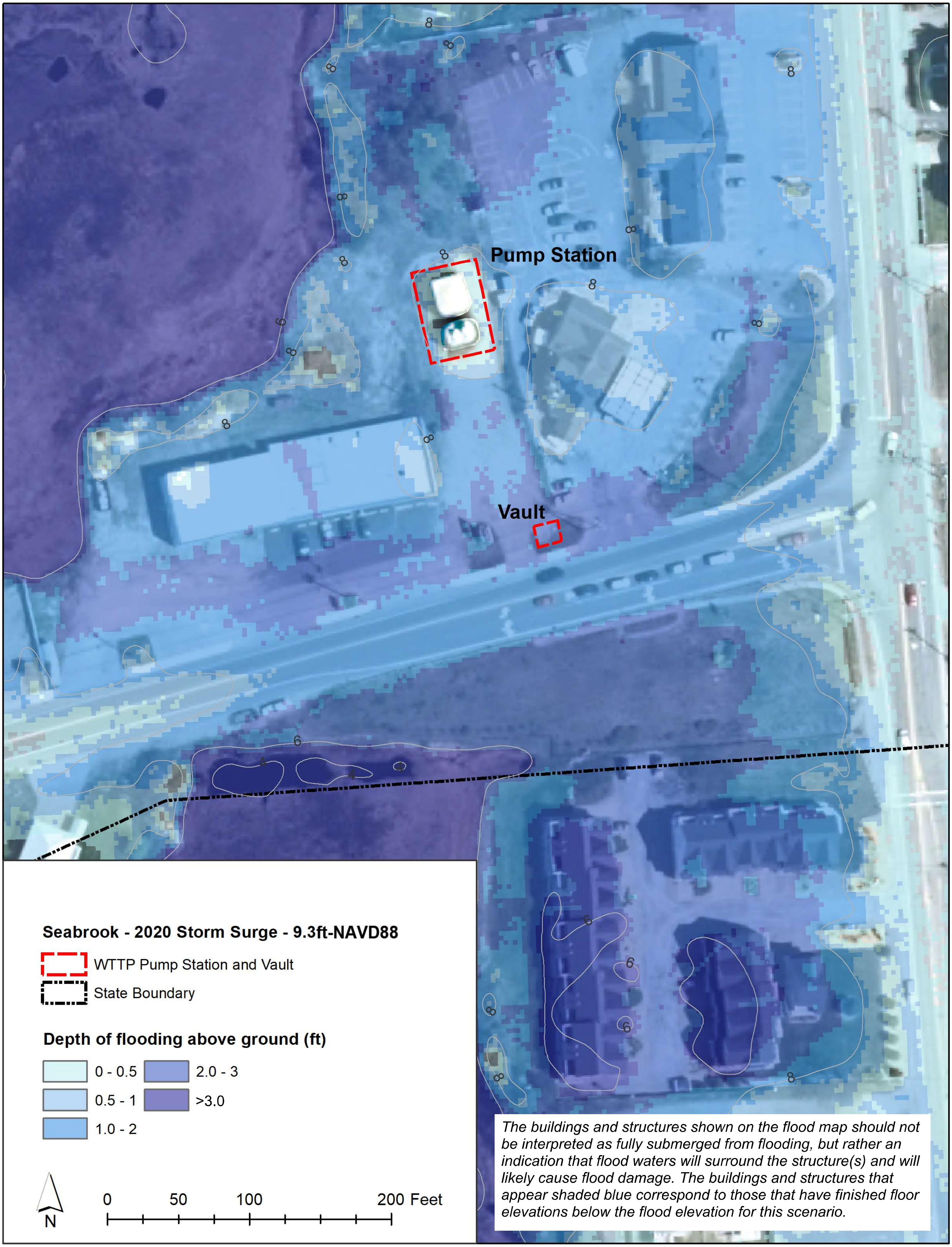

Seabrook - 2050 Storm Surge - 11.8 ft-NAVD88
State Boundary
Wastewater Treatment Plant
Shoreline Structure Inventory
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
150
300
600 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.


Seabrook - 2100 MHHW & SLR - 11.9ft-NAVD88
State Boundary
Wastewater Treatment Plant
Shoreline Structure Inventory
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
150
300
600 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.



Seabrook - 2100 Storm Surge - 16.8ft-NAVD88
State Boundary
Wastewater Treatment Plant
Shoreline Structure Inventory
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0 150 300 600 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.


Pump Station
Vault
Seabrook - 2020 MHHW - 4.4ft-NAVD88
WTTP Pump Station and Vault
State Boundary
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
50
100
200 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.



Pump Station
Vault
Seabrook - 2020 Storm Surge - 9.3ft-NAVD88
WTTP Pump Station and Vault
State Boundary
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
50
100
200 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.


Pump Station
Vault
Seabrook - 2050 MHHW & SLR - 6.9 ft-NAVD88
WTTP Pump Station and Vault
State Boundary
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
50
100
200 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.

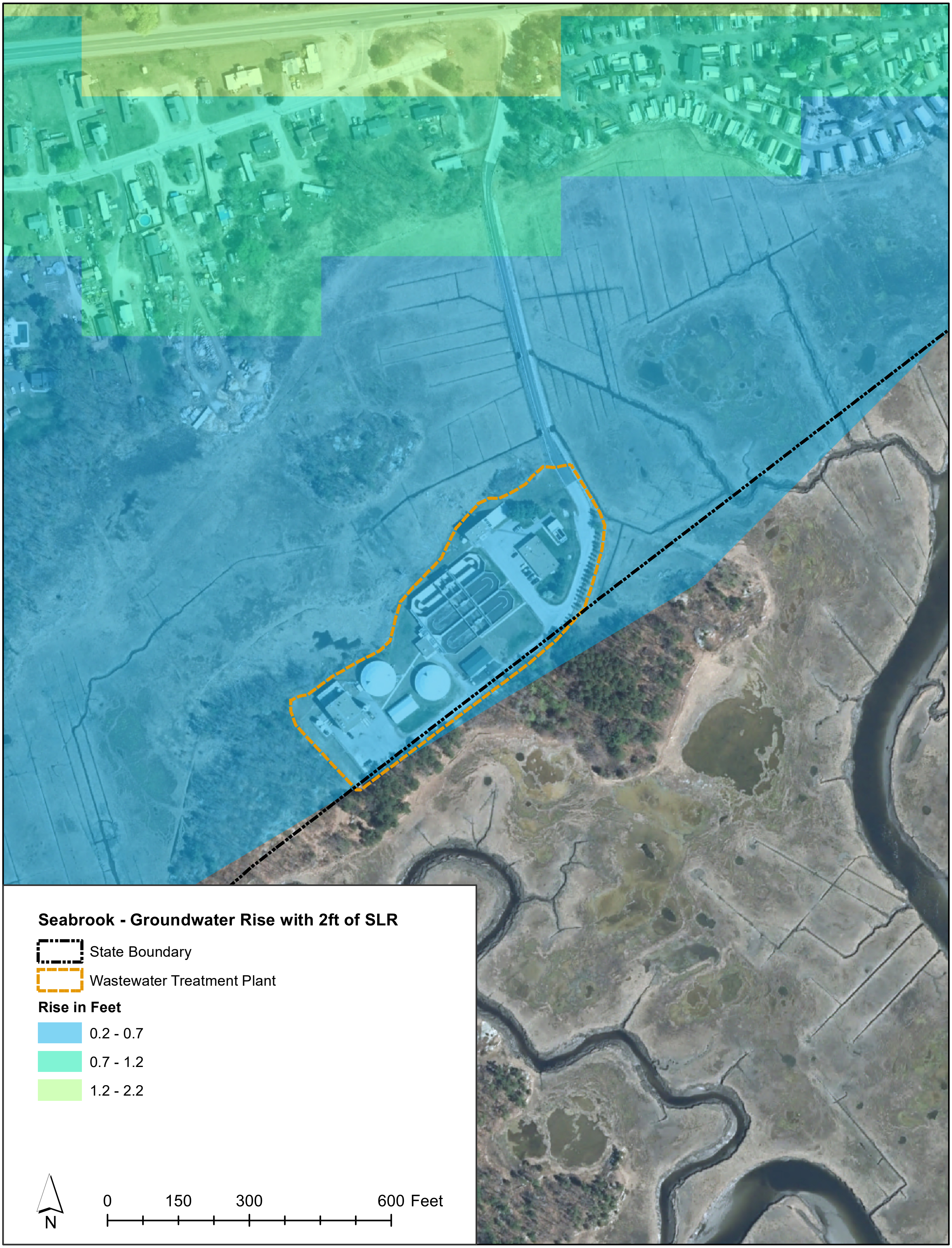

Pump Station
Vault
Seabrook - 2050 Storm Surge - 11.8 ft-NAVD88
WTTP Pump Station and Vault
State Boundary
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
50
100
200 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.


Pump Station
Vault
Seabrook - 2100 MHHW & SLR - 11.9ft-NAVD88
WTTP Pump Station and Vault
State Boundary
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0
50
100
200 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.

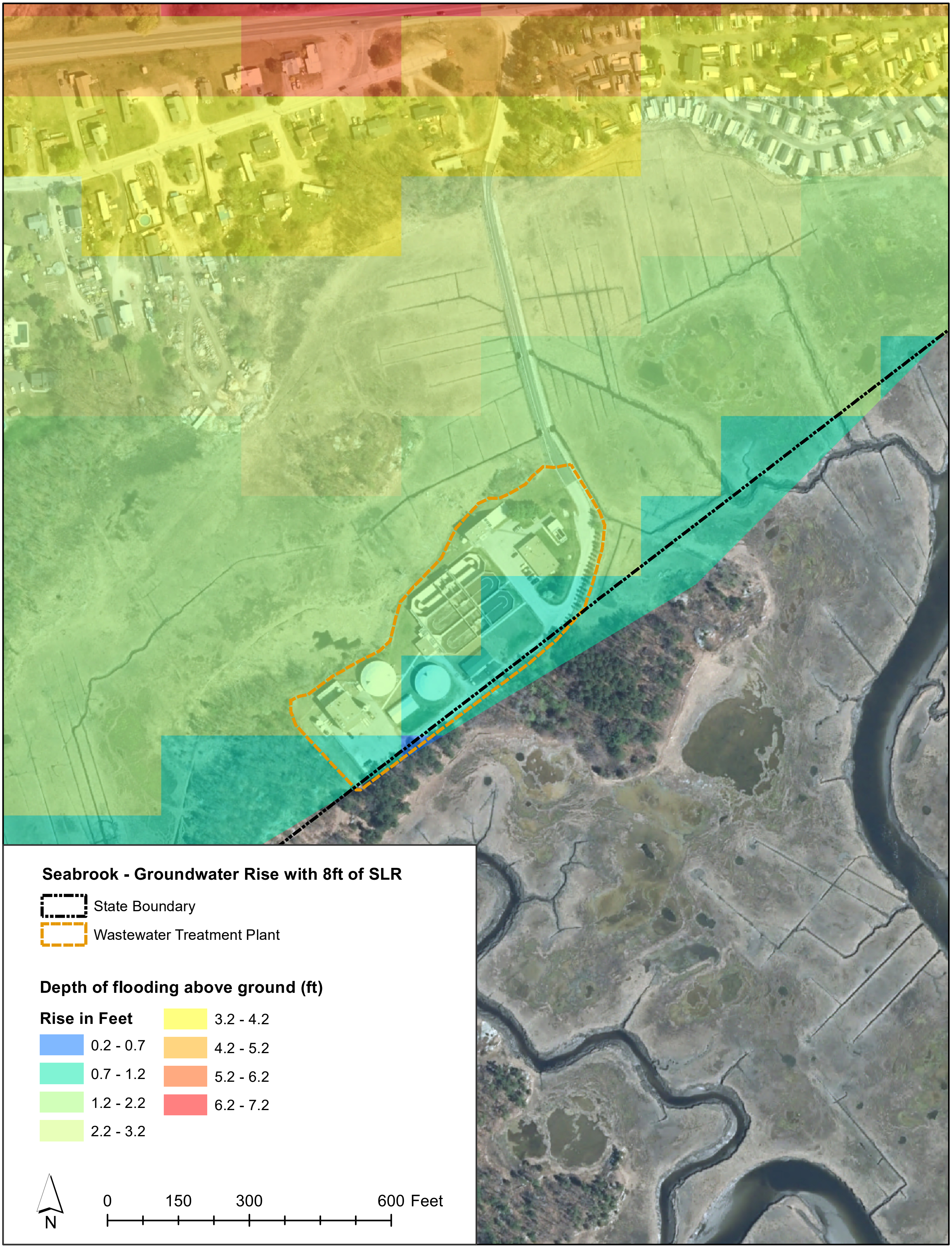
Pump Station
Vault
Seabrook - 2100 Storm Surge - 16.8ft-NAVD88
WTTP Pump Station and Vault
State Boundary
Depth of flooding above ground (ft)
0 - 0.5
0.5 - 1
1.0 - 2
2.0 - 3
>3.0
N
0 50 100 200 Feet
The buildings and structures shown on the flood map should not be interpreted as fully submerged from flooding, but rather an indication that flood waters will surround the structure(s) and will likely cause flood damage. The buildings and structures that appear shaded blue correspond to those that have finished floor elevations below the flood elevation for this scenario.

APPENDIX B

WWTF Groundwater Rise Maps



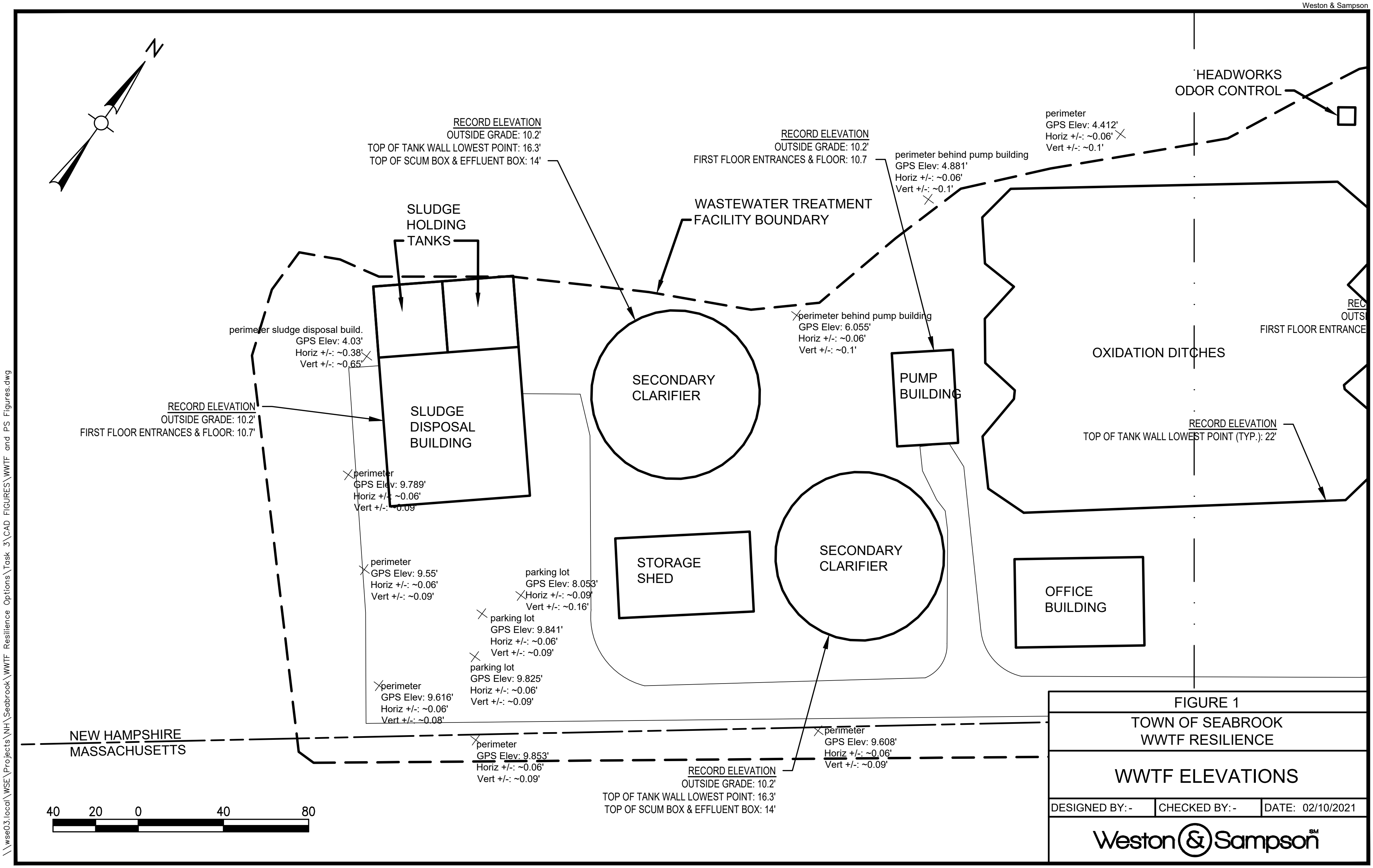
Seabrook - Groundwater Rise with 2ft of SLR
State Boundary
Wastewater Treatment Plant
Rise in Feet
0.2 - 0.7
0.7 - 1.2
1.2 - 2.2
N
0
150
300
600 Feet



Seabrook - Groundwater Rise with 8ft of SLR
State Boundary
Wastewater Treatment Plant
Depth of flooding above ground (ft)
Rise in Feet
0.2 - 0.7
0.7 - 1.2
1.2 - 2.2
2.2 - 3.2
3.2 - 4.2
4.2 - 5.2
5.2 - 6.2
6.2 - 7.2
N
0
150
300
600 Feet

APPENDIX C

WWTF and Pump Station Record and GPS Elevation Figures


N
HEADWORKS
ODOR CONTROL
RECORD ELEVATION
OUTSIDE GRADE: 10.2'
TOP OF TANK WALL LOWEST POINT: 16.3'
TOP OF SCUM BOX & EFFLUENT BOX: 14'
RECORD ELEVATION
OUTSIDE GRADE: 10.2'
FIRST FLOOR ENTRANCES & FLOOR: 10.7
perimeter behind pump building
GPS Elev: 4.881'
Horiz +/-: ~0.06'
Vert +/-: ~0.1'
perimeter
GPS Elev: 4.412'
Horiz +/-: ~0.06'
Vert +/-: ~0.1'
SLUDGE
HOLDING
TANKS
WASTEWATER TREATMENT
FACILITY BOUNDARY
perimeter behind pump building
GPS Elev: 6.055'
Horiz +/-: ~0.06'
Vert +/-: ~0.1'
perimeter sludge disposal build.
GPS Elev: 4.03'
Horiz +/-: ~0.38'
Vert +/-: ~0.65'
SECONDARY
CLARIFIER
PUMP
BUILDING
OXIDATION DITCHES
RECORD ELEVATION
OUTSIDE GRADE: 10.2'
FIRST FLOOR ENTRANCES & FLOOR: 10.7'
SLUDGE
DISPOSAL
BUILDING
RECORD ELEVATION
TOP OF TANK WALL LOWEST POINT (TYP.): 22'
perimeter
GPS Elev: 9.789'
Horiz +/-: ~0.06'
Vert +/-: ~0.09'
STORAGE
SHED
SECONDARY
CLARIFIER
OFFICE
BUILDING
perimeter
GPS Elev: 9.55'
Horiz +/-: ~0.06'
Vert +/-: ~0.09'
parking lot
GPS Elev: 8.053'
Horiz +/-: ~0.09'
Vert +/-: ~0.16'
parking lot
GPS Elev: 9.841'
Horiz +/-: ~0.06'
Vert +/-: ~0.09'
parking lot
GPS Elev: 9.825'
Horiz +/-: ~0.06'
Vert +/-: ~0.09'
perimeter
GPS Elev: 9.616'
Horiz +/-: ~0.06'
Vert +/-: ~0.08'
NEW HAMPSHIRE
MASSACHUSETTS
perimeter
GPS Elev: 9.853'
Horiz +/-: ~0.06'
Vert +/-: ~0.09'
perimeter
GPS Elev: 9.608'
Horiz +/-: ~0.06'
Vert +/-: ~0.09'
RECORD ELEVATION
OUTSIDE GRADE: 10.2'
TOP OF TANK WALL LOWEST POINT: 16.3'
TOP OF SCUM BOX & EFFLUENT BOX: 14'
40 20 0 40 80
\\wse03.local\WSE\Projects\NH\Seabrook\WWTF Resilience Options\Task 3\CAD FIGURES\WWTF and PS Figures.dwg
FIGURE 1
TOWN OF SEABROOK
WWTF RESILIENCE
WWTF ELEVATIONS
DESIGNED BY: -
CHECKED BY: -
DATE: 02/10/2021
Weston & Sampson

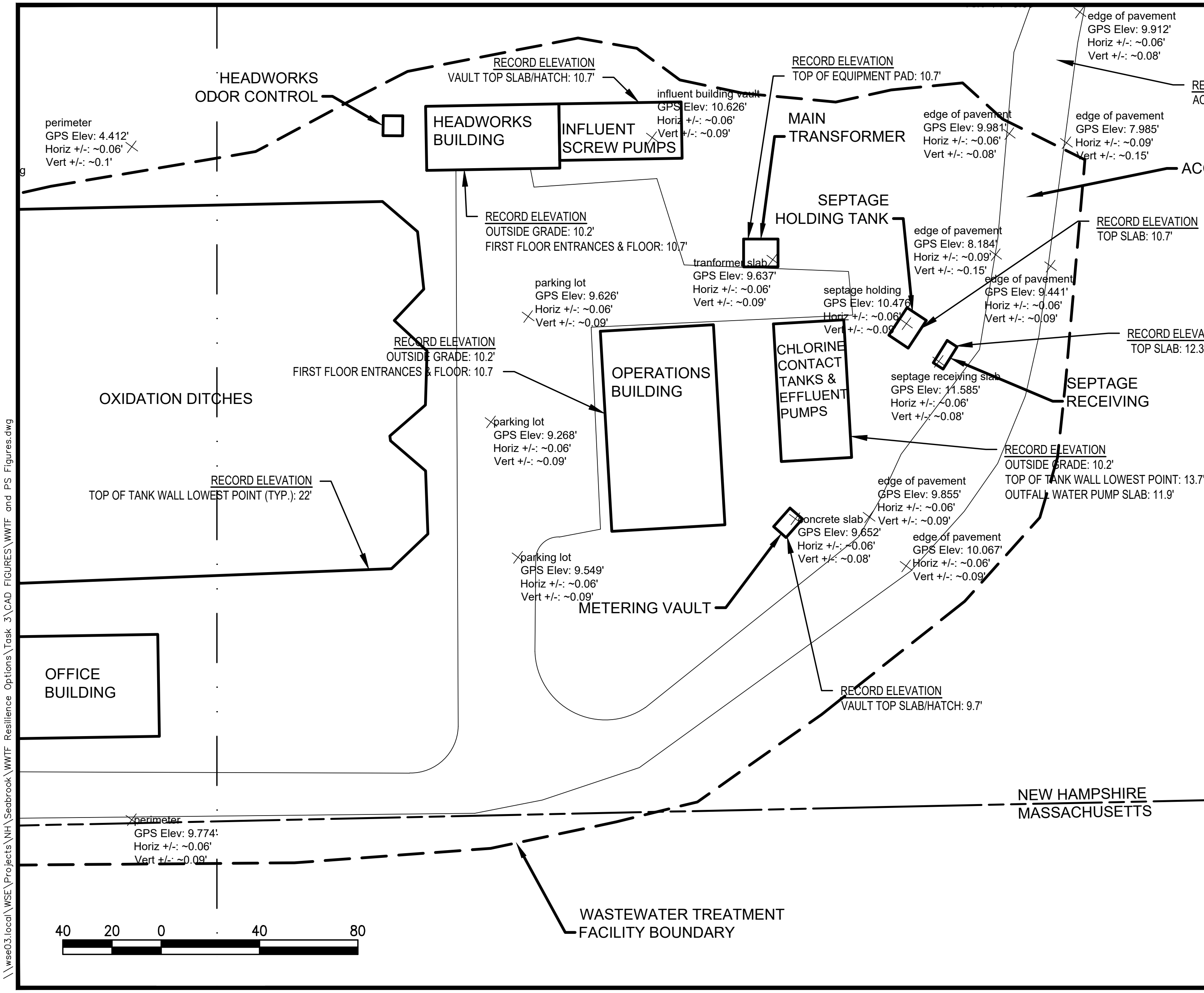


FIGURE 2		
TOWN OF SEABROOK WWTF RESILIENCE		
WWTF ELEVATIONS		
DESIGNED BY: -	CHECKED BY: -	DATE: 02/10/2021
Weston & Sampson		

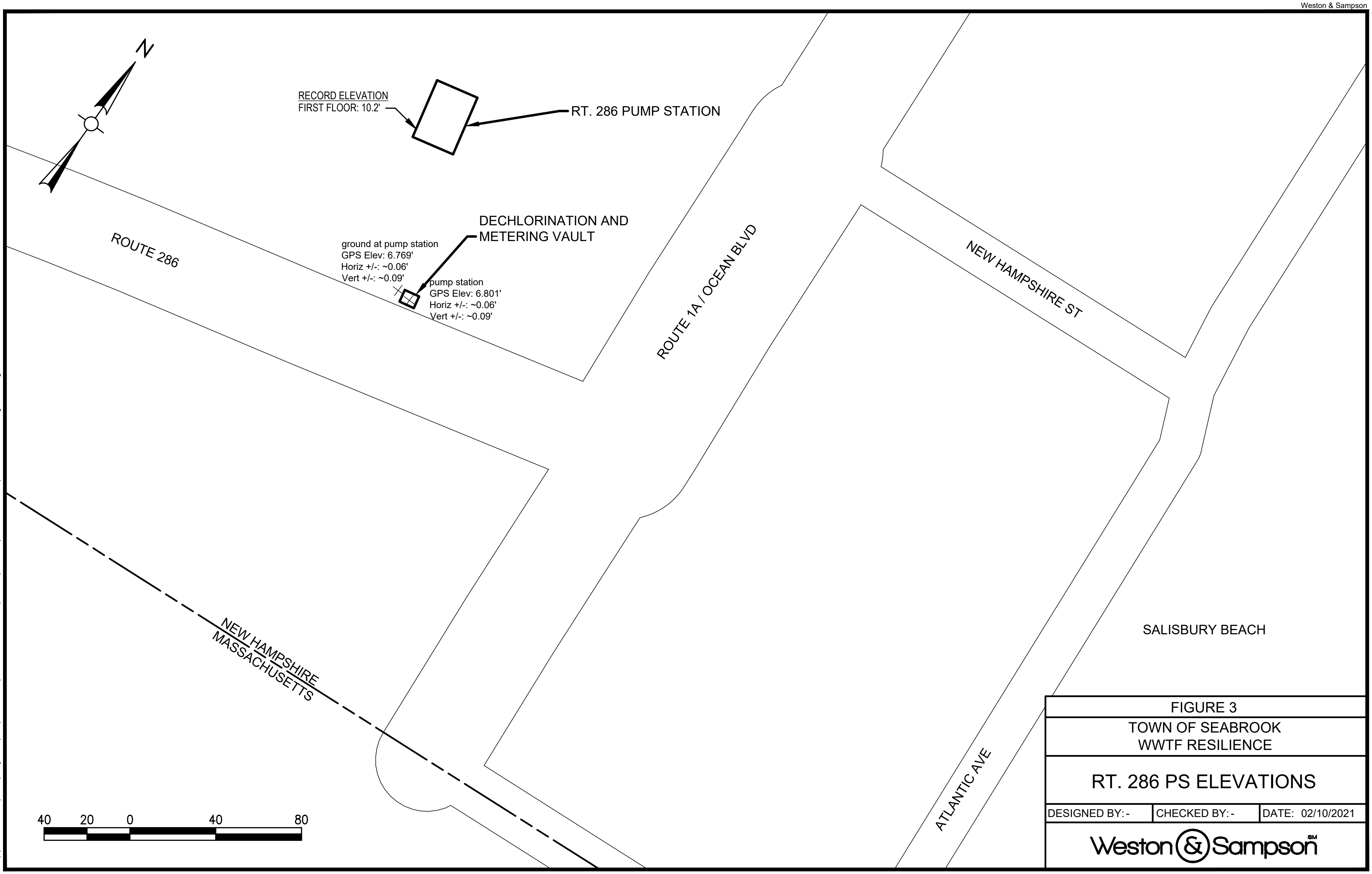


FIGURE 3

TOWN OF SEABROOK
WWTF RESILIENCE

RT. 286 PS ELEVATIONS

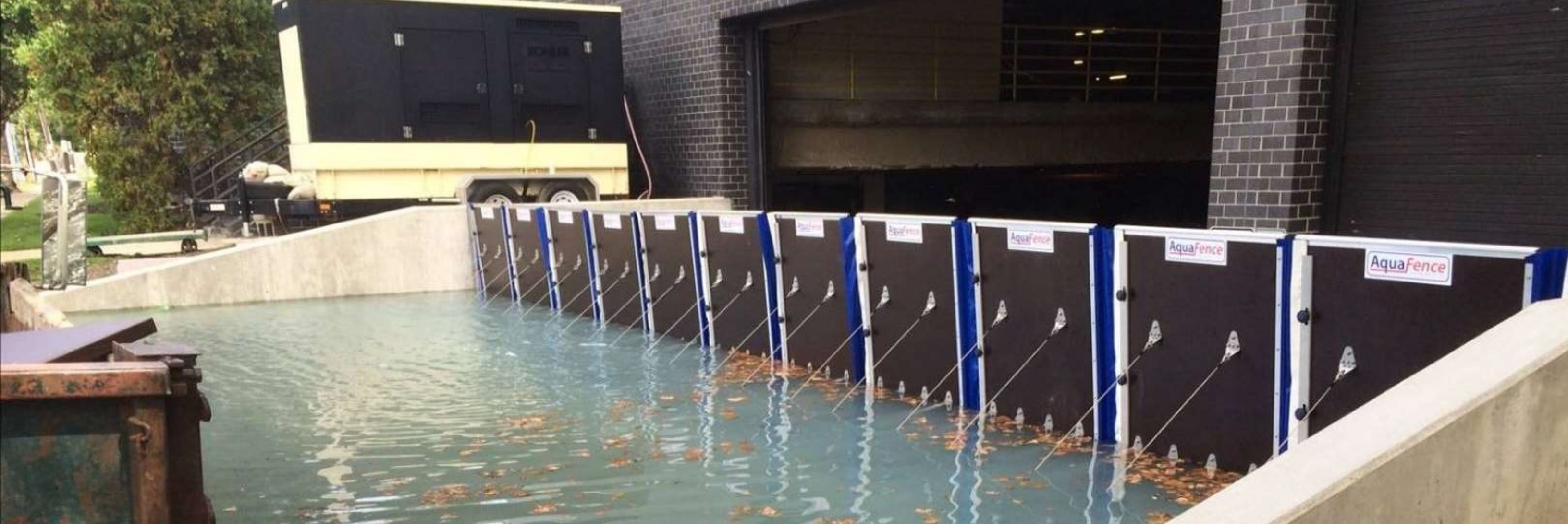
DESIGNED BY: -	CHECKED BY: -	DATE: 02/10/2021

Weston & Sampson

\\wse03.local\WSE\Projects\NH\Seabrook\WWTF Resilience Options\Task 3\CAD FIGURES\WWTF and PS Figures.dwg

APPENDIX D

Example Climate Resilience Options



AquaFence®

AquaFence products are used across North America for new construction, existing buildings, water diversion, construction site protection, perimeter protection, interior asset protection, and entrance protection.

AquaFence has the highest-level certifications for Flood Barriers from FM Approvals, US Army Corp of Engineers, and ASFPM. AquaFence is code compliant throughout major metropolitan areas and recognized as a minimally invasive solution with little prep work and no fill material needed.

Municipalities, transportation hubs, commercial properties and industrial complexes worldwide choose AquaFence for its simplicity, rapid deployment, reliable construction, reusability, and ease of break down and storage. This makes AquaFence the leading and most cost effective choice in Flood Barrier protection.

Highlights

- Deploy 100 linear ft./hour with 4-person team
- Unlimited Barrier Length
- No Fill Material Needed
- Minimal Advance Site Work
- No Heavy Equipment Needed
- Reusable dozens of times
- Easy Breakdown
- Site Specific Customizations
- Stackable Storage Crates

US Army Corps of Engineers®

FM APPROVED

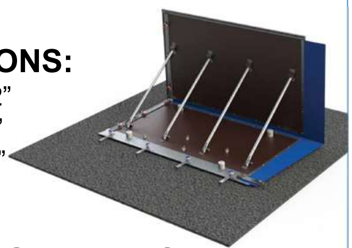
CODE COMPLIANT

- International Building Code IBC 2015
- ASCE 7-10 – Minimum Design Loads for Buildings and Other Structures
- ASCE 24-14 – Flood Resistant Design for Construction

AquaFence®

STANDARD BARRIER SPECIFICATIONS

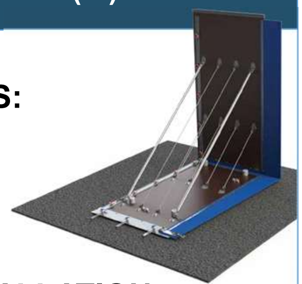
V1200 (4')



DIMENSIONS:
Height: 47.2"
Width: 82.7"
Depth: 47.2"

PANEL INSTALLATION:
Deployment Time 100 linear feet per hour (3-4 person crew)

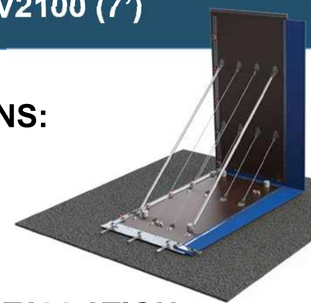
V1800 (6')



DIMENSIONS:
Height: 70.9"
Width: 47.2"
Depth: 70.9"

PANEL INSTALLATION:
Deployment Time 90 linear feet per hour (3-4 person crew)

V2100 (7')



DIMENSIONS:
Height: 82.7"
Width: 47.2"
Depth: 82.7"

PANEL INSTALLATION:
Deployment Time 80 linear feet per hour (3-4 person crew)

MATERIALS

- Marine Laminated Plywood
- Stainless Steel
- Aluminum
- PVC Canvas
- Closed Cell Gasket

RECOMMENDED TOOLS

- Rechargeable Hand Drill
- Pallet Jack or U-Frame Cart

CORNER CONFIGURATIONS

SIDE CLOSERS

STORAGE

Stored in reusable, click lock, stackable wooden crates (L 7.38' x W 4.15' x H 4.23') which can be stacked 4 high. After a deployment, the panels should be cleaned and dried for storage and future use.

SINGLE CRATE STORAGE CAPACITY	
63 linear feet/crate	V1200
36 linear feet/crate	V1800 & Higher

CONTACT

Adam Goldberg
203-939-5176
Adam.Goldberg@AquaFence.com

AquaFence U.S.A.
700 US Hwy 46
Clifton, NJ 07013

www.aquafence.com

FLOODCONTROL INTERNATIONAL

STOP LOG FLOOD BARRIERS

Flood Control International Incorporated offers removable stop log barriers that are engineered to provide similar levels of protection to permanent flood defenses, but with the distinct advantage of being fully removable when not required. They comprise aluminum panels that are inserted into steel channels. Custom made clamps compress specialist gaskets to create a reliable barrier against flood water.

These stop log barriers can be supplied for virtually any configuration including arcs, closed rectangles or circles and straight runs of any length. The system can be used on slopes up to 20° and can be stepped for steeper gradients. Each system is load calculated based on application and the prevailing flood conditions and can be configured for flood depths up to 13 feet. A four-sided detail is available for openings that may become fully submerged.

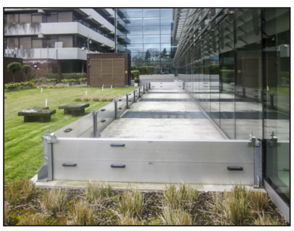
To facilitate installation in new builds, we can supply preformed ground plates with integral anchors for the demountable supports. The systems can be also retrospectively fitted to suitable existing foundations in which case load certified, chemically fixed sleeve anchors are used to attach the demountable supports.

This leaves only stainless steel bolt blanks at each post location. Due to the strength of our beams, this can be at 10 feet spacing.

Purpose designed gaskets that resist silt clogging and reform even after prolonged compression, together with vandal resistant covers and lockable clamps, make these systems ideal for locations where semi-permanent installation is a requirement.

The modular design facilitates storage and transportation and the ergonomically positioned carrying handles enable all but the higher systems to be erected without the need for mechanical lifting equipment.

Fully removable flush-finish perimeter defences - flood depths up to 13 feet, ideal for wide area defences.



USES

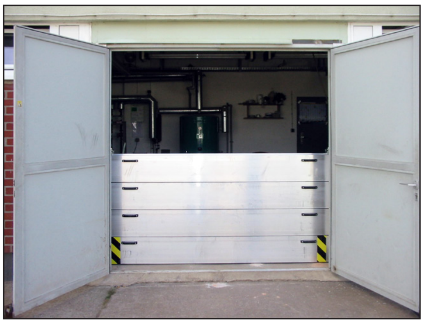
- Single building openings.
- Openings in flood walls.
- Stainless / aluminum system for marine environments.
- Fully removable perimeter defense to buildings.
- A 'usually stored' system for erection when flood warnings received.

BENEFITS

- Low cost system.
- Lightweight - sections allow safe lifting of 10ft beams by one person for rapid deployment.
- Flexibility – can be configured to any geometry.
- High strength – single beams can span up to 10ft unsupported. Spans up to 20ft possible with optional back-braces.
- Choice of bottom gaskets - allow barriers to sit on existing non-porous surfaces.
- Completely removable - leaving a totally flat ground surface.
- Vandal resistant - covers and padlockable clamps available.
- Able to be powder coated to any RAL color.
- Long life - using galvanized and aluminum components.

FLOODCONTROL
INTERNATIONAL

DESIGN



SIZES

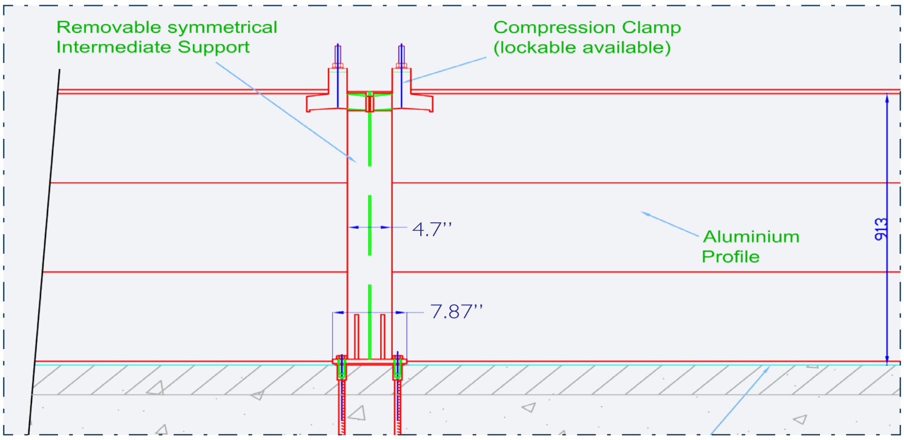
- Unsupported spans possible up to 10 feet.
- Maximum spans of up to 20 feet possible with back bracing.
- Standard maximum flood control height of 13 feet, using 12 inch standard beams.
- Beam weights of 5.5lb per linear foot allow safe single person lifting of 8ft beams.

CONFIGURATIONS

- Any length or layout is achievable.
- Posts and beams can be tailored for any gradient.
- Posts can accommodate steps and changes in direction.

INSTALLATION

- End posts can be surface mounted or recess mounted. Architectural coverplates can be applied to match building finishes.
- Intermediate posts require RC beam foundation. This can be under final surfacing finish with drilled in stainless steel sockets, or with cast in baseplates.
- Systems can be retrospectively fitted to any suitable foundation.
- Every system is bespoke designed using CAD and drawings provided.



FLOODCONTROL INTERNATIONAL

FLOOD PROOF SECURITY DOORS

Our new range of flood proof security doors are flood proof whenever they are locked and due to their steel frame and construction, they are able to operate simultaneously as security doors. Full height flood depths are achievable, depending on the locking mechanism chosen.

The use of these doors ensures that when a door is locked it is watertight - this removes the need to check if barriers are installed when a flood alert is received.

Available as single or double leaf doors, these systems are ideal for use in unmanned locations, such as utility sites, especially where security measures are required. Double leaf doors incorporate a removable center mullion. The door leafs utilize 0.08" zinc-coated steel and come with a range of locking mechanisms. Doors are supplied insulated and can be 60 minute fire rated if required.

Doors and frames are manufactured as standard using galvanized steel and are powder-coated to client's color specification. Door manufacture using stainless steel is available where requested, for the harshest environments. The doors utilize adjustable gaskets that are adjusted upon installation to ensure the correct level of compression is applied to the gaskets.

Doors can incorporate windows or ventilation grilles.

USES

- Existing or new building openings up to 8.2 ft wide.
- Emergency access / escape routes.
- Where flood protection required alongside security or fire resistance.
- Secure sites such as utility sites or commercial premises.

BENEFITS

- Flood proof / security / 60 minute door all in one. No need for separate protection measures.
- Single or double leaf flood door.
- Permanent protection.
- No operational difficulties – operates just like a normal door.
- Suitable for constant daily use.
- Flood-proof to full height.
- Openings to 8 ft high and 8.2 ft wide as standard.

Permanent Flood Protection and Security – single or double leaf – flood depths up to full height.

FLOODCONTROL INTERNATIONAL

DESIGN

SIZES

- Single flood doors available to 3.6 ft width and 8 ft height as standard.
- Double flood doors are available with demountable center mullion to 8.2 ft width and 8 ft height.
- Removable or liftable overpanels available where increased heights are required.

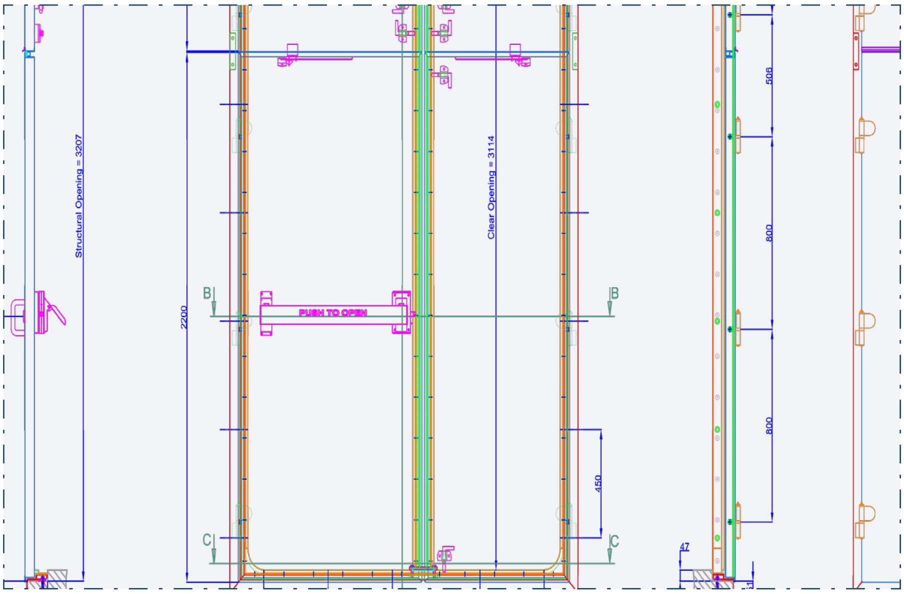
CONFIGURATIONS

- Low profile threshold for situations where doors and frames are installed in existing accesses.
- Face mounted frames enable unrestricted accesses.
- Inward or outward opening doors available.

INSTALLATION

- Doors and frames require adequate walls either side and a flat surface to seal against. Doors and frames provided with all sealants and fixings required.

BESPOKE CAD DRAWINGS



FLOODCONTROL INTERNATIONAL

LIFT-HINGED FLOOD GATES

Our Lift-Hinged flood gates utilize a unique 'raise-swing-lower' mechanism and do not require recessed ground channels, raised ground beams or ramps. This makes them ideal for vehicle entrances and especially suitable for forklift or wheelchair access.

Even the widest flood gates can be operated by one person using the smooth winding lift action and the single point locking mechanism. The lightweight aluminum construction also provides a far higher level of operator safety than heavy steel gates.

Due to their unique design, the gates are able to open a full 180°, either with or against the direction of flooding.

These flood gates are available as single or double leaf, or integrated with a stop-log system for wide entrances. Our gates are suitable for use in unmanned locations, are fully lockable and come complete with anti-theft and vandal resistant features.

The components are manufactured from construction grade steel and aluminum with stainless steel and are virtually maintenance free. They are designed for extreme weather durability to give a lifetime of service and with EPDM gaskets that reform even after prolonged periods of compression, the gates can, if required be left closed indefinitely.

For locations where gate leafs greater than 14.7 ft wide are required, we can also manufacture these gates from steel to any size.

USES

- Openings in floodwalls for continuous flood defense.
- Building openings.
- Vehicle entrances.
- Disabled access or public areas where steps or ramps not allowed.

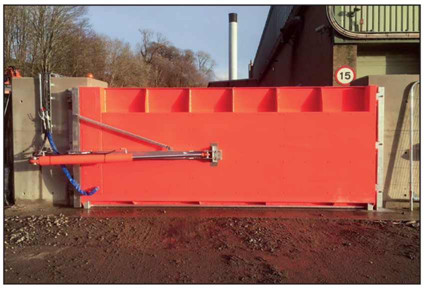
BENEFITS

- Can be used on dead level thresholds for vehicle / disabled access.
- Single person operation.
- Lightweight - requires less massive supporting structure.
- Virtually maintenance free due to aluminum and stainless steel construction.
- Single point locking.
- Can open inwards or outwards up to 180°.

Easy to use lift-hinge floodgate suitable for roads, vehicle and disabled access, flood depths up to 6 ft as standard.

FLOODCONTROL INTERNATIONAL

DESIGN



SIZES

- Single aluminum Lift-Hinged Gates are available up to 14.7 ft wide and 6ft high.
- Double gates are available with demountable central posts for flood situations up to 30 ft wide.
- Steel flood gates can be made to any size – our largest to-date is 21 ft wide by 14.4 ft high.

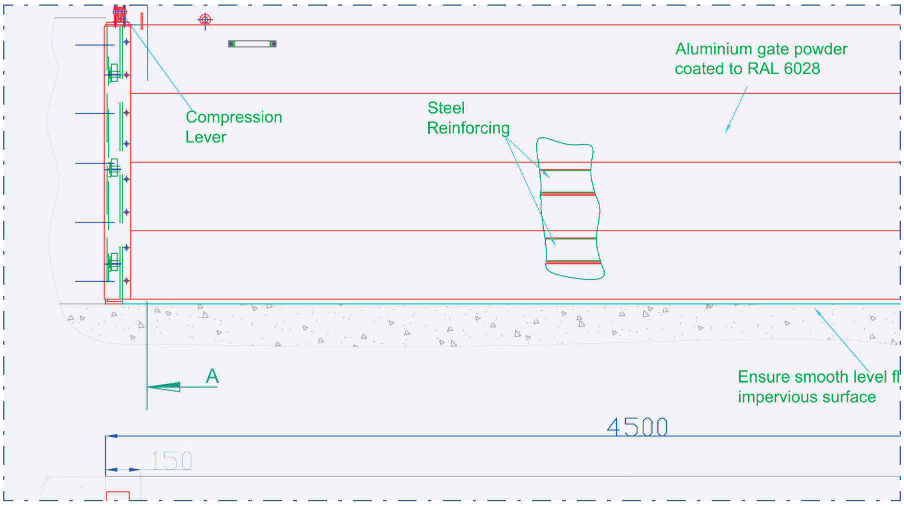
CONFIGURATIONS

- Lift-Hinged Gates operate over a level threshold and are able to seal against any level flat surface.
- Gates can be integrated into glass barrier systems.
- Gates can be integrated with stop-log barriers for large openings over 15 ft.

INSTALLATION

Gates require adequate walls either side and a flat surface to seal against. High compression gaskets enable Lift-Hinged Gates to operate on a variety of surface finishes.

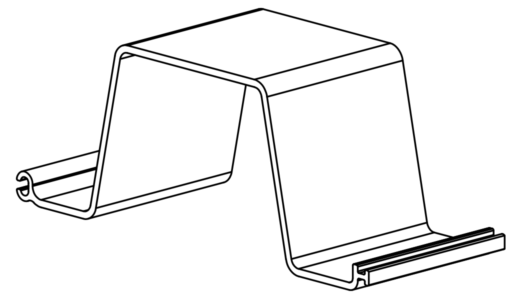
BESPOKE CAD DRAWINGS



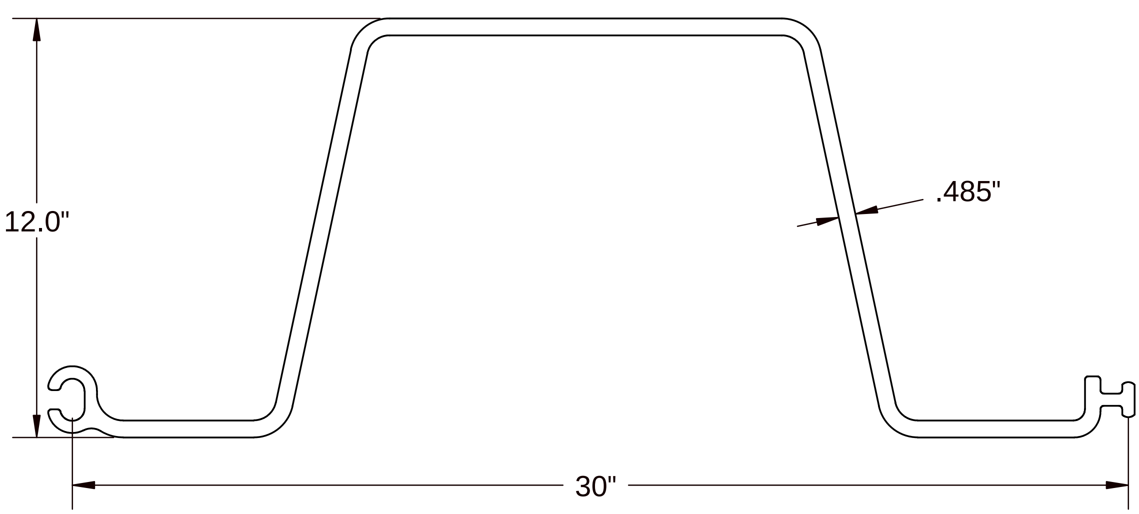
Example Vinyl Sheet Pile Product Data Sheet

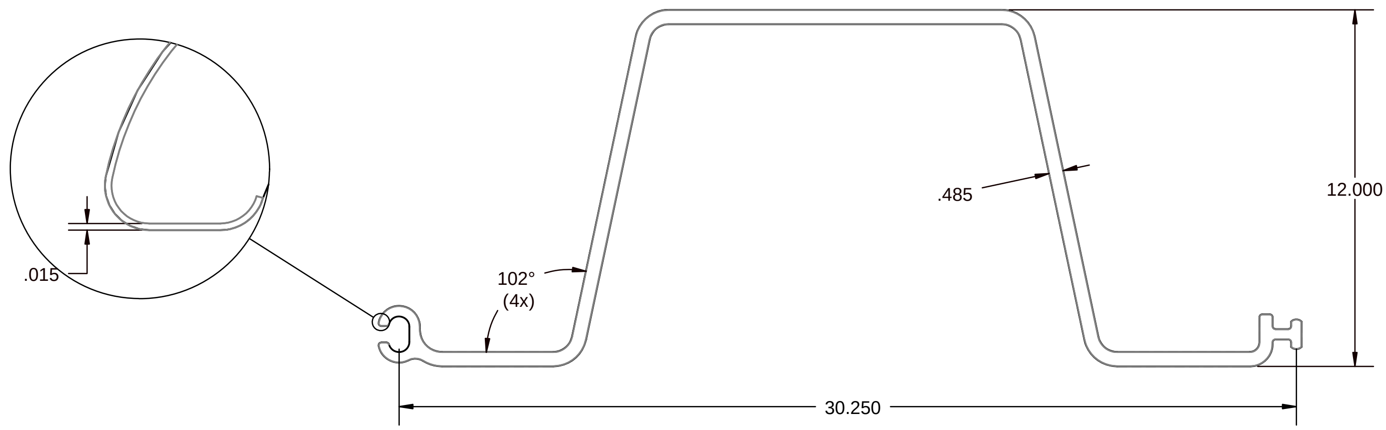
Updated: January 31, 2018

SG-825



Allowable Moment (M)	9,787 ft-lb/ft	43.53 kN-m/m
Section Modulus (Z)	36.7 in^3/ft	1,973 cm^3/m
Moment of Inertia (I)	220 in^4/ft	30,043 cm^4/m
Impact Strength	15,000 in-lbs/in^2	2,627 N-mm/mm^2
Thickness (t)	0.485 in	12.2 mm
Section Depth	12.0 in	305 mm
Section Width	30 in	762 mm
Material	Weatherable Rigid Vinyl	
Standard Colors	Grey, Clay	
Technology	Box Profile, I-Beam Lock, XCR™	
Standard Packaging	5 sheets/bundle	





SW Section Properties

Area = 25.00 inches^2

Centroid relative to output coordinate system origin: (inches)
X = -0.02
Y = 5.69
Z = 12.00

Moments of inertia of the area, at the centroid: (inches ^ 4)
Lxx = **551.17** Lxy = 0.10 Lxz = 0.00
Lyx = 0.10 Lyy = 1993.50 Lyz = 0.00
Lzx = 0.00 Lzy = 0.00 Lzz = 2544.66

SW Mass properties (1 ft)

Density = 0.05 pounds per cubic inch

Mass = **15.60** pounds

Volume = 300.05 cubic inches

Center of mass: (inches)
X = -0.02
Y = 5.69

Published Specs:

Section Modulus (Z) = 36.7 in^3/ft
Moment of Inertia (I) = 220 in^4/ft
Impact Strength = 15,000 in-lbs/in^2
Thickness (t) = 0.485 in
Section Depth = 12.0 in
Section Width = 30 in

COMMENTS:

	NAME	DATE
DRAWN	JAB	12/13/13
ENG APPR.	CBB	12/27/13
EFFECTIVE		

Unless otherwise specified all dimensions are in inches

Core Material Recycled Weatherable PVC meeting ASTM cell class 1-41444-33

Surface Material Virgin PVC meeting ASTM cell class 1-41444-33

Standard Colors Grey/Clay

PROPRIETARY AND CONFIDENTIAL

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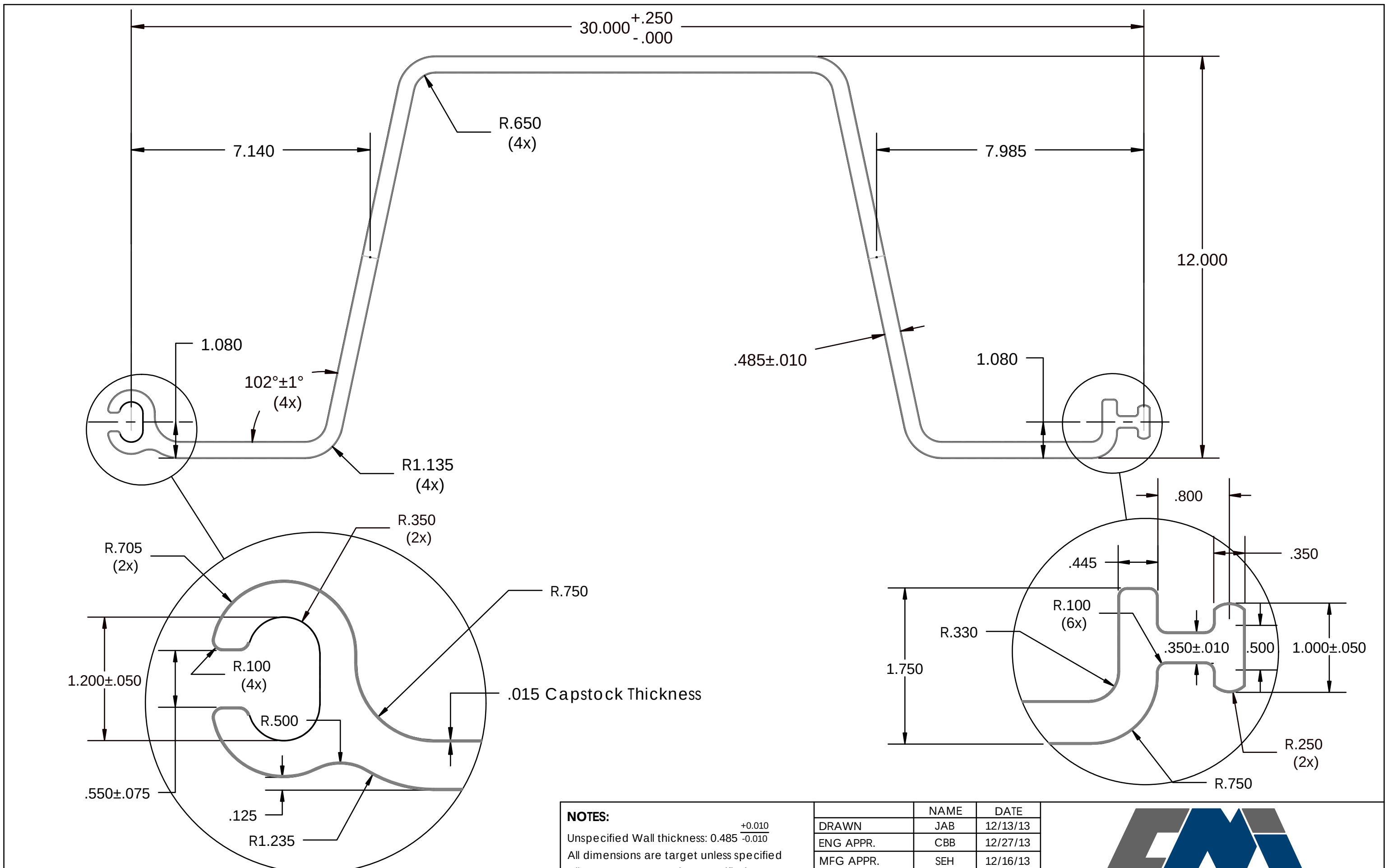
DO NOT SCALE DRAWING

TITLE: SG-825

Part Revision: REL-03

SCALE:

SHEET:



Target Weight: 15.60 $^{+0.3}_{-0.3}$ lb/ft

Unless otherwise specified
all dimensions are in inches

PROPRIETARY AND CONFIDENTIAL

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NOTES:

Unspecified Wall thickness: 0.485 $^{+0.010}_{-0.010}$
All dimensions are target unless specified
All curves tangent unless specified

CORE MATERIAL	Recycled Weatherable PVC meeting ASTM cell class 1-41444-33
SURFACE MATERIAL	Virgin PVC meeting ASTM cell class 1-41444-33
Standard Colors	Grey/Clay

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	JAB	12/13/13
ENG APPR.	CBB	12/27/13
MFG APPR.	SEH	12/16/13
EFFECTIVE		

Purchased Component Spec

Description:	SG-825 Sheet Piling
Manufacturing Std:	N/A
Treatment Standard:	N/A
Other:	5

TITLE:

SG-825

Part Revision: REL-03

SCALE:

SHEET:

SG-825

APPENDIX E

Public Engagement Materials

Town of Seabrook

Equitable Community Engagement Guide for Climate Resilient Projects

JUNE 2021

Town of Seabrook

Weston & Sampson

This document was prepared by Weston & Sampson for the Town of Seabrook

This project was funded, in part, by NOAA's Office for Coastal Management under the Coastal Zone Management Act in conjunction with the New Hampshire Department of Environmental Services Coastal Program

TABLE OF CONTENTS

1.0 EQUITABLE COMMUNITY ENGAGEMENT GUIDE FOR CLIMATE RESILIENT PROJECTS

Chapter 1 includes an introduction to the Town of Seabrook's engagement and climate resilience goals, an overview of the Equitable Community Engagement Guide, and information on how to use and maintain the guidance document.

1.1 INTRODUCTION

1.1.1 Town of Seabrook Engagement & Climate Resiliency Goals

The Town of Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP) identified community engagement as a top priority (see the examples listed below). Please refer to the CHAMP for more information and additional priorities.

Vision Statement

The CHAMP Vision Statement lists major goals related to coastal hazards and climate adaptation, including that "residents and businesses are aware of and better prepared to respond and adapt to coastal hazards" (Town of Seabrook 2016, 2)

Community Preparedness & Awareness

The CHAMP lists recommendations for long-term adaptation and resilience strategies for Community Preparedness & Awareness, including the selection of actions bulleted below related to the goals and content in this Guide. The full list of recommendations is available in the CHAMP.

- C2: Provide informational materials about flood risk reduction at public and community events
- C4: Provide information through outreach to residents and businesses about alternative approaches, reducing risk and lowering insurance premiums through adaptation
- C10: Partner with federal and state agencies as well as regional and local organizations to expand resources for education, outreach, and coordination (Town of Seabrook 2016, 18-19)

Municipal Action Plan for Facilities, Infrastructure and Services

The CHAMP lists recommendations for long-term adaptation and resilience strategies related to Municipal Action Plan for Facilities, Infrastructure and Services including conducting "outreach to property owners, land use boards, staff and elected officials" specific to various resiliency considerations (Town of Seabrook 2016, 20).

For more information on resilience-related recommendations, please refer to Section 9.8 "Recommendations for Long-Term Adaptation and Resilience Strategies and Actions" in the CHAMP.

1.1.2 Document Overview

Outreach Versus Engagement
Outreach includes public communication and "getting the word out" about a project. Engagement includes getting residents involved in project processes, providing input, and helping make decisions about design options. This Guide includes recommendations for both outreach and engagement.

What is resilience?
As defined in Seabrook's 2016 CHAMP, resilience is, "a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment" (Town of Seabrook 2016, 15).

What is equity? Equity is about addressing gaps in resources, understanding, actions, and policies. Equity requires building empathy, understanding, and healing (Martin and De Simone, 2020)

What is equitable community engagement? Equitable community engagement seeks to address barriers by providing resources and formats that facilitate participation in engagement processes by equity-seeking audiences.

The Equitable Community Engagement Guide for Climate Resiliency Projects is intended to assist with conducting both equitable community outreach and engagement in Seabrook based on previous experiences, local and regional expertise, and existing resources. As a local playbook, this framework provides local context and contact information, and documents the input of experienced advocates and engagement professionals to support capacity building and facilitate long-term cohesion and consistency in future engagement efforts. The Guide includes a summary of key target audiences, specific messaging about climate resilience, available communication and distribution channels, and steps to implement engagement efforts. Rather than being project-specific, the Engagement Guide is structured as a resource that can be applied across project types. Additionally, this framework could inform the development of equitable community engagement guides in other communities beyond Seabrook.

In addition to identifying engagement goals, the 2016 CHAMP also identified several wastewater treatment components vulnerable to sea level rise, including the critically important Wastewater Treatment Facility (WWTF) on Wright's Island. The CHAMP recommended conducting an analysis of the WWTF to identify flood reduction strategies. In 2019, the Town of Seabrook secured funding from NOAA's Office for Coastal Management under the Coastal Zone Management Act and the New Hampshire Department of Environmental Services (DES) Coastal Program to pursue a Wastewater Treatment Facility Resiliency Opportunities Analysis project alongside the development of this Guide. The WWTF project will be used as a pilot to test the implementation of the engagement guide, which will be further refined based upon the outcomes. Please refer to Chapter 4 for more information on the WWTF project.

1.1.3 Why Make an Equitable Community Engagement Guide for Climate Resilient Projects?

Public outreach, engagement, and feedback are critical to the success of climate resiliency projects and to building resilience across the community. Early public involvement improves the quality of the deliverable by ensuring local expertise and operations have been incorporated, which saves money and time by avoiding redesigns and maladaptation. Community conversations on climate change can elevate participants' understanding of possible threats and potential solutions to ensuring personal and public health and safety. Authentic dialogue can also increase public support for the project and future funding for similar work. Equitable community engagement also provides an opportunity for redefining resilience in climate resiliency projects to be understood as "bouncing forward" to healthier, greener, more equitable, and more resilient communities; rather than simply "bouncing back" after an extreme event to return to the status quo (Antioch University, "Enhancing Opportunities," 2020). By including everyone in conversation, creating safe and accessible spaces for input, and reaching vulnerable populations who face everyday stressors and institutionalized barriers, equitable engagement can increase public awareness of a project and may inspire new champions to contribute towards making our communities better places to live. Equitable engagement strategies will be described in more detail in Sections 2 and 3 but include creating accessible and understandable written and visual materials, compensating participation, reinvesting parts of engagement budgets into the community, working with trusted community partners, providing translation support, prioritizing listening, and addressing barriers to participation. Additional reasons for creating an Equitable Community Engagement Guide are summarized below.

- increase equity in outreach, engagement, and design
- engage audiences that we are not currently reaching
- communicate climate resilience
- identify new engagement tools, strategies, and formats
- document and share evolving best practices for equitable community engagement
- coordinate with local, state, and regional partners
- build capacity for Town staff, climate change and engagement champions, and consultants
- put everything in one place (templates, checklists, and more) to better support equitable engagement processes

1.1.4 Who are the Anticipated Users of this Guide?

Climate change is a long-term challenge, and compiling resources and recommendations for engagement in Seabrook into a single document will facilitate the work of future team members. This Guide is intended to build capacity and support anticipated users that include new Town employees, staff who do not regularly conduct engagement, staff working to increase equity in engagement efforts, future climate change and engagement champions, and future consultants working in Seabrook. This single repository of information will ensure that previous lessons learned, ongoing efforts, and existing local and regional partners are included in engagement processes.

1.1.5 How was the Guide Developed?

The Engagement Guide was developed in conjunction with the entities and resources listed below. By coordinating with local and regional groups, the project team used lessons learned from previous projects to inform future efforts.

- Interviews with Town staff
- Ongoing local and regional climate resilience initiatives, including work being completed by the New Hampshire Coastal Adaptation Workgroup (CAW)
- A review of related documents including the 2016 CHAMP, and equitable engagement best practices. Please see Chapter 5 for more information on resources and references.

1.1.6 How to Use this Guide

The Equitable Community Engagement Guide documents ongoing communication methods in the Town of Seabrook that could be leveraged for climate resilience planning and implementation. The Engagement Guide is a playbook for Town staff, external consultants, and local groups wishing to interact with the community and to build upon existing efforts.

To leverage this Guide, use each chapter like a workbook:

- In Chapter 2, start by developing the goals you would like to achieve, such as the input you would like to receive and the messages you would like to share. Then, identify key audiences. These goals and audiences will inform the type of engagement that you pursue.
- In Chapter 3, explore the list of communication techniques, step-by-step process for implementing the techniques, and existing communication channels and resources.
- In Chapter 4, the Wastewater Treatment Facility Resiliency Opportunities Analysis project has been provided as an example of how this Guide can be applied to a specific project.

Examples of upcoming projects at the time of publication that could apply this Guide include, but are not limited to:

- Implementation of the findings from the Wastewater Treatment Facility Resiliency Opportunities Analysis project. Please see Chapter 4 for more information.
- Integrated Master Plan update incorporating climate resilience.
- Town Pier Restoration, a $1.2 million restoration of the pier by fixing the sheet piling.
- Ensuring that NextEra and the nuclear energy station operate safely.

1.1.7 How will the Guide be Maintained and Approved?

The Engagement Guide should be updated regularly to reflect new resources, partnerships, initiatives, ways of communicating, and lessons learned. The Town Manager has been selected as the “keeper” of the Guide. The keeper will be an advocate for the plan across Town departments and projects, and will update the Guide with subsequent lessons learned and new resources. The Town of Seabrook Board of Selectmen will formally approve the Guide and any major subsequent updates, as necessary.

1.1.8 Frequently Asked Questions

I’m a member of the local board or commission. How can I use this Guide? As a member of a local board or commission, you can direct project teams working on natural resource and open space projects in Seabrook to use this Guide to inform their engagement efforts. Some of the techniques may also be used for the board or commission’s own meetings and engagement efforts. In your advisory role to the Board of Selectmen and other municipal agencies, you can share this resource with new Town staff, and new engagement and climate change champions.

I want to talk to the community about moving critical infrastructure at risk from sea level rise. How can I do that? You can refer to Chapters 2, 3, and 4 of this Guide to inform engagement efforts for your project. Section 2 offers information related to goals, audiences, and climate resilience messaging. Chapter 3 includes specific recommendations and checklists for a variety of engagement tools and formats. Chapter 4 includes an example of how equitable engagement was applied to the Wastewater Treatment Facility Resiliency Opportunities Analysis project.

What are the anticipated barriers to using this Guide? Engagement efforts will require funding, which was cited by the Town as among its most significant challenges. Additionally, the Town has limited staff capacity and will need to plan in advance and allocate staffing hours to complete engagement processes and meet engagement goals. This Guide can support the local planning and implementation of engagement processes.

2.0 BUILDING A FRAMEWORK

Chapter 2 includes information on goals, key audiences, and examples of climate resilience messaging to reach the audiences outlined.

2.1 Goals

Project teams should develop engagement and equity goals in coordination with local and regional partners. Project goals may identify the extent and type of awareness or feedback that you are hoping to receive. Teams can evaluate whether engagement and equity goals were met by tracking information such as attempts to reach targeted audiences, attendance at meetings, and participation in surveys. Please refer to Section 3.1.5 for more examples of strategies to track participation.

2.2 Key Audiences

The target stakeholders for this Equitable Community Engagement Guide are vulnerable populations who face everyday stressors and institutionalized barriers, and are most at-risk to existing extreme events (winter storms, power outages, wind, flooding, extreme heat) and worsening future climate change impacts. These population groups typically include youth, seniors, residents with limited English fluency, and residents with lower incomes. Additionally, New Hampshire defines Social Vulnerability Index Measures to include data related to socioeconomic status, household composition, disability, minority status, language, housing and transportation (NH Division of Public Health Services). Where possible, these index measures were included and used to organize the table of demographic data below, which compares information for the Town of Seabrook to the State. Tracking demographics in engagement efforts can help project teams assess participation and if they have reached a cross-section of the population. This can help teams determine if the engagement achieved was representative of the community, and if the team has met the project's equity goals.

Summary of Seabrook Demographic Data and Social Vulnerability Index Measures Compared to the State of New Hampshire		
	Seabrook	New Hampshire
Socioeconomic Status		
Below Poverty Level	10%	7%
Median Household Income	$32,397	$35,807
Without a High School Diploma	9%	14%
Household Composition And Disabilities		
Youth (Under 18 Years Old)	15%	19%
Seniors (65 Years Old and Older)	26%	18%
Disability	18%	13%
Race, Ethnicity, and Language		
Residents With Limited English Fluency	1%	1%
White	98%	95%
Black or African American	1%	2%
American Indian and Alaska Native	1%	1%
Asian	2%	3%
Native Hawaiian and Other Pacific Islander	0.1%	0.1%
Hispanic or Latino	1%	4%

Summary of Seabrook Demographic Data and Social Vulnerability Index Measures Compared to the State of New Hampshire		
	Seabrook	New Hampshire
Housing and Transportation		
Renters	32%	29%
Mobile Homes and Other Types of Housing Units	21%	5%
Households With No Vehicle Access	2%	2%

(Source: 2019 American Community Survey (ACS) 5-Year Estimates. Statistics are rounded to the nearest whole integer)

As the table above demonstrates, seniors make up a greater percentage of the Town's population when compared to the State average. The Town cites elderly residents as among the most difficult populations to reach through virtual engagement approaches, along with residents who are not comfortable using a computer, or who do not have access to a computer or Wi-Fi. The Town recommends sharing information through the local television station, Channel 22, in order to reach these residents. Please see Section 3.1.1 for more information on addressing technology gaps, and Section 3.1.3 for more information on Channel 22.

Youth were also cited by the Town as among the most difficult populations to reach during engagement efforts. Seabrook has a lower percentage of youth than the State's average but this is still an important population/audience. Messaging shared through the public school system may reach both students and their parents, and information shared through social media may effectively reach younger residents. See Section 3.1.2 for more information on social media platforms and strategies. Additionally, certain projects or messaging may particularly resonate with younger residents, such as the climate change impacts that young people will experience throughout their lifetime. See Chapter 5 for more information on how messaging was developed for a climate resilient project.

While the Town's poverty rate is lower than the State's, Seabrook's median household income is lower than New Hampshire overall and there are more renters. This data may indicate a strong working, middle class in Seabrook. Transient populations such as tourists, seasonal workers, or off-season renters are also an important part of the Seabrook community. Although not full-time residents, they may be frequent and long-term returnees, and should be included in climate resiliency planning efforts where possible.

2.3 Examples of Climate Resilience Messaging to Key Audiences

The examples on the following page are audience-specific messages for climate resiliency projects, which were drafted to assist Town staff and others with outreach and engagement (please see Section 1.1.2.2 for more information on anticipated users of this Guide). The messaging below are examples and can be tailored further to better serve specific projects in Seabrook. It is recommended that, as project-specific messaging is developed, phrasing avoids industry-specific jargon and focuses on the local impacts of global issues such as climate change. For example, project-specific messaging can focus on the potential public safety and economic impacts of flooding and extreme weather events.

Youth	Your voice and your energy are important. Your future will be largely impacted by climate change, and we need your help to plan for a resilient future.
Seniors	Your experiences of historic events will help us prepare for tomorrow. We want our resiliency efforts to support your safety and quality of life.
Residents with limited English fluency	You are an important part of our community. We want to find ways to communicate effectively to prepare for a safer future.
Residents who are low-income	We want to reduce the financial burden of climate change by investing wisely now. Extreme events will worsen the daily challenges faced by many. Help us understand what resources can better support you during a crisis.
Black, Indigenous, and People of Color (BIPOC)	We know that environmental issues have historically impacted BIPOC groups. We want to work toward just and fair development and implementation of climate plans.
Transient/Tourists	You are welcome in our community, and we want to make sure you are safe while you are here.
Additional Messaging	The economic future of the community is linked to resilience and adverse climate impacts can affect all residents, including through property values. Seabrook's fishing cooperative is threatened by future climate change impacts. Help us identify strategies to protect our local fisheries.

3.0 CHOOSING ENGAGEMENT TOOLS

Chapter 3 includes recommendations and content development techniques for meetings, online tools, printed materials, equitable engagement modifiers, promoting events, and more. The meeting materials discussed in Chapter 3 can incorporate the messaging outlined in Chapter 2. Additionally, a robust and multi-faced engagement strategy may include several of the tools and formats presented below. This section offers a menu of options for techniques and approaches that support and inform each other.

Public Engagement Case Study: Spotlight on Videos

The Water & Sewer Department needed funding to paint the Town of Seabrook's water tanks. After failing to secure Town Meeting approval, the Department used a drone to take aerial imagery of the condition of the tanks. The resulting video, which included audio commentary, was shared on YouTube and social media and increased public understanding of the need for this funding, and public support. The Department successfully secured Town Meeting approval after a second presentation. This experience demonstrates the importance of using accessible and dynamic materials when conducting engagement and seeking public support, buy-in, and funding for critical infrastructure projects.

3.1 Content Development – Techniques

3.1.1 Summary of Content Recommendations

The following table summarizes the content development techniques covered in Section 3.1, including recommendations for tracking participation and audiences who may be best reached by each strategy. This summary assumes that equitable engagement best practices will be used for all content types. Please refer to the subsequent sections for more information on equitable engagement best practices.

Content Type	Audience Best Reached	Tools to Track Participation
Meetings		
In-Person Meetings	All	RSVPs and meeting attendance
Virtual Meetings	All	RSVPs, meeting attendance, and virtual interactions (i.e., poll responses, "thumbs-up" reactions)
Interviews	All	Number of interviewees and the organizations or communities that they represent
Online Content		
Videos	All	Video views
Social Media	Youth	"Likes," shares, and comments

Content Type	Audience Best Reached	Tools to Track Participation
Website content	All	Google Analytics offers information related to page visits, new versus return visitors, time spent on page. Questions submitted via an online comment form.
Supporting Materials		
Surveys	All	Survey responses, and responses to an option demographic data question section
Press Release	All	Number of articles that reference press release
Local Television Channel	Elderly	Number of views
Printed Materials	All	Printed copies taken from location

3.1.2 Equitable Engagement Best Practices

The Town should use equitable engagement best practices to reach residents who may otherwise be less able to participate in the planning process. These practices may include:

- Providing childcare and food at meetings (this could include a giveaway for gift cards to local restaurants for virtual meetings)
- Meeting residents where they are (for example, elderly housing in Seabrook) rather than hosting public meetings in municipal buildings
- Tabling at existing community events, including regular events recommended by the Town:
  - Drop-in Senior Bingo Thursdays, 12:30-2:30PM, hosted by the Seabrook Recreation Department
  - Monthly Blue Ocean Society for Marine Conservation Beach Cleanup events
  - Annual Lights on After-school Halloween Event, October, hosted by the Seabrook Recreation Department
  - Annual Seabrook Tree Lighting, December
  - Old Home Day, hosted annually in August
  - Recreation Department events
- Offering giveaways for meeting attendees, including gift cards to local businesses
- Offering transportation to meetings
- Translation of meeting materials and translation support during meetings. This could include captioning during virtual meetings.
- Addressing technology barriers by offering free Wi-Fi hotspots for virtual events, partnering with libraries when possible to advertise events and offer computers to attend virtually, sharing visual, step-by-step instructions for joining virtual calls, including a back-up call-in number, and sharing meeting materials in advance for those joining by phone
- Allowing for sufficient lead time to "get the word out" and advertise engagement opportunities and events
- Using visuals to share information in accessible and understandable formats, rather than sharing text-heavy materials

- Recording the meetings so they can be shared across platforms (see section 3.1.2.1 on videos)
- Including equity considerations or "modifiers" for online content. At a minimum, all online content should comply with the Americans with Disabilities Act (ADA) 508 requirements and follow best practices outlined in the Web Content Accessibility Guidelines (WCAG) AAA Standards. This includes considerations like sans-serif fonts, underlined and descriptive text links, color best practices, headers in tables, images with alt text, gender-neutral text, and consideration of the Plain Writing Act.

3.1.3 Meetings

This category may include meetings with municipal department heads and representatives from local and regional organizations, expert interviews, public meetings open to all residents, and workshops with elected officials, boards, and committees. These meetings can be conducted in-person, virtually, or in combination. It is important to define the goals and key stakeholders for each meeting. Feedback received during each meeting can improve the outreach process and project deliverables. Meeting materials should incorporate consistent branding, which could include the Town of Seabrook branding and project-specific branding such as specific hashtags used across social media posts. Please see Section 3.3 for more information on Town of Seabrook branding.

3.1.1.2 In-person

A checklist for planning and facilitating a meeting includes the considerations listed below.

- [ ] Develop an invitation list.
- [ ] For smaller meetings, use a scheduling tool (including online platforms like Doodle Poll or embedded email tools such as FindTime) to gauge availability. This can also be paired as needed with direct emails or phone calls to participants who are not comfortable using these tools.
- [ ] Consider the accessibility of different meeting venue options (including parking availability, public transportation, wheelchair access, etc.)
- [ ] Select a meeting venue and consider accessibility considerations such as parking availability, public transportation, and wheelchair access. The Town recommends the following options, depending on the anticipated audience size:
  a. Community Center: the largest available venue, and can televise from this space. Parking is available.
  b. Town Hall: a familiar Town venue.
  c. Public Library: more difficult to televise from this space, but it is a comfortable and familiar community space. Parking is available.
  d. Water Department: may be appropriate for infrastructural projects led by the Water Department.
- [ ] Develop a staffing plan for meeting facilitators, moderators, translators, and notetakers.
- [ ] Create a meeting agenda, which may include a streamlined external agenda for participants, and a detailed internal agenda for organizers.
- [ ] Share a "save the date" 5-6 weeks in advance and follow up with more details when available

- ☐ Aim to send an invitation at least three weeks in advance as an email and calendar invitation. Include the agenda, meeting logistics (when and where), and any other available meeting materials (which could include a presentation, map of the project site, etc.). The registration process can also capture information related to:
    a. name, email, role (e.g., town staff, board member, seasonal or permanent resident, etc.)
    b. dietary needs (if providing refreshments)
    c. accessibility needs
    d. (optional) demographic information
    e. Any other questions that would be useful to inform the event planning such as familiarity with certain resources or capturing questions ahead of time
- ☐ Promote the meeting through channels including
    a. social media platforms of Town departments and local and regional partners
    b. e-blasts
    c. press release
    d. webpage content
    e. Posters in community space
    f. Communication with libraries, schools, recreation departments
    g. Channel 22
    h. Sharing publicity materials with Board members and Town staff and residents to help spread the word
    i. Connecting with the Patch and local online calendars to help advertise.
- ☐ Send a reminder e-mail one or two days before the meeting with any meeting logistics, including those related to parking and accessibility.
- ☐ Consider printing a few copies of the meeting materials.
- ☐ Call ahead for coffee and refreshment pick up or delivery.
- ☐ Day of:
    a. Pick up coffee and refreshments
    b. Arrive early to setup
- ☐ Send meeting materials, notes, a thank you, and information on future opportunities for engagement as a follow-up after the meeting.

- [ ] Assess if meeting goals related to engagement, content, equity, and participation were achieved.

3.1.1.3 Virtual

While similar to the checklist included above, there are additional considerations for virtual meetings, which include the list below:

Virtual Engagement: The COVID-19 crisis required adapting in-person outreach and engagement to virtual formats. The lessons learned can enrich future engagement efforts, even when in-person meetings are once again feasible.

- [ ] Develop an invitation list.
- [ ] For smaller meetings, use an online scheduling platform (such as a Doodle Poll) to gauge availability.
- [ ] Select an online conferencing platform
    a. The Seabrook Board of Selectmen successfully used Zoom during the COVID-19 pandemic and had higher attendance than during previous in-person meetings. Town residents may be most familiar and most comfortable with Zoom as a virtual meeting platform. Zoom can also livestream meetings to Facebook.
    b. Virtual meetings in Seabrook can also be televised to reach a wider audience
- [ ] Develop a staffing plan for meeting facilitators, moderators, notetakers, translators, and technical assistance.
- [ ] Create a meeting agenda.
- [ ] Share a "save the date" 5-6 weeks in advance and follow up with more details when available.
- [ ] Aim to send an invitation three weeks in advance as an email and calendar invitation. Include the agenda, meeting logistics (when, where, and how to join online), and any other available meeting materials (which could include a presentation, map of the project site, etc.)
- [ ] Promote the meeting through channels such as social media platforms of Town departments and local and regional partners, e-blasts, press release, and webpage content.
- [ ] Test the chosen video conferencing platform with municipal staff and meeting facilitators/presenters in advance.
- [ ] Send a reminder e-mail one or two days before the meeting with any meeting logistics.
- [ ] Day of:
    a. Join the meeting early to help troubleshoot any technical issues.
- [ ] Send meeting materials, evaluation, notes, a thank you, and information on future opportunities for engagement as a follow-up after the meeting.

3.1.1.4 Interviews

A checklist for interviews, which are defined as smaller group meetings with local topic area experts, includes:

- [ ] Draft and confirm a list of interviewees and interview materials
- [ ] Use an online scheduling platform (such as a Doodle Poll) to gauge availability.
- [ ] Confirm scheduling in an email and calendar invitation.
- [ ] Send interview questions and supporting materials in advance.

- [ ] If conducted virtually, use a video conferencing platform for the interview so that the interviewer can share their screen as they walk through the interview materials and record notes.
- [ ] Send interview notes, a thank you, and information on future opportunities for engagement as a follow-up after the interview.

3.1.4 Online Content

Online content may include videos, social media, and website content. Online content should incorporate consistent branding, which could include the Town of Seabrook branding and project-specific hashtags to help get the word out and create a searchable database on social media. Please see Section 3.3 for more information on Town of Seabrook branding.

3.1.2.1 Videos

Videos and recordings of meetings allow residents to engage in a project on their own time. Videos can direct viewers to additional project materials and opportunities for engagement, including project webpages and online surveys. Videos were cited by the Town as among the most popular engagement formats in Seabrook. See Section 3.0 for more information on a video-related case study. Resources for recording and editing videos are summarized below:

- Recording visuals and audio using a video conferencing platforms like Zoom, Skype, PowerPoint, or Microsoft Teams
- Recording video using a cell phone, camera, or a drone
- Leveraging open source video available through platforms like Pixabay
- Editing with video editing software and platforms like Adobe Premier Pro, After Effects, iMovie, YouTube, or Microsoft Stream

Seabrook Community Television – SCTV 22

- Virtual meetings and videos can be televised through Channel 22, the local access TV
- Channel 22 was cited by the Town as an effective strategy to reach elderly residents
- Generally, 10 to 20 views, but up to over 500

Additionally, videos can be shared through the following means:

- Posted to Facebook, YouTube, or other social media platforms
- Posted to a project webpage
- Shared in an email blast

Implementation Steps include:

- [ ] Develop an outline/storyboard for the video content and get feedback
- [ ] Create the video content. Assess options for including other content listed in this section, such as a project hashtag or link to an online survey.
- [ ] Record the video
- [ ] Translate the video, if applicable
- [ ] Distribute/promote the video

3.1.2.2 Social Media

Social media posting can be a quick and informal way to engage residents. Social media posting can range from select posting to a strategized campaign. Posts should include three main types of content:

1. An introduction that grabs that audience's attention

2. Concise and easily digestible information
3. An achievable call to action (i.e., "take our survey")

There are free design tools available to assist in the development of social media posts and graphic design for other engagement materials, including Canva and Adobe Spark. Social media campaigns should introduce an idea and use each post to develop a story. Campaigns regularly post three to five times a week. Social media posts can be scheduled and uploaded in advance for efficiency through some social media platforms, or by using external tools such as Hootsuite. Posts with images are more likely to be read. Opportunities to increase engagement with social media posts may include:

- Cross posting or sharing posts between multiple municipal department social media accounts
- Sharing posts with local and regional partners and/or tagging relevant partners' accounts in posts. See Section 3.2 for more information on working with partners.
- Including hashtags and social media accounts in meeting materials, promotional materials, and online
- Social media challenges, photos contests, or giveaways for posting, sharing or liking posts.
- Paying to "boost" a post based on a targeted audience
- Responding to engagement with a social media posts

Examples of social media posts are included below:

How have you been impacted by flooding in Seabrook? Tell us your story and share a photo. #ResilientSeabrook

We've been mapping projected sea level rise to assess flood risk to the Wastewater Treatment Facility, and found that sea level rise will affect access and operations. Share with your friends and family and read more about what we're doing about to reduce flood impacts on the Town's webpage #ResilientSeabrook

Want to learn more about future flood risk and mitigation strategies that the Town is exploring? Join us at the Library on DATE to hear about ongoing Resiliency Opportunities Analysis project and share your thoughts. #ResilientSeabrook

Didn't get a chance to join the event last night? Watch our video, take our survey, and share your thoughts online with #ResilientSeabrook

TikTok

At the time of report writing, the Town did not have a TikTok account. However, the Town is interested in creating an account to increase engagement with young residents.

Implementation steps include:

- ☐ Create a Town TikTok account and profile
- ☐ Prepare to record a video by selecting special efforts, if applicable
- ☐ Record a video
- ☐ Edit the video in the TikTok platform and add a caption that includes a hashtag
- ☐ Participate in a challenge or create and share a new challenge
- ☐ Assess engagement results and options for increasing engagement
- ☐ Respond to questions and comments on posts

Periscope

Periscope is a video streaming platform similar to Facebook Live and owned by Twitter. The Town Manager uses the Town's Periscope account occasionally.

Implementation steps include:

- ☐ Craft a catchy broadcast title and include a hashtag
- ☐ Record and livestream an event
- ☐ Interact with viewers by responding to questions and feedback
- ☐ The video will expire after 24 hours. Consider saving the video and uploading it to Facebook, the Town's website, or another platform
- ☐ Assess engagement results and options for increasing engagement
- ☐ Respond to questions and comments on posts

Instagram

At the time of report writing, the Town did not have an Instagram account. Instagram offers opportunities to share both static posts and live videos. If the Town creates an Instagram account in the future, implementation steps include:

- ☐ Create an Instagram account, chose a profile picture, and write a short bio
- ☐ Create a post that includes an eye-catching image, concise text (Instagram has a 2,200 character limit), and pair the post with hashtags
- ☐ Assess engagement results and options for increasing engagement
- ☐ Respond to questions and comments on posts

Facebook

The Town can use Facebook for posts that can include text, images, and videos; and for Facebook Live presentations. The most important posts should be cross posted on other Town department accounts, and the Facebook accounts of local and regional partners. Seabrook's Facebook accounts include:

- @townofseabrooknh
    - 711 followers
- @seabrookwwtf
    - 208 followers

Implementation steps include:

- ☐ Develop a hashtag for consistent use across social media posts
- ☐ Develop social media posts and include visual content such as images or a video
- ☐ Translate social media posts as needed
- ☐ Upload and schedule posting
- ☐ Work with a social media manager or other municipal departments to cross post
- ☐ Assess engagement results and options for increasing engagement
- ☐ Respond to questions and comments on posts

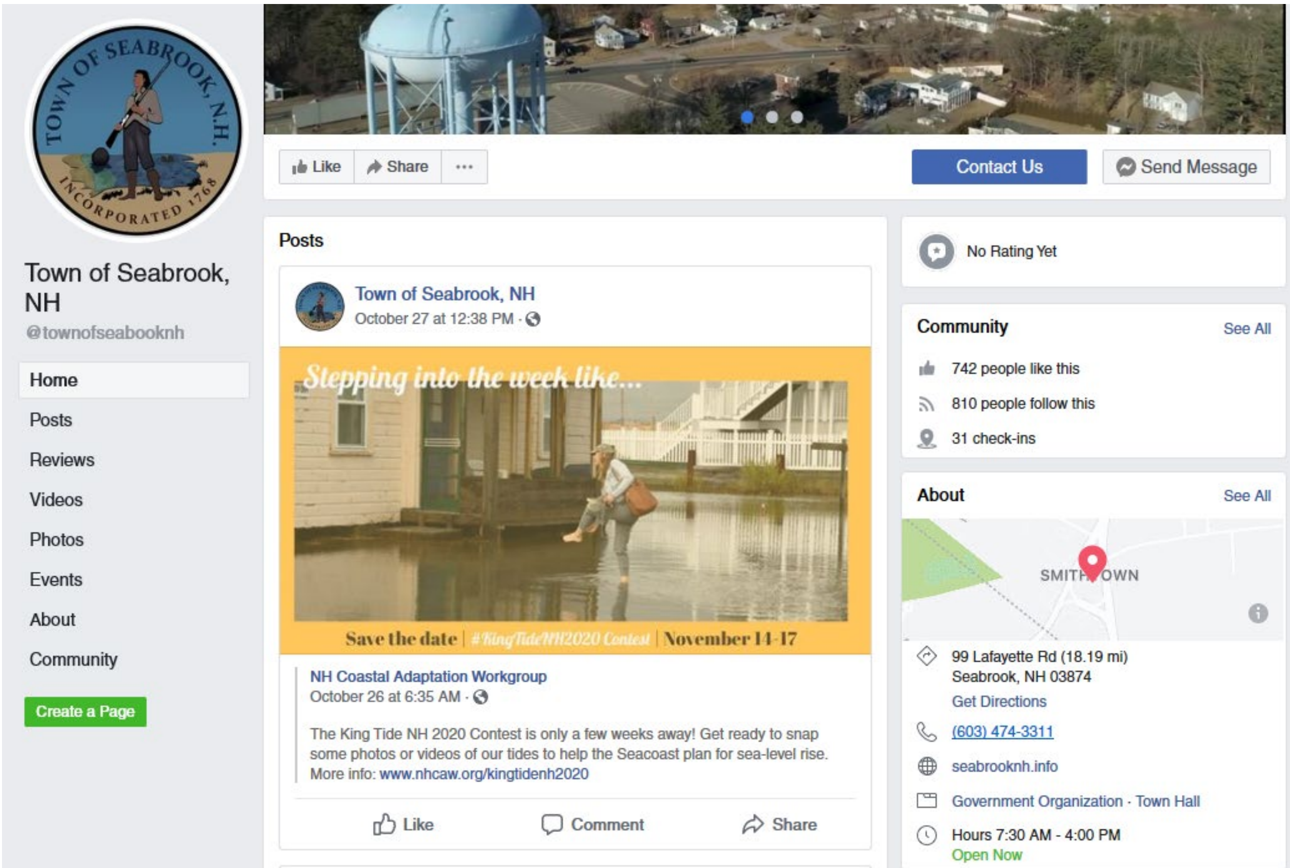


Figure 1: a Facebook post by the Town of Seabrook advertising CAW's King Tide NH 2020 Contest

3.1.5 Website

Content described in other sections of this guide can be posted on a dedicated project webpage. A link to the project webpage can be shared in email blasts, a press release, and on social media platforms. Website content may include:

- Videos and recordings
- Link to online survey
- Meeting materials, notes, and presentations
- Interactive online map or Esri Story Map
- Educational materials including fact sheets and brochures.
- FAQ section
- Comment form and/or contact information for a project point-person
    - Information on how to get involved

Key locations of the Town of Seabrook webpage for climate resiliency projects include:

- News & Announcements on homepage
- Upcoming Events on homepage
- Wastewater Division page

Implementation steps include:

- [ ] Updating or creating website content.

- ☐ Developing promotional material that directs people to the website.

3.1.6 Supporting Materials

Supporting materials include surveys, press releases, TV, and printed materials. Supporting materials should incorporate consistent branding, which could include the Town of Seabrook branding and project-specific hashtags. Please see Section 3.3 for more information on Town of Seabrook branding.

3.1.4.1 Surveys

Surveys can be created online and also printed to be distributed in person. Surveys allow for quickly collecting data and identifying trends, as well as capturing personal stories through short-answer boxes. Surveys also offer a chance to collect demographic data related to residents who were successfully engaged as part of the planning process and contact information for residents who wish to receive updates related to the project. Online surveys can be created using platforms including:

- Survey Monkey (free accounts are available, with limited options)
- Microsoft Forms
- Google Forms (free)
- PublicInput.com: The Rockingham Planning Commission (RPC) has an administrative account that communities can use in partnership with RPC.

Additionally, surveys can be shared through the following means:

- Online survey shared via a weblink in an email blast, on a project webpage, in a press release, or during a virtual meeting
- PDF survey attached to an email blast
- Printed survey posted in a high traffic location
- Printed survey shared during an in-person meeting

Implementation Steps Include:

- ☐ Draft, review, and finalize a survey
- ☐ Distribute the survey online and/or in printed forms
- ☐ Advertise the survey with a defined timeline for public comment
- ☐ Collect responses online and through hardcopies
- ☐ Analyze responses and create a summary of responses and next steps
- ☐ Report back to participants

3.1.4.2 Press Release/TV

A press release can be used to share information about the project and opportunities for engagement. This information can inform articles in local newspapers and stories on TV news stations. Project information and public meetings can also be shared through Channel 22, the local access TV. The Town notes that Channel 22 is a particularly effective channel through which to reach elderly residents. Information in press releases can also be distributed through The Patch, a local news and information platform.

Implementation steps:

- ☐ Develop a press release
- ☐ Distribute through local channels

3.1.4.3 Printed Materials

Printed materials could include: promotional flyer advertising meetings, fact sheets, FAQ handout, and brochures. Printed materials can be posted in high traffic locations, shared in email blasts, and shared online. Flyers can also be added to the water and sewer bill, as most residents have Town water or sewer. Additionally, orange construction signs can include a short public message. Printed materials should be highly visual in order to accessibly share information, and can be translated as needed.

Implementation steps:

- [ ] Develop printed materials
- [ ] Distribute printed materials

3.2 Working with Partners

Equitable engagement strategies often leverage existing networks and implement equitable engagement strategies to reach people where they are. In order to do this, engagement champions in Seabrook should coordinate with local and regional groups who serve target subpopulations in the area. This coordination and collaboration can include identifying overlaps between a project's goals and a local or regional organization's mission. Organizations representing equity-seeking populations should be consulted early and often in the planning process to inform any outreach or engagement strategy. Project partners may collaborate by attending or presenting at existing meetings, sharing or engaging with social media posts, posting physical flyers, and sharing e-blasts with their listserv. Please refer to Section 3 for more information on equitable engagement modifiers specific to different engagement strategies and formats.

3.2.1 Partners & Climate Initiatives

- Southern New Hampshire Services, which has a location in Seabrook
- New Hampshire Coastal Adaptation Workgroup (CAW)
- Seabrook-Hamptons Estuary Alliance (SHEA)
- Rockingham Planning Commission
- Piscataqua Region Estuaries Partnership (PREP)
- New Hampshire Coastal Program

3.2.2 Potential Equity Partners

The table below was informed by a list of organizations found on the Town's website, interviews with local experts, the Town of Seabrook's list of local groups, and input from project partners.

Organization Name	Available Contact Information
Boy Scouts	603-625-6431
Girl Scouts	(888) 474-9686
Business Association of Greater Seabrook	PO BOX 800, SEABROOK, NH, 03874
Firemen's Association	(603) 474-2132
Friends of Seabrook Community (FOSC)	Fosc2901@gmail.com
Hampton Falls/ Seabrook Rotary	Larry Marsolais, Hampton President, larrym1956@comcast.net

Hampton Rotary Club	Online contact form
Lions Club	Linda Lyons
NH Food Bank & Cooking Matters	Dennis Gichana, Director of Operations, dgichana@nhfoodbank.org, 603.669.9725
Northern Essex Community College Health & Human Services (NECC)	(978) 556-3700
Raymond E. Walton Post 70 American Legion	Ernie Henry, erniehenry30@gmail.com
Seabrook Beach Civic Organization	Vickie Sawyer, President
Seabrook Community Center	Katie Duffey, Recreation Director, kduffey@seabrooknh.org, 603-474-5746
Seabrook Elementary and Middle School	(603) 474-2252
Seabrook Historical Society	(603) 498-2182
Seabrook Housing Authority	(603) 474-7460
Seabrook Library	Susan Schatvet, Director, sschatvet@sealib.org, 603-474-2044
Seabrook PTO	seabrookpto@sau21.org
Seabrook Welfare Office	Bonnie Armentrout, Welfare Director, barmentrout@seabrooknh.org, 603-474-8931
Seacoast Youth Services	Vic Maloney, Executive Director, 603.474.3332
Senior Citizens Organization	kduffey@seabrooknh.org, (603)474-2139
Southern New Hampshire Services	Henry Harris, Community Outreach Director, (603) 474-3507
UNH Cooperative Extension 4-H (UNHCE)	Michael Harris, ce.rockingham@unh.edu, 603-679-5616
UNH Human Development & Family Studies	Carolyn Hale, (603) 862-5021, carolyn.hale@unh.edu

3.3 Town of Seabrook Branding

Consistency in branding can help create unified engagement and project materials, and allow audiences to quickly recognize content created by the Town.

3.3.1 Seabrook Color Palette

Dark Blue – 0, 40, 78
Blue – 22, 81, 121
Orange – 248, 145, 50
Lime – 142, 202, 60

Grey – 239, 239, 239
Aqua – 77, 211, 214
Accent Blue – 79, 139, 189
Dark Grey – 44, 56, 64

3.3.2 Seabrook Logo

3.3.3 Seabrook Slogans

"Welcome to the Seacoast's southern gateway to New Hampshire, the Granite State. Seabrook is the heart of New England, connecting the rich resources and recreation areas of Northern New England with the centuries old marketing and population centers of Southern New England" (Town Website, "About Seabrook," Town Manager).

3.3.4 Opportunities for Co-Branding

When applicable, project teams may also consider co-branding opportunities to leverage existing and recognizable branding of related initiatives, particularly when working with local and regional partners. Branding may include colors, hashtags, taglines, logos, fonts, and other visual imagery. For example, the Rockingham Planning Commission worked with the Town of Seabrook and other municipalities to design High Water Mark signage visualizing projected future flood levels. The final sign incorporated multiple project partner logos and leveraged the existing branding in use for the High Water Mark initiative. Please see below for an example of a sign used in Seabrook, and see Section 3.2.1 for more information on potential project partners.

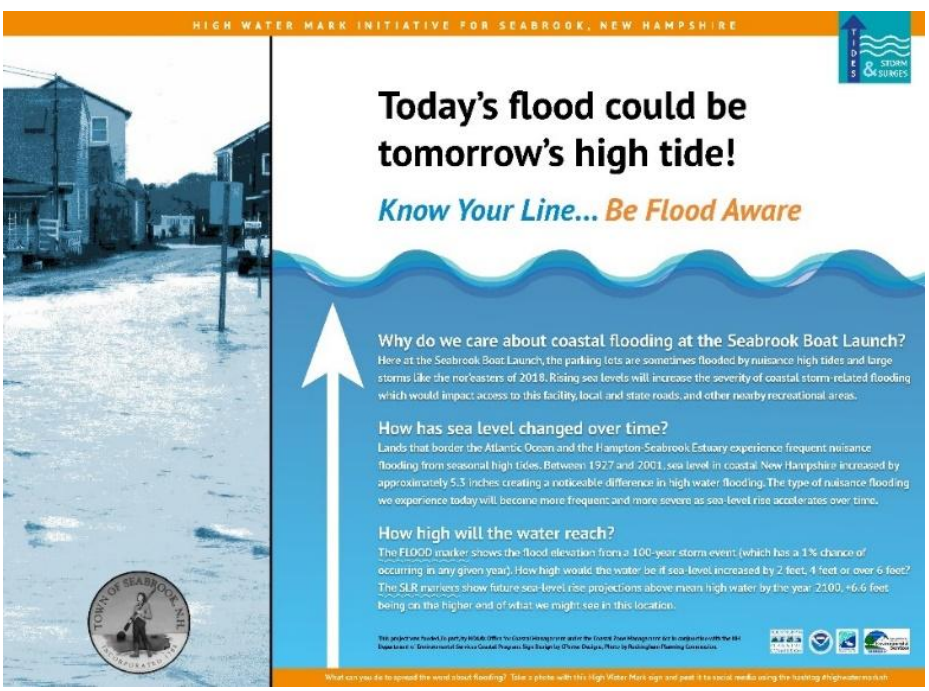


Figure 2: High Water signage used at the Seabrook Boat Launch

4.0 WASTEWATER TREATMENT FACILITY RESILIENCY OPPORTUNITIES ANALYSIS

Please see Section 5: Public Engagement in the final report for detailed information on the outreach and engagement conducted relative to the Wastewater Treatment Facility (WWTF). The outreach related to the WWTF was informational in nature but also included opportunities to receive feedback from the community through engagement with social media posts and an online comment form. This chapter provides examples of how the information in previous chapters was applied to the WWTF Resiliency Opportunities Analysis project. All public engagement deliverables are documented in this chapter and in the Appendix.

4.1 Goals and Messaging

4.1.1 Goals

- Equitably engage the public using new engagement methods
- Communicate the near-term and local impacts of climate change, and how it will impact residents' everyday lives as part of facilitating a conversation about the WWTF
- Share updated information on coastal flood risk relative to the WWTF
- Share initial, conceptual ideas for climate resilient solutions for the WWTF
- Gather input from stakeholders on how to facilitate a difficult future conversation with the public about the possible future relocation of the WWTF

4.1.2 Messaging

- Importance of WWTF for a clean, clear, swimmable and fishable Atlantic Ocean
- Visualize the anticipated future flood extent in Seabrook relative to the WWTF and discuss how sea level rise will impact the Town
- Communicate why adapting to climate change is critical, even if some residents will not see the most extreme anticipated impacts during their lifetime
- The WWTF on Wright's Island is vulnerable to climate risks such as sea level rise and coastal storm surge
- A resilience analysis was conducted to inform the community's decisions to ensure the short- and long-term viability of the WWTF
- The WWTF runs 24/7 and is needed to facilitate day-to-day operations in Seabrook. If impacted by sea level rise, the facility will not be able to function at full capacity
- The WWTF is approaching 25 years old but, in the minds of many residents, it is brand new. The Town reports that the reason for this discrepancy is that many residents remember when the facility was originally built. Facilitate a discussion about the need to address climate impacts to this facility and the different conceptual options to do so.

4.1.3 Target Audience and Engagement Tool Selection

The project team sought to reach the audiences outlined in Section 2.2, and used formats including social media posts, a press release, interviews, a video (i.e., prioritizing images rather than text), an online comment form, and direct outreach to equity partners.

4.2 Outreach and Engagement Approach

4.2.1 Techniques

The public engagement strategy was developed through research, a series of meetings and interviews with Town staff, DES, and the New Hampshire Costal Adaptation Workgroup (CAW). Informed by their input and additional research. The techniques are summarized below and described in more detail in sections 4.2.1.1-4.2.1.4.

- Interview with Tom Morgan, Town Planner (in addition to the interviews previously completed)
- Educational video on climate risks to the WWTF, paired with a link to an online comment form for questions (using Microsoft Forms), with a deadline for public comments
    - The final export of public comments will be shared with the Town
    - W&S will support the Town in responding to the public comments by preparing and posting a 1-page FAQ sheet informed by the questions and comments received.
    - The Town will post the video online, on Channel 22, and on social media.
- Presentation to the Board of Selectmen
- Promotional materials including:
    - Press release giving project overview and information on upcoming opportunities for engagement.
    - Outreach via email or phone to partners listed in the Engagement Guide to promote the video and comment form.
    - Social media posts for the Town and WWTF Facebook pages promoting the educational video and comment form

4.2.1.1. Social Media

Did you know the Town is mapping future flooding and assessing options to reduce risk to the Wastewater Treatment Facility? Watch our video below for more information, and share your questions through our online comment form at tinyurl.com/SeabrookComment! #ResilientSeabrook

4.2.1.2. Press Release

[Insert into Town Letterhead]
FOR IMMEDIATE RELEASE
DATE

Town of Seabrook Wastewater Treatment Facility Climate Resilience Assessment

Seabrook's Wastewater Treatment Facility (WWTF), supporting roadway, and pump stations are vulnerable to climate impacts such as sea level rise and coastal storm surge. Located on Wright's Island, the aging WWTF collects and treats residential, commercial, and industrial wastewater from most of the town. Any disruptions to WWTF operation due to flooding from sea-level rise and storm surge could result in significant public health risks. In order to inform long-term planning and ensure public health and safety, the WWTF Climate Resilience Assessment project will help the Town:

- Better understand specific climate impacts to the WWTF
- Identify potential adaptation options for improving the resilience of the WWTF
- Inform the public of project results

Preparing for the long-term impacts of climate change will be critical for the future of our community. Through the Wastewater Treatment Facility (WWTF) resiliency planning process, we want to ensure you are informed about the decisions the Town is making to safeguard this critical community asset. The Town has released a video and online comment form (tinyurl.com/SeabrookComment) to hear your comments and questions about the conceptual options that have been identified to ensure our WWTF is able to function in current and future changing conditions.

This project was funded, in part, by NOAA's Office for Coastal Management under the Coastal Zone Management Act in conjunction with the New Hampshire Department of Environmental Services Coastal Program. The Town has contracted Weston & Sampson, an interdisciplinary design and engineering consultancy, to support this project.

Follow the Town's website and Facebook platforms (@townofseabooknh and @seabrookwwtf) for updates on this project. Visit the comment form (tinyurl.com/SeabrookComment) or contact the Seabrook Sewer Department at Wastewater@seabrooknh.org or 603-474-8012 for questions regarding this project.

4.2.1.3. Meetings

The Town gave a verbal presentation and overview of the project to the Board of Selectmen on April 19, 2021, supported by Weston & Sampson. The educational video can be used as a tool to support the Town in presenting information on climate risks to the WWTF during future meetings.

4.2.1.4. Interviews

Information on interviewees, summaries used to introduce the project, and a question bank to facilitate discussion, is summarized below.

Interviewees

1. Curtis Slayton, Water & Sewer Superintendent
2. Bill Manzi, Town Manager
2. Tom Morgan, Town Planner
3. CAW Outreach Committee

Introduction for Interviewees:

Climate Resilience

Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP) defines resilience as "a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment."

Wastewater Treatment Facility (WWTF) Resiliency Options: Overview

The Town of Seabrook identified several critical wastewater treatment components vulnerable to sea level rise in the 2016 CHAMP, including the critically important WWTF on Wright's Island. The isolated nature of the WWTF makes it particularly susceptible to sea level rise and coastal storm surge, and any disruptions to WWTF operation quickly become a public health risk. The project will assess the specific vulnerabilities at the site and assess up to four options for improving resiliency. The project will also identify effective communication and outreach methods to continue the conversation about climate change in Seabrook and to engage the public in the results of the WWTF assessment.

Equitable Community Engagement Guide: Overview

The Equitable Community Engagement Guide is intended to assist with conducting community outreach in Seabrook based on previous experiences, expertise, and existing resources. The Engagement Guide is intended to build capacity and support new Town employees, staff who do not regularly conduct engagement, staff working to increase equity in engagement efforts, future climate champions, and future consultants working in Seabrook for the first time. The document itself should evolve as new resources become available and lessons are learned. The Engagement Guide currently provides step by step recommendations for engaging traditionally underrepresented audiences, specific messaging about climate resilience, and engagement technique checklists. The WWTF Resiliency project described above will be used as a pilot to test the implementation of the engagement guide, a process that could be replicated by other coastal communities in New Hampshire. As an interviewee, your participation in the project can help inform outreach methods for both the Equitable Community engagement Guide and the WWTF Resiliency Options project.

Question Bank

A list of possible questions that will be selected and prioritized as applicable for each interview. A list of prioritized questions will be shared with each interviewee in advance, along with an opportunity for their feedback on the prioritization. Low-priority questions can be moved to a "Time-Permitting" Question Bank as needed.

Broad Engagement:

1) What are some of the barriers to engaging Seabrook residents in town decision-making and needs today? Do you think those barriers will change in the future?
2) What are you doing differently for public engagement during the COVID-19 pandemic? What has worked well, and what didn't work?
    a) What are your thoughts on the effectiveness of strategies like virtual meetings or webinars, videos, and online surveys in Seabrook?
3) What communication channels do you use to reach Seabrook residents?
    a) What groups of residents are the hardest to reach and obtain feedback from in Seabrook and why are they difficult to reach?
    b) Do you use any particularly effective methods for obtaining input/feedback from people who are less likely to show up to public meetings (which could include translation support, providing childcare at meetings, etc.)?
    c) Do you partner with or interact with any organizations to reach traditionally underrepresented groups? Is there anyone else that we should be talking with?
    d) At which local venues is the public most likely to attend engagement events? (i.e., the Public Library, a community center, or other venues).

e) We have started to develop a list of annual or recurring events in Seabrook that engagement efforts could plug-into (during times when COVID is not a concern). Are there other events that we should add to our list below?
   i) Drop-in Senior Bingo Thursdays, 12:30-2:30PM, hosted by the Seabrook Recreation Department
   ii) Monthly Blue Ocean Society for Marine Conservation Beach Cleanup events
   iii) Annual Lights on After-school Halloween Event, October, hosted by the Seabrook Recreation Department
   iv) Annual Seabrook Tree Lighting, December
   v) Old Home Day, August

Climate Resiliency Engagement:

4) What messages related to climate resiliency would resonate with all Seabrook residents, and what messages would resonate with specific populations (youth, seniors, seasonal residents, renters, etc.)?
5) Do you foresee any barriers to engaging residents on climate resilience?
6) What do you think the climate resiliency priorities are in Seabrook?
7) How do see climate resilience overlapping with your mission as the Town Manager?
8) What current initiatives are ongoing related to climate resilience? What reports or resources should we be aware of?

WWTF Engagement:

9) What messages would you use to engage the public about protecting critical assets like the WWTF? What messages are you currently using?
   a) What is the most important thing that residents need to know about the Seabrook WWTF?
   b) What should they know about its vulnerability to coastal hazards and the options for addressing that vulnerability?
   c) What if your best alternative is to relocate parts or all of the WWTF at some point in the future? How should that be communicated to residents? What reaction do you anticipate?
10) Would you be willing to help spread the word related to the WWTF Resiliency project? What resources would assist you in doing so (i.e., email blast template, social media post template)?
11) What areas are you most concerned about when it comes to current and future flood risk in Seabrook?
12) What are some of your initial thoughts about strategies to make Wright's Island and the WWTF more resilient to coastal flood risks?

Engagement Guide:

13) Can you think of any upcoming community resilience planning or construction projects in Seabrook that might benefit from engaging residents? Would assistance, such as an engagement guide, be useful for these projects?
14) Do you foresee any barriers to using an engagement guide in the future? If so, what are the barriers? For example, funding, staff capacity, or specific expertise (i.e., social media post writing).

5.0 APPENDIX

5.1 Strategies to Address Current Engagement Gaps

Town staff and project partners shared the resources summarized below to address current public engagement gaps and needs, including potential funding sources and related resources.

5.1.1 Sharing Resources

The resources below were collected by the project team and local and regional partners. This list is intended as a sample of available equitable engagement resources, not a comprehensive list.

- "Guide to Equitable, Community-Drive Climate Preparedness Planning," Urban Sustainability Directors Network
- "Equitable Adaptation Legal & Policy Toolkit," Georgetown Climate Center
- Adaptation Equity Portal, Adaptation Clearinghouse
- Alliances for Equity, Resilient Nation Partnership Network
- "Climate Justice in Frontline Communities: Here's How to (Really) Help," Katherine Egland and Hilton Kelley, Changing America

5.2 References

Antioch University. 2020. "Enhancing Opportunities for Socially Vulnerable Populations to have "A Seat at the Table" in Climate Resilience Planning." Weathering Change Webinar Series.

Interview with Bill Manzi, Town Manager. September 8, 2020.

Interview with Curtis Slayton, Water & Sewer Superintendent. August 31, 2020.

Martin, Atyia and De Simone, April. 2020. "Designing for Equity and Engaging Diverse Communities." Trustees of Reservations Webinar. September 15, 2020.

Meeting with the New Hampshire Coastal Adaptation Workgroup (CAW). November 12, 2020.

New Hampshire Division of Public Health Services. Undated. "social Vulnerability Index: An Emergency Response Tool." https://www.nh.gov/epht/highlights/documents/social-vulnerability-index.pdf

Town of Seabrook. 2020. "Welcome to the Town of Seabrook, NH." Town Website. https://seabrooknh.info/

Town of Seabrook. 2016. "Seabrook Master Plan 2016." Chapter 9: Coastal Hazards and Adaptation.

US Census Bureau. 2014-2018. *American Community Survey 5-Year Estimates.*

New Hampshire Coastal Adaptation Workgroup (CAW)

October 14, 2020 | 9:30 AM
Proposed Agenda

Introductions (5 mins)

Present project overview (5 mins)

Wastewater Treatment Facility Resiliency Opportunities Analysis and Equitable Community Engagement Strategy

Present draft Equitable Community Engagement Strategy (5 mins)

Discuss reactions to the project (15 mins)

Questions for the Workgroup could include the following, time permitting:

Community Engagement:

- How can we coordinate with CAW to complement your work?
- What are your lessons learned and best practices related to engagement in Seabrook?
- Do you use any particularly effective methods for obtaining engagement from people who are less likely to show up to public meetings (which could include translation support, providing childcare at meetings, etc.)?
- Do you partner with or interact with any organizations to reach traditionally underrepresented groups? Is there anyone else that we should be talking with? What are you doing differently for public engagement during the COVID-19 pandemic? What has worked well, and what didn't work?
- How can the engagement strategy help connect future climate champions with long-standing community resources like CAW?
- Would you be willing to help spread the word about this project? What resources would assist you in doing so (i.e., email blast template, social media post template)?

Climate Resilience Messaging:

- Do you foresee any barriers to engaging residents on climate resilience?
- What messages related to climate resiliency would resonate with residents? Would you recommend tailored messaging for specific populations (youth, seniors, seasonal residents, renters, etc.)?
- What messages would you use to engage the public about protecting critical assets?
- What reports, resources, initiatives related to climate resilience should we add to the engagement strategy for newcomers to be aware of?

Nice to meet you!

Amanda Kohn
Sustainability Project Planner
Kohn.Amanda@wseinc.com

Adria Boynton
Resiliency Specialist
BoyntonA@wseinc.com

1

CAW Outreach Committee Presentation

Wastewater Treatment Facility Resiliency Opportunities Analysis and Equitable Community Engagement Strategy Project

This project was funded, in part, by NOAA's Office for Coastal Management under the Coastal Zone Management Act in conjunction with the New Hampshire Department of Environmental Services Coastal Program

2

- **Introductions** | 5 min.
- **Present** overview of WWTF Resiliency Opportunities Analysis & Public Engagement Goals | 5 min.
- **Present** draft Equitable Community Engagement Strategy | 5 min.
- **Discuss** | 15 min.

We're here to listen and learn!

3

Project Overview

Wastewater Treatment Facility Resiliency Opportunities Analysis

- Identified as vulnerable to sea level rise in the 2016 CHAMP
- Disruptions to WWTF operations impact public health
- To assess vulnerabilities and identify up to four options for improving resiliency
- Pilot the Equitable Community Engagement Strategy

Equitable Community Engagement Strategy

- Guide for conducting community outreach and engagement in Seabrook
- Intended to build capacity and evolve over time
- Anticipated users include new Town employees, staff new to engagement, staff working to increase equity in engagement, future climate champions, and future consultants

4

"a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment"

Resilience as defined in Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP)

5

Why Make an Equitable Community Engagement Strategy?

- increase equity in outreach, engagement, and design
- engage audiences that we aren't currently reaching
- communicate climate resilience
- identify new tools, strategies, and formats
- document and share evolving best practices
- coordinate with partners
- build capacity for staff, champions, and consultants
- put everything in one place – templates, checklists, and more!

6

Equitable Community Engagement Strategy

Strategy Outline

- Introduction to the strategy and how to use
- Building a framework through goals, messaging, and audiences
- Choosing engagement tools for in-person and virtual meetings, working with partners, and consistency in branding
- WWTF Resiliency Options: considering goals, messaging, audiences, and techniques

Spotlight on Draft Messaging

Youth	Your future will be largely impacted by climate change and we need your help to plan for a resilient future.
Seniors	Your experiences of historic events will help us prepare for tomorrow. We want our resiliency efforts to support your safety and quality of life.
Residents with limited English fluency	You are an important part of our community with a story to tell. We want to find ways to communicate effectively.
Residents who are low-income	Extreme events will worsen the daily challenges faced by many. Help us understand what resources can better support you during a crisis.
BIPOC	We know that environmental issues have historically impacted BIPOC groups disproportionally. We want to work toward a just, fair, and resilient future.
Transient/Tourists	You are welcome in our community and we want to make sure you are safe while you are here.

CAW Outreach Committee
10.14.2020 | 9:30 AM

7

8

Town Manager Interview

Bill Manzi, Town Manager

Introduction

Climate Resilience

Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP) defines resilience as "a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment."

Wastewater Treatment Facility (WWTF) Resiliency Options: Overview

The Town of Seabrook identified several critical wastewater treatment components vulnerable to sea level rise in the 2016 CHAMP, including the critically important WWTF on Wright's Island. The isolated nature of the WWTF makes it particularly susceptible to sea level rise and coastal surge, and any disruptions to WWTF operation quickly becomes a public health risk. The project will assess the specific vulnerabilities at the site and assess up to four options for improving resiliency. The project will also identify effective communication and outreach methods to continue the conversation about climate change in Seabrook and to engage the public in the results of the WWTF assessment.

Equitable Community Engagement Strategy: Overview

The Equitable Community Engagement Strategy is a guide for conducting community outreach in Seabrook based on previous experiences, expertise, and existing resources. The Engagement Strategy is intended to build capacity and support new Town employees, staff who do not regularly conduct engagement, staff working to increase equity in engagement efforts, future climate champions, and future consultants working in Seabrook for the first time. The document itself should evolve as new resources become available and lessons are learned. The Engagement Strategy currently provides step by step recommendations for engaging traditionally underrepresented audiences, specific messaging about climate resilience, and engagement technique checklists. The WWTF Resiliency project described above will be used as a pilot to test the implementation of the engagement strategy, a process that could be replicated by other coastal communities in New Hampshire.

Primary Question Bank

A list of possible questions that have been selected and prioritized for this interview. Interviewees are welcome to share feedback on the prioritization of these questions.

Community Engagement

Broad Engagement:
1) What are some of the barriers to engaging Seabrook residents in town decision-making and needs today? Do you think those barriers will change in the future?
2) What are you doing differently for public engagement during the COVID-19 pandemic? What has worked well, and what didn't work?
   a) What are your thoughts on the effectiveness of strategies like virtual meetings or webinars, videos, and online surveys in Seabrook?
3) What communication channels do you use to reach Seabrook residents?
   a) What groups of residents are the hardest to reach and obtain feedback from in Seabrook and why are they difficult to reach?
   b) Do you use any particularly effective methods for obtaining engagement from people who are less likely to show up to public meetings (which could include translation support, providing childcare at meetings, etc.)?
   c) Do you partner with or interact with any organizations to reach traditionally underrepresented groups? Is there anyone else that we should be talking with?
   d) At which local venues is the public most likely to attend engagement events? (i.e., the Public Library, a community center, or other venues).
   e) We have started to develop a list of annual or recurring events in Seabrook that engagement efforts could plug-into (during times when COVID is not a concern). Are there other events that we should add to our list below?
      i) Drop-in Senior Bingo Thursdays, 12:30-2:30PM, hosted by the Seabrook Recreation Department
      ii) Monthly Blue Ocean Society for Marine Conservation Beach Cleanup events
      iii) Annual Lights on After-school Halloween Event, October, hosted by the Seabrook Recreation Department
      iv) Annual Seabrook Tree Lighting, December
      v) Old Home Day, August

Climate Resiliency Engagement:
4) What messages related to climate resiliency would resonate with all Seabrook residents, and what messages would resonate with specific populations (youth, seniors, seasonal residents, renters, etc.)?
5) Do you foresee any barriers to engaging residents on climate resilience?

WWTF Engagement:
6) What messages would you use to engage the public about protecting critical assets like the WWTF?
   a) What is the most important thing that residents need to know about the Seabrook WWTF?
   b) What should they know about its vulnerability to coastal hazards and the options for addressing that vulnerability?
   c) What if your best alternative is to relocate parts or all of the WWTF at some point in the future? How should that be communicated to residents? What reaction do you anticipate?

Engagement Strategy:
7) Can you think of any upcoming community resilience planning or construction projects in Seabrook that might benefit from engaging residents? Would assistance, such as an engagement strategy, be useful for these projects?

8) Do you foresee any barriers to using an engagement strategy in the future? If so, what are the barriers? For example, funding, staff capacity, or specific expertise (i.e. social media post writing).

Time-Permitting Question Bank

Climate Resilience:

1) What do you think the climate resiliency priorities are in Seabrook?
2) How do see climate resilience overlapping with your mission as the Town Manager?
3) What current initiatives are ongoing related to climate resilience? What reports or resources should we be aware of?

WWTF Resiliency:

1) Would you be willing to help spread the word related to the WWTF Resiliency project? What resources would assist you in doing so (i.e., email blast template, social media post template)?
2) What areas are you most concerned about when it comes to current and future flood risk in Seabrook?
3) What are some of your initial thoughts about strategies to make Wright's Island and the WWTF more resilient to coastal flood risks?

Water & Sewer Interview

Curtis Slayton, Acting Superintendent

Introduction

Climate Resilience

Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP) defines resilience as "a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment."

Primary Question Bank

A list of possible questions that have been selected and prioritized for this interview. Interviewees are welcome to share feedback on the prioritization of these questions.

Community Engagement:

1. What communication channels do you use to reach Seabrook residents?
    a. What groups of residents are the hardest to reach and obtain feedback from in Seabrook and why are they difficult to reach?
    b. Do you use any particularly effective methods for obtaining engagement from people who are less likely to show up to public meetings (which could include translation support, providing childcare at meetings, etc.)?
    Do you partner with or interact with any organizations to reach traditionally underrepresented groups? Is there anyone else that we should be talking with?
    c. What Town buildings or community centers would you recommend for public engagement events? (i.e., the Public Library or other venues).
    d. We have started to develop a list of annual or recurring events in Seabrook that engagement efforts could plug-into. Are there other events that we should add to our list below?
        i. Drop-in Senior Bingo Thursdays, 12:30-2:30PM, hosted by the Seabrook Recreation Department
        ii. Monthly Blue Ocean Society for Marine Conservation Beach Cleanup events
        iii. Annual Lights on After-school Halloween Event, October, hosted by the Seabrook Recreation Department
        iv. Annual Seabrook Tree Lighting, December
2. What are you doing differently for public engagement during the COVID-19 pandemic? What has worked well, and what didn't work?
    a. What are your thoughts on the effectiveness of strategies like virtual meetings or webinars, videos, and online surveys in Seabrook?
3. What messages would you use to engage the public about protecting critical assets like the WWTF?
    a. What is the most important thing that residents need to know about the Seabrook WWTF?
    b. What should they know about its vulnerability to coastal hazards and the options for addressing that vulnerability?
    c. What if your best alternative is to relocate parts or all of the WWTF at some point in the future? How should that be communicated to residents? What reaction do you anticipate?

4. What messages related to climate resiliency would resonate with all Seabrook residents, and what messages would resonate with specific populations (youth, seniors, etc.)?
5. Can you think of any upcoming community resilience planning or construction projects in Seabrook that might benefit from assistance with engaging residents?
6. Do you foresee any barriers to using an engagement strategy in the future? If so, what are the barriers? For example, funding, staff capacity, or specific expertise (i.e. social media post writing).
7. What are some of the barriers to engaging Seabrook residents in town decision-making and needs today? Do you think those barriers will change in the future?

Time-Permitting Question Bank

Climate Resilience & WWTF Resiliency:

1. What do you think the climate resiliency priorities are in Seabrook?
2. What areas are you most concerned about when it comes to current and future flood risk in Seabrook?
3. What are some of your initial thoughts about strategies to make Wright's Island and the WWTF more resilient to coastal flood risks?
4. How do see climate resilience overlapping with your department's mission?

Planning Interview

Tom Morgan, Town Planner

Introduction

Climate Resilience

Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP) defines resilience as "a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment."

Wastewater Treatment Facility (WWTF) Resiliency Options: Overview

The Town of Seabrook identified several critical wastewater treatment components vulnerable to sea level rise in the 2016 CHAMP, including the critically important WWTF on Wright's Island. The isolated nature of the WWTF makes it particularly susceptible to sea level rise and coastal surge, and any disruptions to WWTF operation quickly becomes a public health risk. The project is assessing the specific vulnerabilities at the site and up to four options for improving resiliency. The project is also identifying effective communication and outreach methods to continue the conversation about climate change in Seabrook and to engage the public in the results of the WWTF assessment.

Equitable Community Engagement Strategy: Overview

The Equitable Community Engagement Strategy is a guide for conducting community outreach in Seabrook based on previous experiences, expertise, and existing resources. The Engagement Strategy is intended to build capacity and support new Town employees, staff who do not regularly conduct engagement, staff working to increase equity in engagement efforts, future climate champions, and future consultants working in Seabrook for the first time. The document itself should evolve as new resources become available and lessons are learned. The Engagement Strategy currently provides an introduction and overview, step by step recommendations for engaging traditionally underrepresented audiences, specific messaging about climate resilience, and engagement technique checklists. The WWTF Resiliency project described above is being used as a pilot to test the implementation of the engagement strategy, a process that could be replicated by other coastal communities in New Hampshire.

Primary Question Bank

A list of possible questions that have been selected and prioritized for this interview. Interviewees are welcome to share feedback on the prioritization of these questions.

Community Engagement & Equity:

Broad Engagement:

1) What are you doing differently for public engagement during the COVID-19 pandemic? What has worked well, and what didn't work?
    a) What are your thoughts on the effectiveness of strategies like virtual meetings or webinars, videos, and online surveys in Seabrook?
2) What are some of the barriers to engaging Seabrook residents in town decision-making and needs today? Do you think those barriers will change in the future?

3) What communication channels do you use to reach Seabrook residents?
    a) What groups of residents are the hardest to reach and obtain feedback from in Seabrook and why are they difficult to reach? What groups are underrepresented?
    b) Do you use any particularly effective methods for obtaining engagement from people who are less likely to show up to public meetings (which could include translation support, providing childcare at meetings, etc.)?
    c) Do you partner with or interact with any organizations to reach traditionally underrepresented groups?
    d) At which local venues is the public most likely to attend engagement events? (i.e., the Public Library, a community center, or other venues).
    e) Rather than asking residents to come to a Town meeting, has the Town taken an approach of "meeting people where they are"? In other words, does the Town attend regularly scheduled meetings by local organizations?
    f) We have started to develop a list of annual or recurring events in Seabrook that engagement efforts could plug-into (during times when COVID is not a concern). Are there other events that we should add to our list below?
        i. Drop-in Senior Bingo Thursdays, 12:30-2:30PM, Seabrook Recreation Dept.
        ii. Monthly Blue Ocean Society for Marine Conservation Beach Cleanup events
        iii. Annual Lights on After-school Halloween Event, October, hosted by the Seabrook Recreation Department
        iv. Annual Seabrook Tree Lighting, December
        v. Old Home Day, August

Engagement Strategy:

4) Can you think of any upcoming community resilience planning or construction projects in Seabrook that might benefit from a guide to assist with engaging residents?
5) Do you foresee any barriers to using an engagement strategy in the future? If so, what are the barriers? For example, funding, staff capacity, or specific expertise?

Climate Resiliency Engagement:

6) What messages related to climate resiliency would resonate with all Seabrook residents, and what messages would resonate with specific populations (youth, seniors, seasonal residents, renters, etc.)?
7) Do you foresee any barriers to engaging residents on climate resilience?

Time-Permitting Question Bank

Climate Resilience & WWTF Resiliency:

1) What current initiatives are ongoing related to climate resilience? What reports or resources should we be aware of?
2) What do you think the climate resiliency priorities are in Seabrook?
3) How do see climate resilience overlapping with your department's mission?
4) What areas are you most concerned about when it comes to current and future flood risk in Seabrook?
5) What are some of your initial thoughts about strategies to make Wright's Island and the WWTF more resilient to coastal flood risks?
6) Would you be willing to help spread the word related to the WWTF Resiliency project? What resources would assist you in doing so (i.e., email blast template, social media post template)?

Board of Selectmen April 19, 2021

April 19, 2021

Open Meeting at 10:30 A.M.

TURN CELL PHONES TO VIBRATE OR OFF PLEASE
PLEDGE OF ALLEGIANCE

Public Hearing

1.) Public Hearing - USDA-RD Grant - Up to $2,400,000.00

USDA Grant

2.) Public Hearing - Climate Resilience Assessment & Targeted Engagement & Climate Communication Grant - $45,000

Grant

Meetings

1.) Monthly Meeting - DPW Manager

Monthly Report

Question of approving street paving recommendations

Question of approving reactivation of recycling program and transfer station reopening

2.) Monthly Meeting - Recreation Director

Monthly Report

New Business

1.) Question of approving previous minutes of November 16 public.

November 16th Minutes

2.) Question of approving encumbrances.

Encumbrances

3.) Question of approving water service applications for;

Domenic Mazzacco - 107 Atlantic Avenue

Mark & Elisia Saab - 150 Ocean Blvd.

Mark & Elisia Saab - 154 Ocean Blvd.

B&G Corey Landscaping & Excavator - 319 Route 286

205 Bristol Street LLC. - 206 Bristol Street

4.) Question of approving sewer service applications for;

Gray Construction - 107 Atlantic Avenue

Mark & Elisia Saab - 154 Ocean Blvd.

B.G. Corey Landscaping & Construction Co. - 319 Route 286

205 Bristol Street LLC. - 206 Bristol Street

5.) Question of approving 9 elderly exemptions

Elderly Exemption 1

Elderly Exemption 2

Elderly Exemption 3

Elderly Exemption 4

Elderly Exemption 5

Elderly Exemption 6

Elderly Exemption 7

Elderly Exemption 8

Elderly Exemption 9

6.) Question of approving 2 disability exemptions

Disability Exemption 1

Disability Exemption 2

7.) Question of approving veteran exemptions for:

Charlotte Hatt - 41 Stacey Avenue

James Starr, Jr. - 8 Timber Court

Daniel Pollard - 231 Walton Road

8.) Question of approving 200 bicycle helmets through CHaD

Acceptance of Bike Helmets

9.) Question of approving parking enforcement pay adjustment

Police Request for Parking Enforcement

10.) Question of discussion on Beach Rules & Regulations; Overnight Parking, Dog Fines and Marking/Striping Beach Streets

11.) Question of approving appointment for Gilbert Nevarez - Planning Board Alternate.

Appointment Letter- Gilbert Nevarez

12.) Question of approving surplus request - DPW truck #70

DPW Request for Surplus Truck #70

Questions/Comments

PUBLIC PARTICIPATION

Non-Public Session

1.) RSA 91-A:3, II (c) welfare liens and (e) legal

Seabrook WTF Resiliency Opportunities Analysis Project

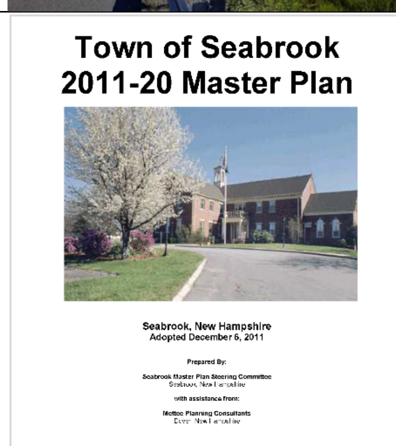
4-Minute Educational Video Storyboard and Promotion Package

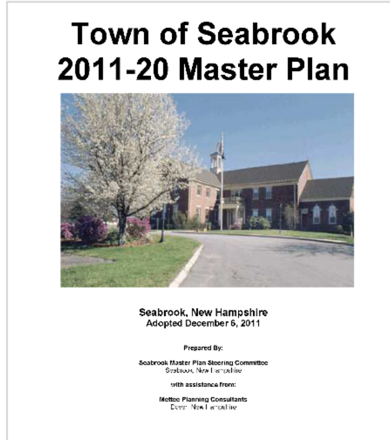
This document includes a proposed storyboard for a 4-minute video on climate risks to the WWTF, paired with a link to an online comment form for questions. Additional details are summarized below:

- The final export of public comments from the comment form will be shared with the Town
- W&S will support the Town in responding to the public comments by preparing and posting a 1-page FAQ sheet informed by the questions and comments received.
- The Town will post the video online, on Channel 22, and on social media. A proposed Facebook post is included below.
- The video and comment form will also be announced through a press release. An updated draft is included below.
- W&S will conduct direct outreach via phone or email to partners listed in the Engagement Guide to promote the video and comment form.

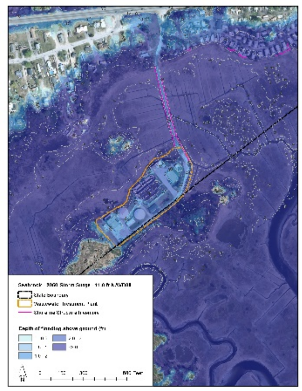
4-Minute Educational Video Storyboard

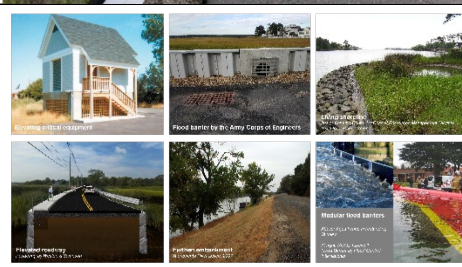
Note: music will play in the background of the video, along with an audio voiceover.

Timing	Audio Voiceover Script	Visual
00:02	What is resilience?	
00:28	Seabrook's 2016 Coastal Hazards and Adaptation Master Plan Chapter (CHAMP) defines resilience as "a capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment."	 **Town of Seabrook** **2011-20 Master Plan** Seabrook, New Hampshire Adopted December 6, 2011 Prepared By: Seabrook Master Plan Steering Committee Seabrook, New Hampshire with assistance from: Mettee Planning Consultants Dover, New Hampshire

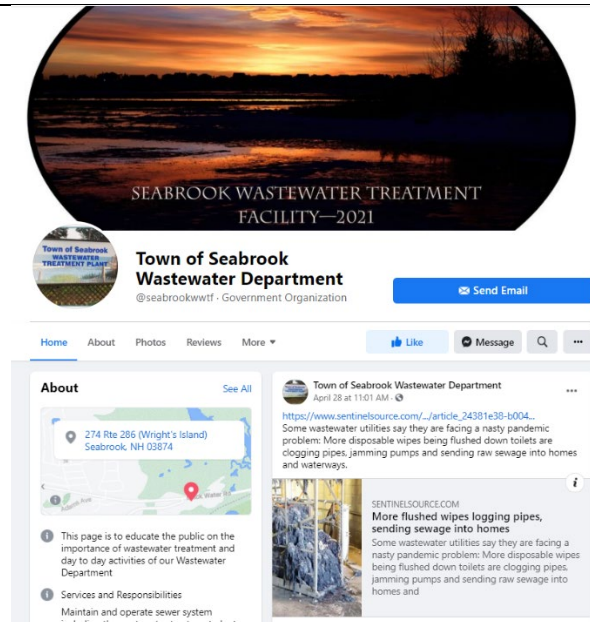
00:05	The CHAMP is helping guide the Town's approach to preparing for climate change.	
00:15	In particular, the CHAMP identified critical local infrastructure vulnerable to sea level rise, including the Wastewater Treatment Facility on Wright's Island and the pump station that supports the facility	
00:05	What is Seabrook's Wastewater Treatment Facility (WWTF)?	
00:12	The WWTF runs 24/7 to support day-to-day life and public health in Seabrook! The WWTF collects and treats residential, commercial, and industrial wastewater from most of the Town	

00:10	The WWTF is vulnerable to climate risks like sea level rise, coastal storm surge, groundwater rise, and precipitation	
00:10	Any disruptions to the Wastewater Treatment Facility could pose serious public health risks and could impact commercial operations and cause business disruptions	 *(Photo from the Town of Seabrook Facebook page)*
00:25	As a result, the Town is working on a project to assess vulnerabilities at the Wastewater Treatment Facility and pump station on Route 286.	
	The treatment facility is currently at elevation 9 NAVD88, which keeps it out of harm's way now, but we're exploring how flooding could exceed that elevation in the future and what the options are to improve resilience	 Add text over image that reads, "NAVD88 is a vertical datum used to compare flood elevations"
00:06	The Route 286 pump station is currently at a low elevation and is already experiencing flooding. This is critical infrastructure for the collection system and pumps all of the wastewater flows from the beach area to the WWTF.	

00:10	The flood analysis found that water levels could reach elevation 6.9 NAVD88 at the WWTF and pump station if sea-level rises 2.5 feet by 2050.	 
00:12	The flood analysis also modeled 4.9 feet of storm surge with 2.5 feet of sea-level rise by 2050. Under this scenario, water levels could reach elevation 11.8 NAVD88 at the WWTF and Pump Station.	 
00:08	This could mean flood depths of more than a foot above ground at the Wastewater Treatment Facility and pump station, as shown in this image	
00:08	This could also mean flood depths of more than one foot above ground on the access road, as shown in this image	

<table>
<tr><td>00:12</td><td>While there is uncertainty beyond 2050, we anticipate coastal flood risk and associated flooding extent and depth to continue increasing by 2100 and beyond.</td><td>
(Photo from the Wastewater Department’s Facebook page, 2016)</td></tr>
<tr><td>00:10</td><td>The key takeaway from this flood assessment is that sea level rise will affect access and operations at the Wastewater Treatment Facility</td><td></td></tr>
<tr><td>00:20</td><td>Conceptual resiliency options could include those shown on this slide, such as flood barriers, deployables, elevating critical infrastructure, elevated berms, and living shorelines.</td><td>
</td></tr>
<tr><td>00:15</td><td>Additional analysis will need to be completed before a final strategy is selected. As the Town continues to explore options, we want to keep the conversation going. We invite you to submit a question or comment about this assessment through our online comment form!</td><td>

(Will show video clip scrolling through comment form, and the link (tinyurl.com/SeabrookComment) will be written prominently on the screen)</td></tr>
</table>

00:13	You can also follow the Town's website and Facebook platforms at @townofseabrooknh for the most up to date information about this project.	 (Will show video clip scrolling through Facebook page)
04:00 – Approximate Anticipated Length of Video		

Microsoft Forms Comment Form for Town website

Review the draft comment form here.

Facebook Post

**Note: the written Facebook post will be paired with the video.*

Did you know the Town is mapping future flooding and assessing options to reduce risk to the Wastewater Treatment Facility? Watch our video below for more information, and share your questions through our online comment form at tinyurl.com/SeabrookComment! #ResilientSeabrook

Press Release

[Insert into Town Letterhead]
FOR IMMEDIATE RELEASE
DATE

Town of Seabrook Wastewater Treatment Facility Climate Resilience Assessment

Seabrook's Wastewater Treatment Facility (WWTF), supporting roadway, and pump stations are vulnerable to climate impacts such as sea level rise and coastal storm surge. Located on Wright's Island, the aging WWTF collects and treats residential, commercial, and industrial wastewater from most of the town. Any disruptions to WWTF operation due to flooding from sea-level rise and storm surge could result in significant public health risks. In order to inform long-term planning and ensure public health and safety, the WWTF Climate Resilience Assessment project will help the Town:

- Better understand specific climate impacts to the WWTF
- Identify potential adaptation options for improving the resilience of the WWTF
- Inform the public of project results

Preparing for the long-term impacts of climate change will be critical for the future of our community. Through the Wastewater Treatment Facility (WWTF) resiliency planning process, we want to ensure you are informed about the decisions the Town is making to safeguard this critical community asset. The Town has released a video and online comment form (tinyurl.com/SeabrookComment) to hear your comments and questions about the conceptual options that have been identified to ensure our WWTF is able to function in current and future changing conditions.

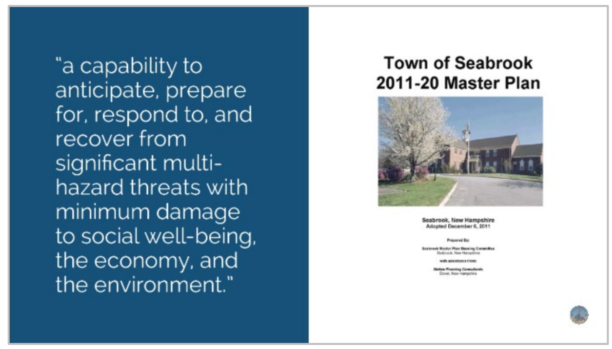
This project was funded, in part, by NOAA's Office for Coastal Management under the Coastal Zone Management Act in conjunction with the New Hampshire Department of Environmental Services Coastal Program. The Town has contracted Weston & Sampson, an interdisciplinary design and engineering consultancy, to support this project.

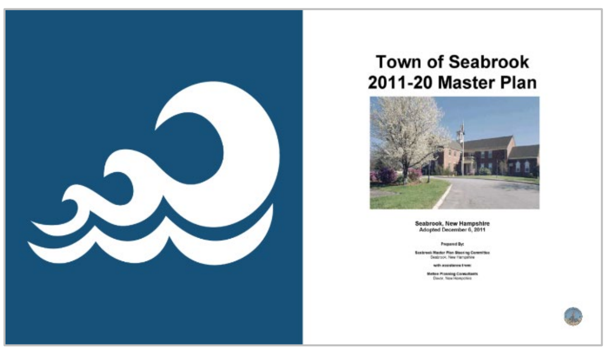
Follow the Town's website and Facebook platforms (@townofseabooknh and @seabrookwwtf) for updates on this project. Visit the comment form (tinyurl.com/SeabrookComment) or contact the Seabrook Sewer Department at Wastewater@seabrooknh.org or 603-474-8012 for questions regarding this project.

Seabrook Wastewater Treatment Facility (WWTF) Resiliency Opportunities Analysis

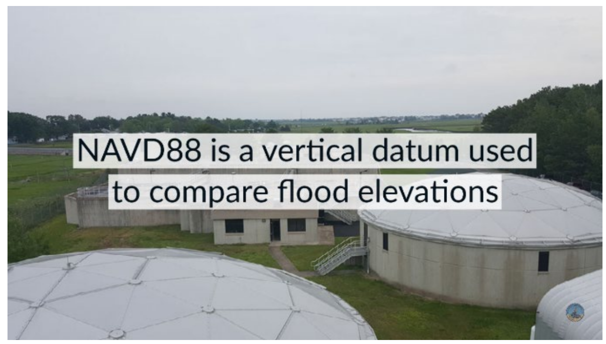
Educational Video

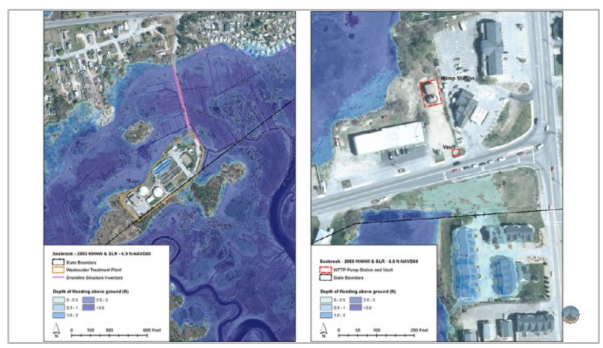
Video stills from the 5-minute educational video are included below, and the video can be viewed online at [tinyurl.com/SeabrookWWTFVideo.](tinyurl.com/SeabrookWWTFVideo)

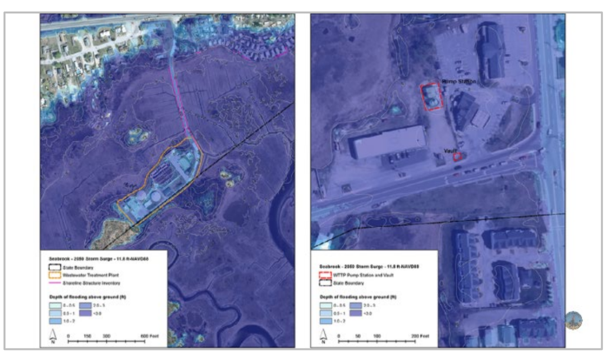





INFLUENT HEADWORKS BUILDING
CHLORINE CONTACT TANKS
OXIDATION DITCHES
METER VAULT
OPERATIONS BUILDING
PUMP BUILDING
SECONDARY CLARIFIERS


NAVD88 is a vertical datum used
to compare flood elevations

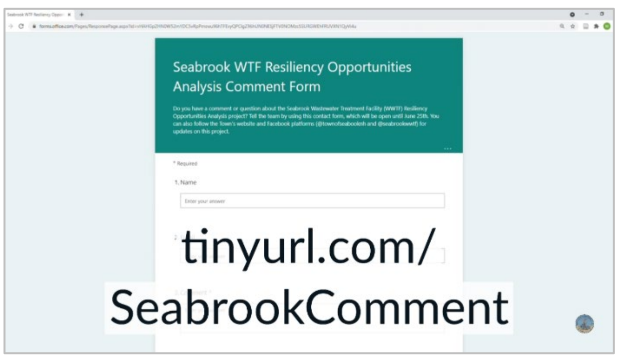


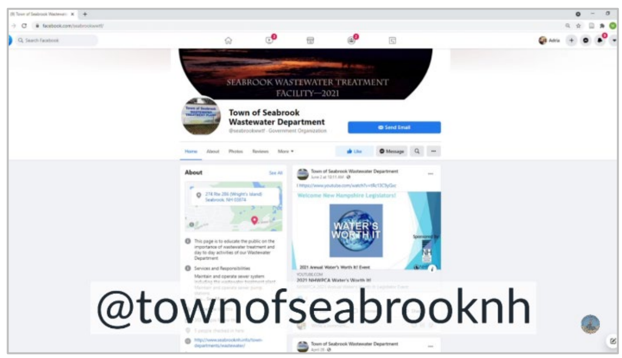



2050 SLR + 100-yr Surge EL = 11.81 ft-NAVD88
Record EL = 9.3 ft-NAVD88
Present MHHW + 100-yr Surge EL = 9.31 ft-NAVD88
Parking Lot EL = 9.27 ft-NAVD88


2050 SLR + 100-yr Storm Surge EL = 11.8 ft-NAVD88
Record EL = 10.2 ft-NAVD88


Elevating critical equipment
Flood barrier by the Army Corps of Engineers
Living shoreline
Elevated roadway
Rendering by Weston & Sampson
Earthen embankment
Sacramento River Levee, 2007
Modular flood barriers
Above: Aqua Fence Freestanding Barriers
At right: NOAQ Tubewall Flood Barrier by Flood Control International

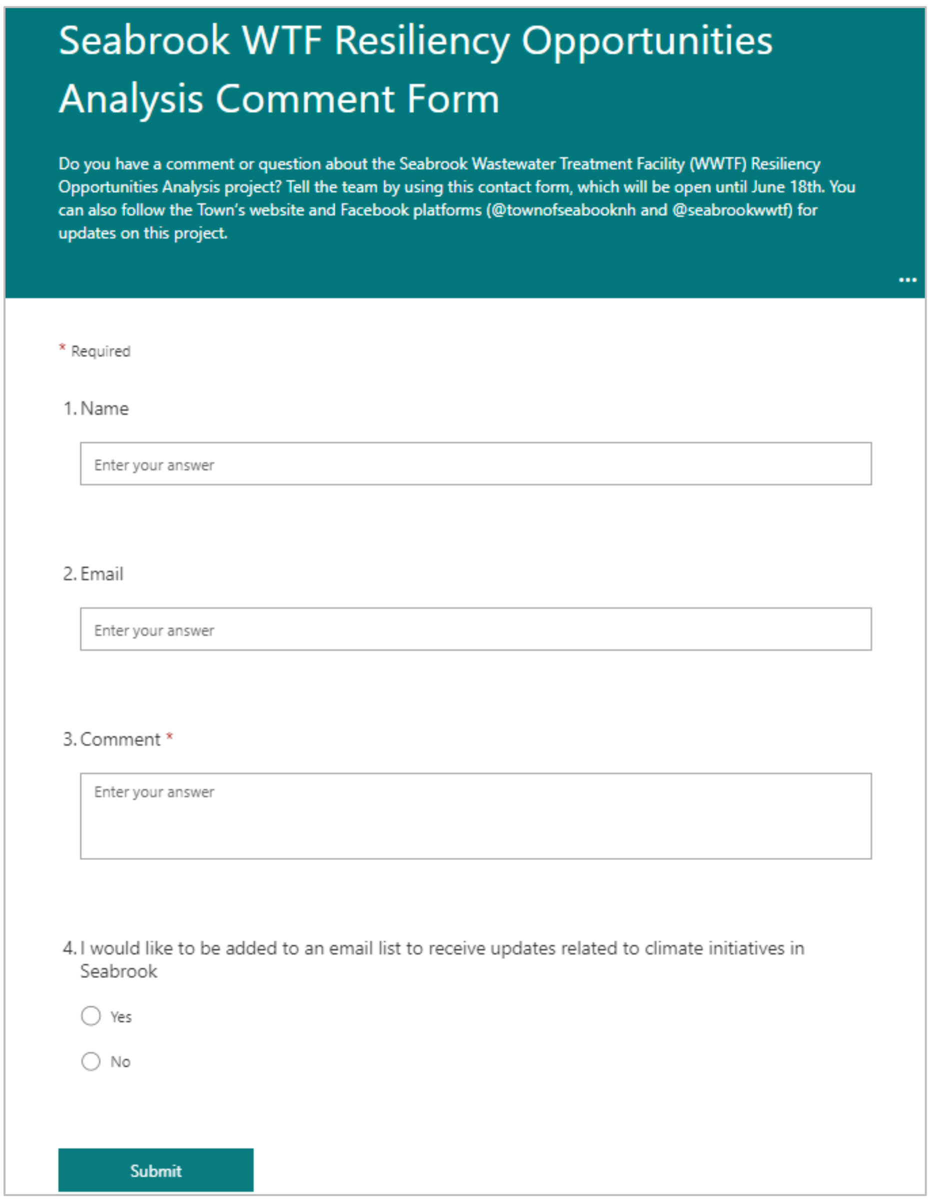

Seabrook WTF Resiliency Opportunities Analysis Comment Form
Do you have a comment or question about the Seabrook Wastewater Treatment Facility (WWTF) Resiliency Opportunities Analysis project? Tell the team by using this contact form, which will be open until June 25th. You can also follow the Town's website and Facebook platforms (@townofseabooknh and @seabrookwwtf) for updates on this project.
* Required
1. Name
Enter your answer
tinyurl.com/
SeabrookComment


SEABROOK WASTEWATER TREATMENT FACILITY—2021
Town of Seabrook Wastewater Department
Send Email
WATER'S WORTH IT
@townofseabrooknh

Seabrook Wastewater Treatment Facility (WWTF) Resiliency Opportunities Analysis

Comment Form

The comment form was paired with the educational video, and was available at tinyurl.com/SeabrookComment for a two-week period from June 23, 2021, to July 7, 2021. The comment form and video were promoted through social media, Channel 22, updated webpage content, a press release, and direct outreach to key local partners who were listed in the Equitable Community Engagement Guide for Climate Resilient Projects developed as part of this project.



Seabrook WTF Resiliency Opportunities Analysis Comment Form

Do you have a comment or question about the Seabrook Wastewater Treatment Facility (WWTF) Resiliency Opportunities Analysis project? Tell the team by using this contact form, which will be open until June 18th. You can also follow the Town's website and Facebook platforms (@townofseabooknh and @seabrookwwtf) for updates on this project.

* Required

1. Name

Enter your answer

2. Email

Enter your answer

3. Comment *

Enter your answer

4. I would like to be added to an email list to receive updates related to climate initiatives in Seabrook

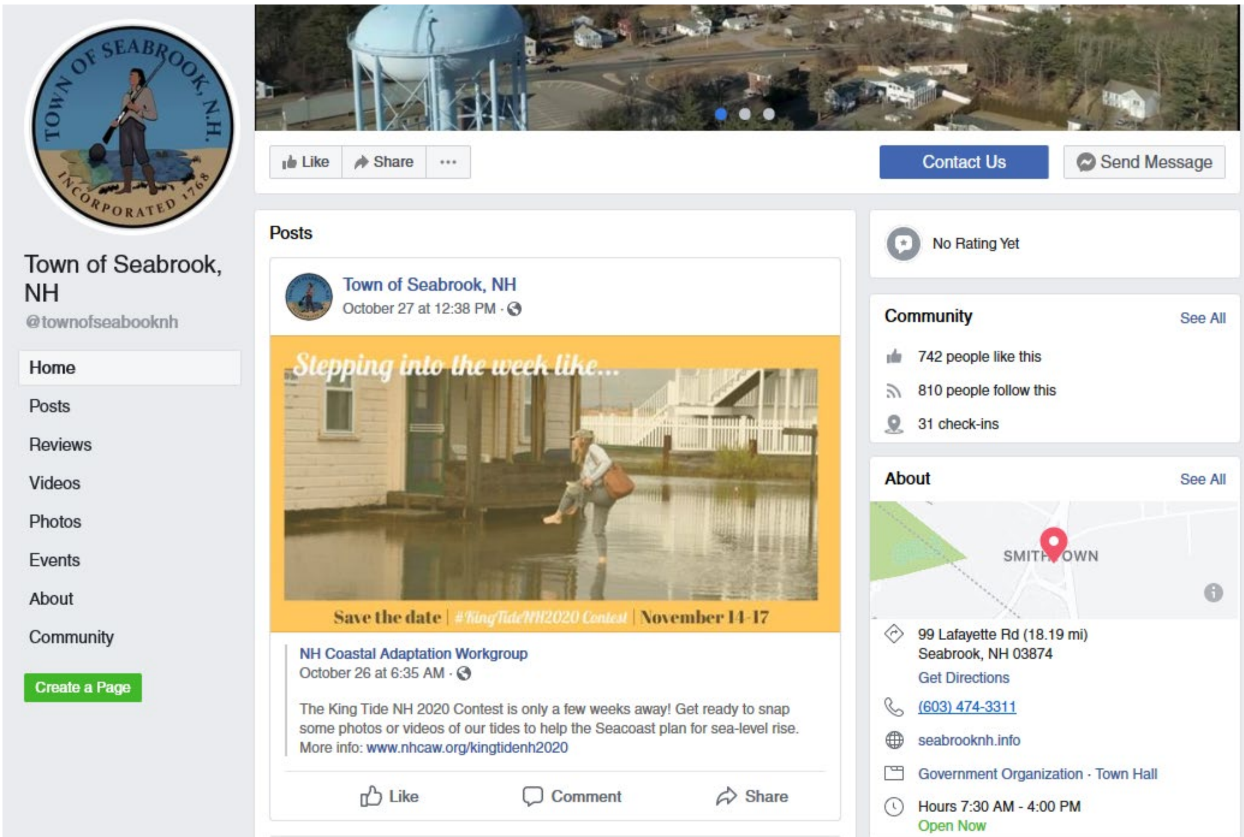
Yes

No

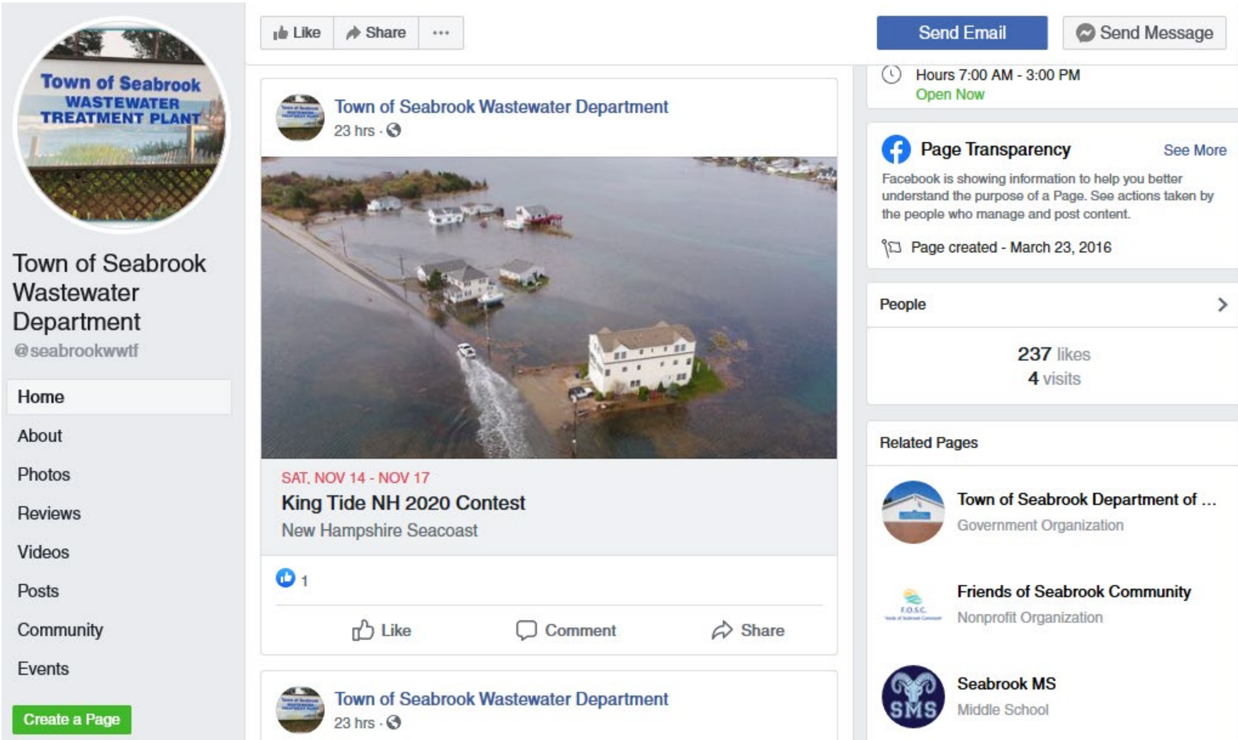
Submit

Seabrook Wastewater Treatment Facility (WWTF) Resiliency Opportunities Analysis

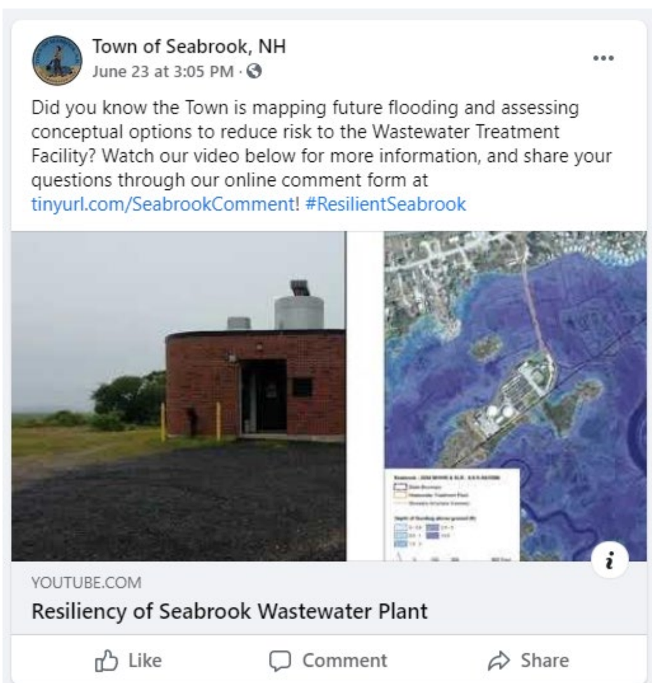
Social Media Posts



The Town of Seabrook Facebook account reposted the NH Coastal Adaptation Workgroup (CAW) King Tide NH 2020 Contest on October 29, 2020



The Town of Seabrook Wastewater Department Facebook account reposted the NH Coastal Adaptation Workgroup (CAW) King Tide NH 2020 Contest on October 29, 2020



The Town of Seabrook Facebook account promoted the educational video and comment form on June 23, 2021