Wiscasset, Maine

Wastewater Treatment & Collection Facilities Coastal Hazard Resilience Study

Date: January, 2017

Prepared Wright-Pierce

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Acknowledgements

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1 Executive Summary

The Committee is considering adaptation strategies for improvements to Wiscasset's wastewater treatment and collection facilities that could mitigate impacts to these facilities from predicted climate change factors, including coastal flooding, sea level rise, storm surge, and rainfall precipitation.

The Wastewater Treatment Plant (WWTP) and Water Street Pump Station along the Sheepscot River and with the Town's Historic Village District have been identified by the Committee as having the potential to be impacted by these climate change factors. With the support of the State's Maine Coastal Program and federal funding from NOAA, the Town of Wiscasset retained Wright-Pierce to assess potential impacts to the wastewater facilities, and to evaluate adaptation strategies for mitigation of the potential impacts.

A review of readily available wastewater facilities, and environmental site conditions data, along with input and guidance from the Committee, served as the basis for selection of (3) three elevation scenarios to be utilized for this assessment. The results of the assessment are intended to provide the Committee with a cost / benefit matrix to guide them in making prioritized capital construction, maintenance and operations decisions. These decisions consider the Committee's near, mid and long-term goals to provide continued sewer service to the communities of Wiscasset and Edgecomb over an approximately 50-year planning horizon.

The Committee does not anticipate significant residential or commercial growth within the community, which would significantly impact the capacity of the current wastewater facilities to serve the needs of the community by 2070.

The following timeframes for guiding prioritized mitigation improvements to the wastewater facilities are recommended for the Committee to consider, along with capital costs:

- Near-term is considered within 20 years (2020 to 2040)
- Mid-term is considered from 20 to 40 years (2040 to 2060)
- Long-term is considered beyond 40 years to the planning horizon (2060 to 2070+)

It is important to note that current federal regulations and funding agency supported guidelines require that critical infrastructure be protected within Federal Emergency Management Agency (FEMA) 100-year coastal flood zones to an elevation of 3 feet above the 100-year base flood elevation (BFE). While this additional elevation above the 100-year BFE may address climate impacts due to increased flooding from sea level rise, or from greater storm surge events, the BFE plus 3 feet (BFE +3) of additional elevation may not account for impacts from both environmental factors combined.

The findings and recommendations associated with this assessment consider elevation scenarios for flood elevations in addition to and in excess of BFE +3 by adding 1 foot, and 3 feet of additional elevation above the current regulatory benchmark. The majority of the wastewater facilities assessed were found to be impacted by inundation in a similar manner under each of these three elevation scenarios. Correspondingly, the differences amoung cost estimates for implementing adaptation measures to mitigate these impacts were generally found to be nominal between the three elevation scenario elevations.

2 Goals, Study Approach and Recommendations

Goals

The Committee's goal for this assessment is to identify which of their wastewater facilities would likely be impacted by coastal flooding associated with potential climate change factors including, sea level rise, storm surge and rainfall precipitation. After the wastewater facilities prone to such impacts were identified, the assessment suggested a variety of adaptation strategies to mitigate potential impacts to the Committee's wastewater facilities from a cost / benefit standpoint, comparing impacts and associated mitigation costs for each of the three elevation scenarios selected by the Committee.

The State's goal in supporting this project is not only to develop a sound planning basis for protection of the Committee's wastewater facilities from predicted coastal hazards, but to also develop a study that may have components which are transferable to other similar coastal riverine Maine communities.

Approach

The assessment commenced with a review of readily available sources including:

- Topographic LiDAR data (Accurate to plus or minus 1.0 vertical foot of elevation).
- Record drawings of the wastewater facilities.
- FEMA flood mapping identifying Special Flood Hazard Areas (SFHAs) over or in close proximity to the wastewater facilities.
- Historic sea level rise data from NOAA and predicted sea level rise scenarios from the United States Army Corps of Engineers (ACOE).
- Historic data and predicted 100-year and 500-year, 24-hour rainfall precipitation totals from the National Weather Service (NWS).
- Historic hurricane records and predicted storm surge inundation depths from NOAA and the NWS.
- Federal regulations, and guidelines of federal and state agency programs supporting operations and maintenance of critical wastewater infrastructure systems.

All elevation data was correlated to a common vertical datum for consistency. The geodetic vertical datum referenced for this study and all subsequent elevations denoted in this assessment (unless otherwise noted elsewhere) is the North American Vertical Datum of 1988 (NAVD88).

Based on the initial review of readily available data, the following wastewater facilities were identified as having a strong potential to be impacted by coastal flooding from sea level rise and storm surge:

- Wastewater Treatment Plant (WWTP)

- Waster Street Pump Station (PS #6)

These initial findings were reviewed by the Committee, who in turn provided additional wastewater facilities data based on maintenance and operations experience with the facilities. Supplemental field observations were also made by Wright-Pierce.

A range of potential inundation elevations corresponding to regulatory requirements and additional predicted sea level rise and storm surge conditions through 2070 were discussed with the Committee. After these discussions, elevations associated with three elevation scenarios were selected by the Committee for assessment of potential impacts to the wastewater facilities and for suggested adaptation strategies to mitigate the impacts at each of these inundation elevations. The three scenarios selected are as follows:

- FEMA 100-year base flood elevation (BFE) plus 3 feet (herein referenced as BFE +3)
- FEMA 100-year base flood elevation (BFE) plus 3 feet, plus 1 foot of sea level rise (herein referenced as BFE +4)
- FEMA 100-year base flood elevation (BFE) plus 3 feet, plus 3 feet of sea level rise (herein referenced as BFE +6)

(See Section 3 for more detail discussion supporting these elevations)

The three elevation scenarios were applied to the existing wastewater facilities data. Mapped plans and profiles of the facilities were created to illustrate delineation of the potential limits of inundation to the wastewater facilities.

Based on a review of the inundation limits at each of the wastewater facilities studied, impacts to the facilities were characterized in association with each of the three elevation scenarios. The results of these potential impacts under each elevation scenario were tabulated to illustrate relative level of inundation impacts by each of the three flood elevation scenarios.

A range of adaptation strategies and associated planning level cost estimates for each of the three elevation scenarios were identified and discussed with the Committee and general public. Based on these discussions and in consideration of the Committee's goals stated above, the range of adaptation strategies and associated planning level cost estimates were further refined.

Recommendations

The Committee is concerned with the potential for negative impacts to the WWTP and several pump stations in the face of potential storm surge and sea level rise impacts to these facilities. Wright-Pierce offers the following recommendations for the Committee's consideration to assist in prioritizing implementation the various suggested adaptation strategies:

- The Committee's wastewater facilities have provided consistent and reliable service to portions of the communities of Wiscasset and Edgecomb for many years, however, equipment and building systems will require upgrades in order to provide continued reliable service. Given the location and elevation of the wastewater facilities, adaptation measures for BFE +3 or BFE +4 should be incorporated into near-term and mid-term capital improvements planning. For

long-term planning, or where costs associated with additional materials to protect the facilities at higher elevation scenarios are relatively small in increase, it may be prudent to consider adaptation measures of BFE +6 in the near term as well. If those options are not feasible, relocation of the wastewater facilities to new sites may become an alternate strategy.

- The costs associated with the potential relocation of the WWTP and PS #6 are substantial. In addition, land that is currently available and may be suitable for relocation of the WWTP or any of the pump stations could be developed by other interests over time (and therefore would no longer be available). In order to proactively address the potential for long-term relocation, it would be appropriate for the Committee to consider potential sites for WWTP and pump station relocations in the near term. Once suitable parcels are identified, it may also be appropriate to consider purchase of some or all of those parcels. While relocation of pump stations would require minimal land area to purchase in fee ownership or be permanent easement, larger land area needed for relocation of the WWTP may be more difficult to find. Relocation of the WWTP may require a developable parcel between 1 to 3 acres (rounded up to the nearest acre), based on the current WWTP's 0.62 million gallon per day (MGD) full treatment capacity and the Water Environment Federation's "Design of Municipal Wastewater Treatment Plants – Manual and Reports on Engineering Practices Vol. 8, 1998" design guidelines of 1 acre/MGD to 4.5 acres/MGD.
- Going forward, the Committee should continue to engage agencies that provide grant funding for wastewater facilities as well as adaptation planning and/or implementation.
- The Committee should estimate the user rate impacts associated with these significant capital projects and develop proposed adjustments to user rate system and reserve accounts to address the near-term, and long-term revenue needs, as they deem necessary and appropriate.
- Coordinate with abutting property owners where adaptation strategies include relocation of, or significant increases in elevation of the wastewater facilities. This will likely be key to integrating upgrades of the Water Street Pump Station, given the amount of public comment concerns regarding potential visual impacts presented in a prior recent waterfront boardwalk study, also supported by funding from the Maine Coastal Program.
- The Committee should identify the potential for 'floating' of tanks based on buoyancy of the WWTP structures under the three elevation scenarios when the structures are not overtopped. Wright-Pierce typically designs for groundwater equal to ground surface, so groundwater/floodwater at several feet above grade will add buoyancy which would involve into a greater level of structural "safety factor" assessment beyond the scope of this study.
- This assessment does not require that the Committee make any immediate, or long term decisions to act on any or all of the suggested adaptation strategies for mitigation of coastal flooding impacts under any of the three elevation scenarios. Some infrastructure improvements will likely be required as the wastewater facilities reach their normal life expectancies regardless of the assessment's adaptation mitigation strategies. When such upgrades of any of the wastewater facilities become necessary, the Committee will likely need to comply with one or more of the New England Interstate Water Pollution Control Commission's (NEIWPCCs) TR-16 Guidelines as follows:

- Evaluate sewer lines that run cross country through easements located in a 100-year floodplain. The sewer manholes in these sections should be protected from Infiltration and Inflow (I&I) in flood conditions. Considerations to include water-tight manholes or manholes raised above the 100-year flood level.
- Underground fuel tanks for generators should be safeguarded against buoyancy and lateral movement by floods. In some cases, extra ballast can be added above the tank as needed.
- Recognize the need for locating process units above potential flood levels to avoid possible process unit and equipment damage or process interruption. When eliminating the potential for process interference is not practical due to flood conditions, provide emergency effluent pumping facilities.
- Wastewater facilities susceptible to flooding should consider implementing a flood monitoring protocol to enable advance warning of rising water.
- Backup power supply for normal operation of the treatment processes should be maintained at all times. Furnish a backup power supply for critical equipment by using emergency power generation or an alternative power source of sufficient capacity. In addition, ensure that there is enough fuel to run under full load or peak flow for at least 48 hours, or under normal operating conditions for at least 96 hours, whichever requires the greater amount of fuel.
- Any basement structure in a building located in a flood plain should consider including a flood alarm.
- Potential emergencies should be considered in the design of wastewater treatment works. During emergencies as well as routine operations, primary concerns are personal safety and the ability to maintain the process equipment efficiently. Designs should include consideration of operations activities that may occur after daylight hours. Effective drainage inside and outside of buildings is key to avoiding icing issues and health impacts, and to ensuring safe working conditions.
- Designs should avoid creating “confined space” conditions whenever possible. Emergency access and egress for emergency vehicles should be included in the engineering report as well as recommendations for permanent safety features (e.g., sprinklers, fire hydrants, and alarm systems).
- In areas where hazardous chemicals are stored or used, provide appropriate emergency equipment such as eye wash stations and emergency showers. Ensure all areas where emergency equipment is located have appropriate signage and means of access and egress for emergency personnel. In areas of the plant where powdered or granular chemicals that can generate dust are handled, provide adequate ventilation.

3 Discussion of Climate Change Parameters

This study considers the follow environmental factors and their potential impacts on the Committee's wastewater facilities:

- Coastal flooding
- Sea level rise
- Storm surge
- Increased rainfall precipitation

Coastal Flooding:

FEMA has recently updated Flood Insurance Rate Maps (FIRMs) within the Town of Wiscasset, effective as of July 16, 2015. These maps indicated that the WWTP and PS #6 are within a Special Flood Hazard Area (SFHA) identified by FEMA as 100-year AE. This flood area has a 1% annual change of being equaled or exceeded within any given year. FEMA defines AE zones as areas subject to inundation by the 1% annual chance flood event with a known BFE. Known elevation for the SFHA is based on coastal flood studies that: analyze the effects of rainfall precipitation, tides, storm surges and waves; consider historical coastal flood events that have affected the study area; and use historical data to validate flood, wave and erosion analyses.

In addition to the defined FEMA 100-year flood zone elevation Federal Executive Order 11988: Flood Plain Management (EO 11988) was amended as of January 30, 2015. Specifics of this amendment in relation to the Committee's wastewater facilities require that this infrastructure be protected by adding an additional 3 feet to the 100-year BFE for "Critical" assets and 2 feet above the 100-year BFE for "Non-Critical" assets.

EO 11988 currently states:

(i) Section 6(c) is amended by striking ", including at a minimum, that area subject to a one percent or greater chance of flooding in any given year" and inserting in lieu thereof:

". The floodplain shall be established using one of the following approaches:

> *"(1) Unless an exception is made under paragraph (2), the floodplain shall be:*
>
> > *"(i) the elevation and flood hazard area that result from using a climate-informed science approach that uses the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science. This approach will also include an emphasis on whether the action is a critical action as one of the factors to be considered when conducting the analysis;*
> >
> > *"(ii) the elevation and flood hazard area that result from using the freeboard value, reached by adding an additional 2 feet to the base flood elevation for non-critical actions and by adding an additional 3 feet to the base flood elevation for critical actions;*

"(iii) the area subject to flooding by the 0.2 percent annual chance flood; or

"(iv) the elevation and flood hazard area that result from using any other method identified in an update to the FFRMS.

EO 11988 defines Critical as:

"(d) The term 'critical action' shall mean any activity for which even a slight chance of flooding would be too great."

The Environmental Protection Agency (EPA) has submitted draft regulations to the Federal Office of Management and Budget (OMB) describing how they will comply with EO 11988. Review by OMB has implied that the draft document was insufficient with no additional information offered to the public at this time.

The Maine Department of Environmental Protection (MaineDEP) who administers distribution of Federal and State Clean Water Revolving Loan Funds (CWSRF) in support of sewer infrastructure needs in the state has no current requirement address the new FIRM elevations. With that said, FEMA has indicated that they are only willing to fund projects that address EO 11988. Furthermore, MaineDEP has long used NEIWPCC's TR-16 Guidelines for the Design of Wastewater Treatment Works and the latest revised version of this document as of May of 2016 generally follows the EO11988 definition of protecting infrastructure.

In short, EO 11988 mandates that any critical asset within the FEMA 100-year flood zone be protected to an elevation of 3 feet above the BFE, and while the regulations defining critical infrastructure are currently being defined, state and federal funding sources are likely to support this elevation benchmark for projects that they support.

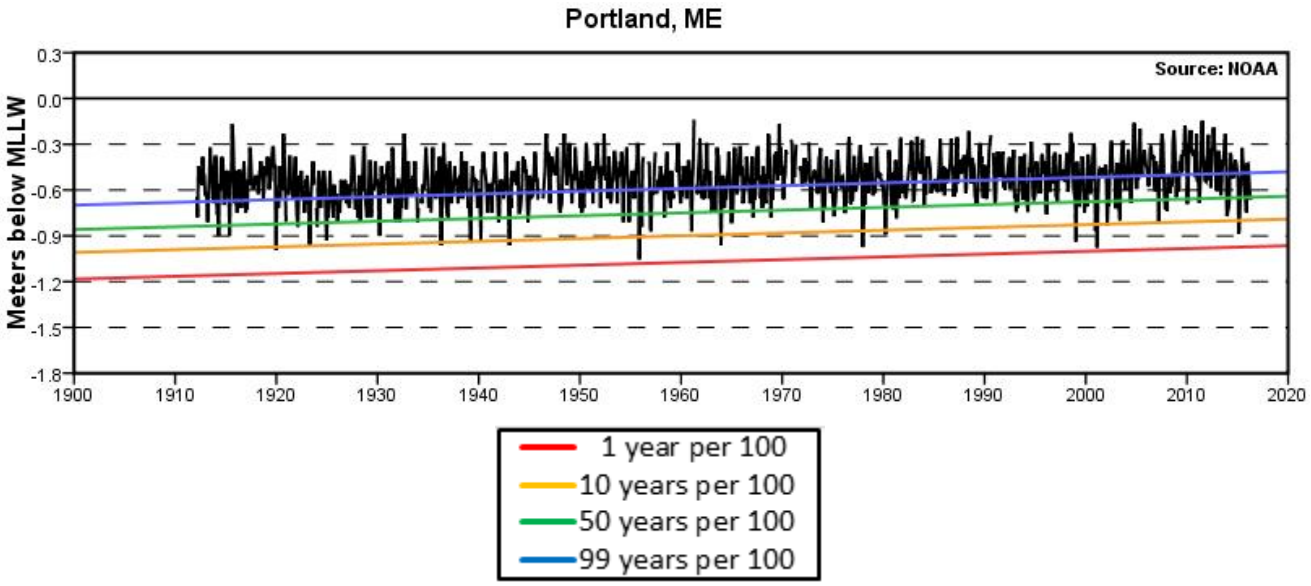
As noted above, FEMA SFHAs are based on analysis of historical flooding data and do not consider potential effects of climate change which may result increases to the 100-year BFEs. Discussions of potential increased impacts due to climate change factors including sea level rise, storm surge and rain fall precipitation follow below in this section of the assessment.

Sea Level Rise:

Advances in predictive scientific modeling and availability of historic sea level rise data for a period of greater than a century have led to development of future sea level rise scenarios that are receiving increased support from local, state and federal entities responsible for operating and maintaining our nation's infrastructure. Studies based on historic flood data alone do not consider effects of climate change on future flooding events and an increased importance has been placed on sea level rise scenarios and their potential impacts to public infrastructure.

Below is a chart of extreme water levels above the mean highest high water elevation as measured at the National Oceanic and Atmospheric Administration's (NOAA) nearest tidal station gauge nearest to Wiscasset (Station 8418150 in Portland). The monthly extreme water levels include a Mean Sea Level (MSL) trend of 1.82 millimeters/year with a 95% confidence interval of +/- 0.17 millimeters/year based on monthly MSL data from 1912 to 2006 which is equivalent to a change of 0.60 feet in 100 years.

The plots below show the monthly highest water levels with the 1%, 10%, 50%, and 99% annual exceedance probability levels in red, orange, green, and blue. The plotted values are in meters relative to the Mean Higher High Water (MHHW) datum established by CO-OPS (1 foot = 0.3 meters). On average, the 1% level (red) will be exceeded in only one year per century, the 10% level (orange) will be exceeded in ten years per century, and the 50% level (green) will be exceeded in fifty years per century. The 99% level (blue) will be exceeded in all but one year per century, although it could be exceeded more than once in other years.



The United States Army Corps of Engineers (USACOE) Sea Level Change Curve Calculator was utilized for this project to illustrate a range of sea level rise scenarios for the Committee's consideration. The USACOE calculator includes historic NOAA tidal gauge data (as indicated above) and the U.S. National Climate Assessment sea level rise curve data in reference to local mean sea level (LMSL).

NAVD88 is 0.09 meters, or 0.30 feet above the LMSL tidal datum at NOAA's Portland Station.

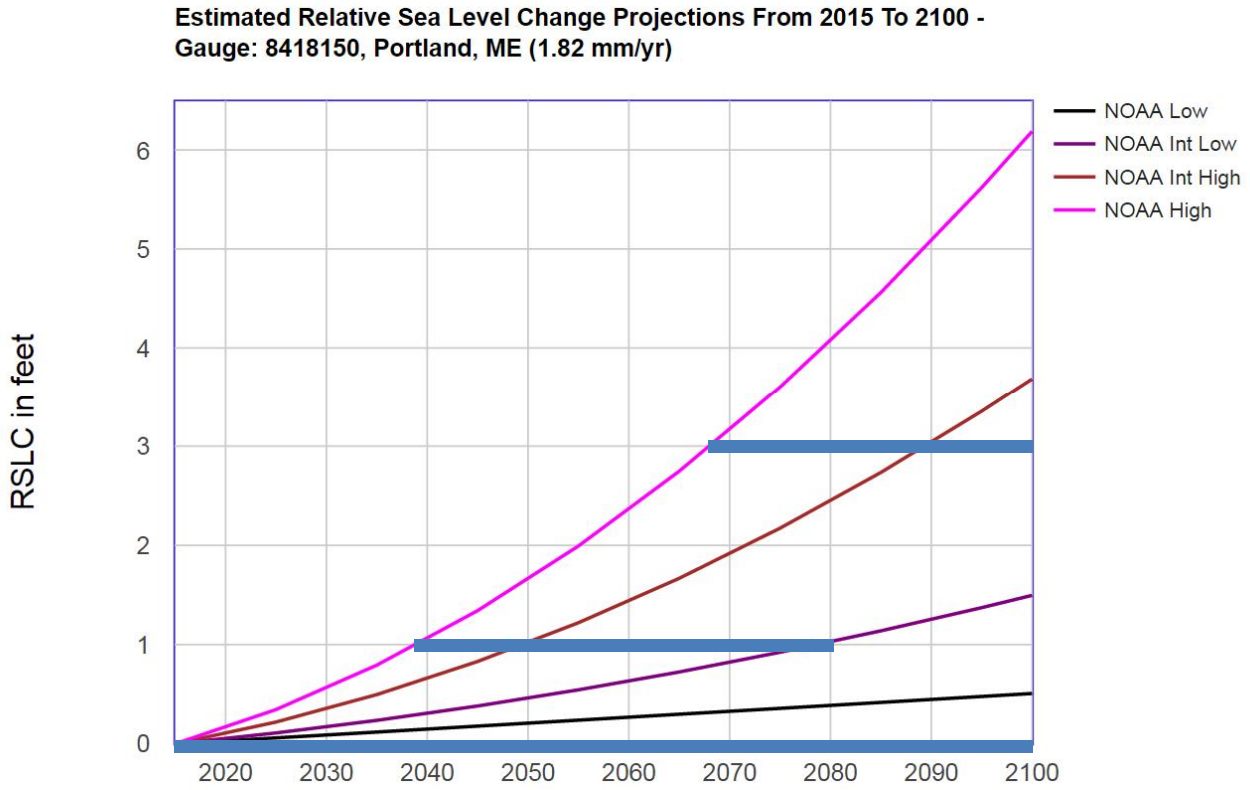
For reference, tidal datums are determined by averaging the water level at a tide gauge over a period of time (known as a national tidal datum epoch). The current epoch is from 1983 to 2001).

The curve data also takes into account predicted regional coastal subsidence and/or upward vertical land movement in relation to global sea level rise projections.

Estimated sea level rise scenarios by 2070 are based on the following:

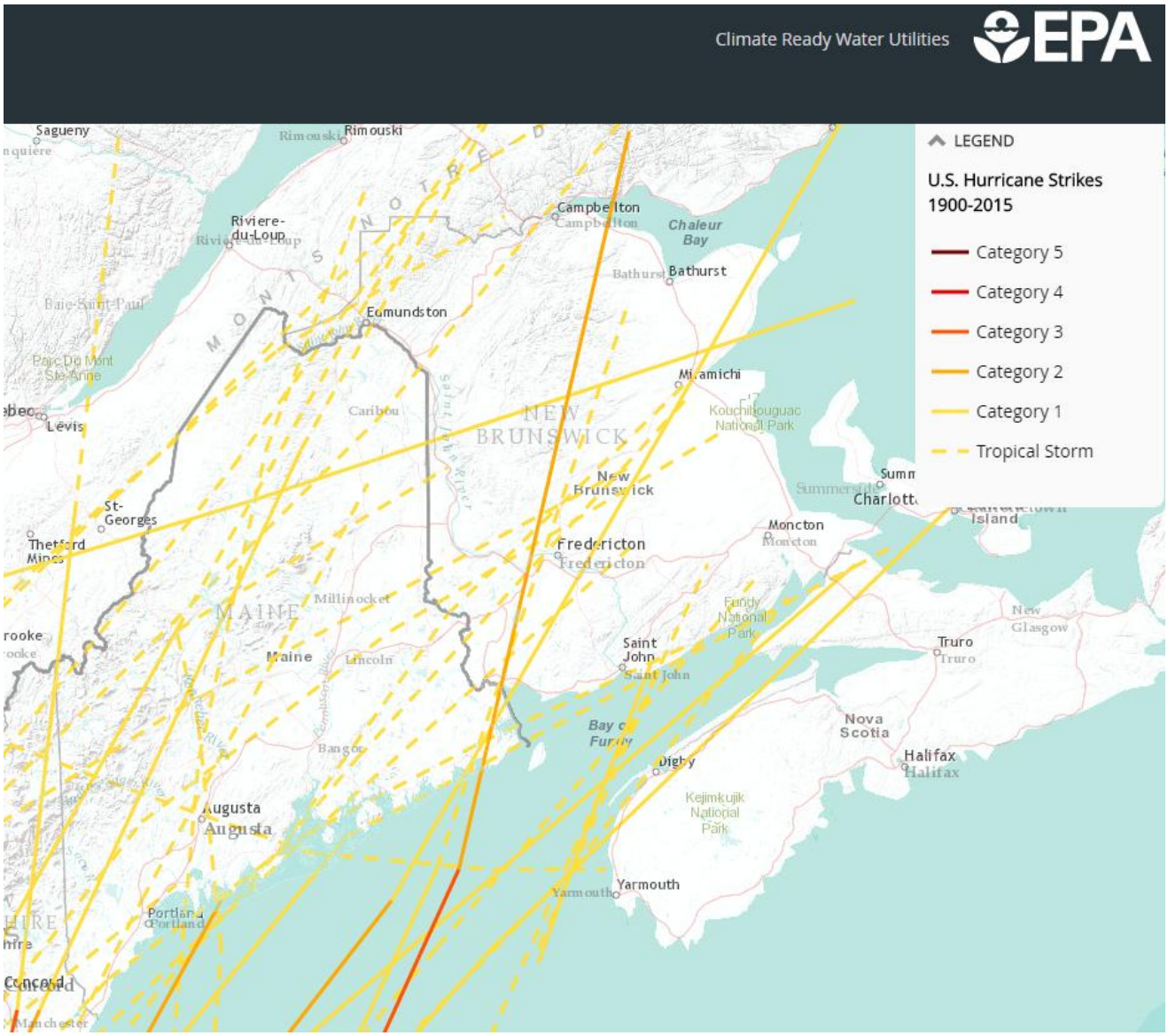
- Low Curve – Linear extrapolation of the historical sea level rise derived from NOAA tidal gauge records over the past century extended to 2070.
- Intermediate Low Curve – Linear extrapolation plus thermal expansion of the ocean waters. (As ocean temperatures increase, the water expands.)
- Intermediate High Curve – Linear extrapolation plus thermal expansion of the ocean waters, plus volumetric increase due to recent melting of land based ice sheets and glaciers.
- High Curve – Thermal expansion plus maximum potential melting of land based ice sheets and glaciers.

The following tables were generated from the USACOE curve calculator to further illustrate potential sea level rise scenarios through the 2070 assessment planning timeframe. (Again, note that the elevation data in the figure below is in relation to the local mean sea level datum and 0.30 feet are then added to adjust to NAVD88. Under the three elevation scenarios selected, sea level rise estimates associated with BFE +3 and BFE + 4 are within the near and long range planning horizon of 2070 and BFE +6 sea level rise estimate begin around 2070.



Storm Surge

Over the past 100 plus years, NOAA records indicated that nine hurricanes have passed through Maine's land borders with only five storms actually making landfall. Three of these storms were category 2 hurricanes and two were category 1 hurricanes.

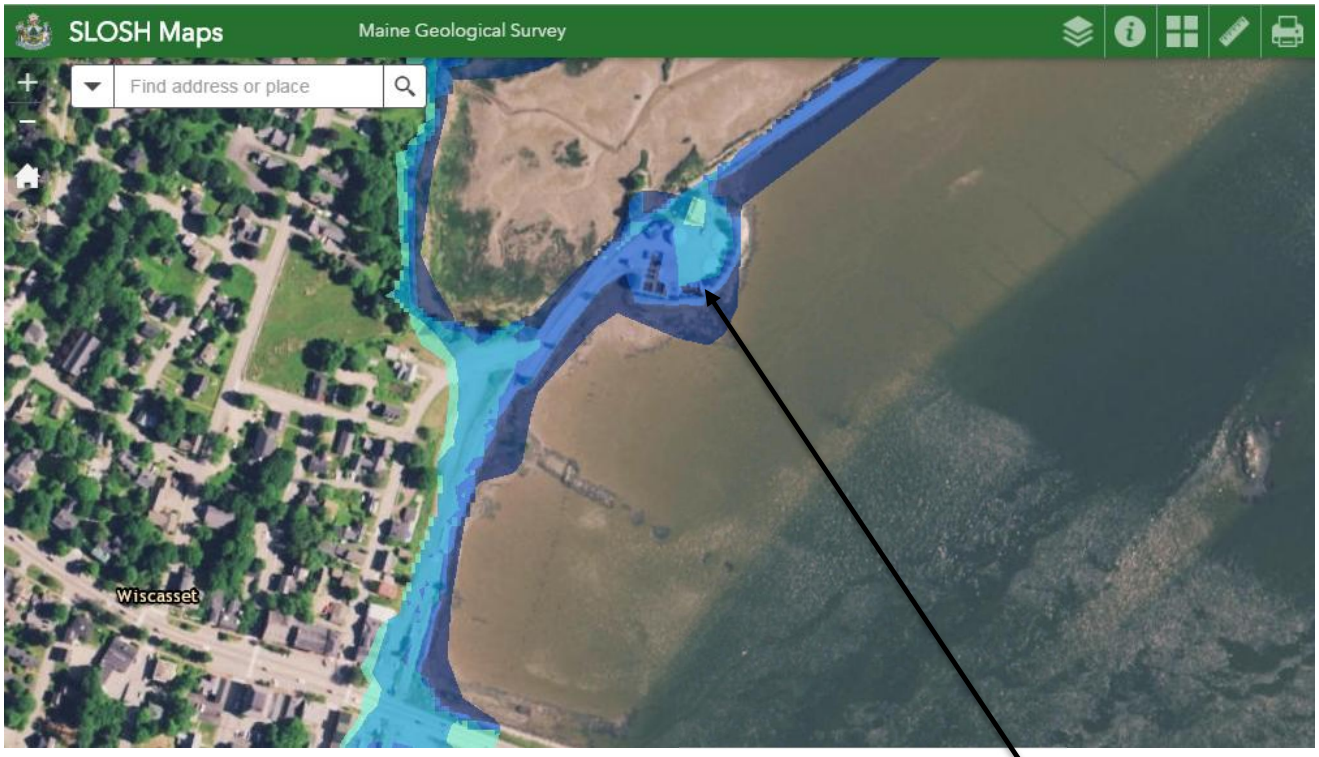


The National Weather Service (NWS) in coordination with NOAA, has developed the Sea, Lake and Overland Surges from Hurricanes (SLOSH) computerized numerical model to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by taking into account the atmospheric pressure, size, forward speed, and track data of the storm. These parameters are used to create a model of the wind field which drives the storm surge. NWS and NOAA uses this model to further look at predicted worst case storm surge scenarios by modeling the Maximum Envelop of Water (MEOW). In addition to this scenario, NWS and NOAA further model the Maximum of the MEOWs (MOM), representing the most conservative storm surge scenario under these predictions. The MOM data set is the most widely used for insurance purposes in predicting areas where storm surge impacts will likely occur.

According to SLOSH model estimates under the MOM scenario for Wiscasset, potential inundation depths for a Category 1 Hurricane are between 0 FT to 3 FT at all of the wastewater facilities. Category

2 Hurricanes are either between 0 FT to 3 FT at the wastewater facilities (represented as the lightest blue shading), between 3 FT to 6 FT (represented as the second lightest blue shading) or between 6 FT to 9 FT (Represented as the third lightest blue shading)

SLOSH maps are provided courtesy of the Maine Geological Survey.



PS #6

Rainfall Precipitation

The NWS estimates that approximately 7.34 inches of rainfall will fall over a 24-hour period during a 100-year event, and 9.73 inches of rainfall will fall over a 24-hour period based on historic data collected from their nearest monitoring station in Newcastle, Maine. While this represents a significant amount of potential floodwater, the inundation impacts associated with this onshore source is not estimated to be of significant concern to the Committee, due to relatively steep topography of watershed areas along the shoreline, minimal low-lying coastal floodplain areas and tidal flushing of waters twice daily between low and high tide coastal conditions. Impacts often associated significant intensity of on-shore precipitation, often associated with coastal storms (hurricanes, tropical storms and blizzards) are of greater concern in southern coastal areas. The geography of these coastal floodplains is relative flat and the coastal region has less variation in daily tidal ranges, than conditions found in the northeast where onshore floodwaters are conveyed seaward typically within the 6-hour period between high and low tides.

4 Description of Existing Wastewater Treatment & Collection Facilities

Wastewater Treatment Plant

- *Location*

The WWTP is located on Cow Island, within the Sheepscot River, and is accessed from the adjacent historic village area via Water Street and Railroad Avenue off U.S. Route 1 (Main Street). The WWTP property is located entirely within the FEMA 100-year flood AE zone at elevation 10.0 FT as is the access drive from Railroad Avenue and crossing over MaineDOT's rail line.

The site elevation of the access drive along Railroad Avenue is approximately 10.0 feet. The state-owned Maine Central Railroad crosses Railroad Avenue at the intersection with the WWTP access drive and is also at an approximate elevation of 10.0 feet.

- *Construction / Upgrades*

The WWTP was originally constructed in 1965 and last received a substantial upgrade in 1992.

- *Capacity / Service Area*

The WWTP is operated by the Town of Wiscasset and is currently licensed to treat 0.62 million gallons per day (MGD) and discharges of secondary treated water effluent into the Sheepscot River. The facility is estimated to be operating at approximately 29% of its capacity on an average daily flow basis.

The WWTP receives wastewater flows from a collection system comprised of approximately 14 miles of sewers and 17 pump stations located throughout the community. The collection system was recently expanded to handle sewage flows from a portion of Edgecomb, directly across the river. The majority of the collection system flows are from residential sources.

View of WWTP from Railroad Avenue and the Maine Central Railroad

Infrastructure

Consisting of:

- Predominantly paved site areas ranging in elevation between 8.0 FT to 12.0 FT. Some lawn and landscape areas are present throughout the site as well. Site access is controlled by a 6-foot high chainlink fence and gate system surrounding the WWTP around the perimeter of Cow Island. The site topography at the plant ranges from 8.0 to 12.0 feet.
- A collection system that combines at a sewer manhole at the intersection of Water Street and Railroad Avenue before flowing by gravity to the WWTP. This sewer manhole has a rim elevation of 12.8 feet. There is another sewer manhole along Railroad Avenue that collects flows from a few properties between Water Street and Railroad Avenue that has a rim elevation of 15.3 feet. All other manholes in the collection system are located above the flood and storm surge elevations that this study considers.
- Overhead power supply from overhead utility lines. Transformers are mounted to utility poles approaching the facility.
- Gravel access drive
- Riprap and ledge shoreline
- Paved site interior

- Partial perimeter lawn and evergreen tree landscaping
- A headworks building
- A disinfection and blower building
- A bar rack.
- Four aeration basins (each with capacity of 55,000 gallons).
- Two clarifiers.
- A chlorination tank with two effluent pumps.
- A sludge storage structure with belt-filter press for dewatering solids for transportation off-site to a composting facility in Maine
- A utility garage and shed
- A control building
- A 14-inch diameter outfall pipe extending into the Sheepscot River, submerged approximately 3.5 feet over the crown of the pipe at mean low water.
- Four portable generators on trailers. Two of which are needed at the WWTP for separate electrical service to the blower building and process building

The facility has not experienced any flood events which have damaged equipment, or which have impacted the ability of the operators to access the plant. Routine high tide cycles do require pumping of treated effluent from the chlorine contact tank to the outfall. Highest annual tide ("King Tide") events have been reported to cause minor flooding of the access drive.

View along Railroad Ave towards Main St

View from Railroad Ave towards Water St

The WWTP has a 10,770 gallon aerated receiving tank by which up to 6,200 gallons of transported septic tank waste can be pumped into the system or to a digester.

The Town does not anticipate significant residential or commercial development in the near future, nor is it expected that land use trends will drastically change such that the capacity of the plant would be exceeded during the study period through 2070.

While the overall condition of the wastewater collection and treatment system is structurally sound and has plenty of capacity to handle additional sewage flows, the age of the system and anticipated future effluent limits due to regulatory requirements of the MaineDEP, and the Environmental Protection Agency (EPA) are expected to require ongoing investment in maintenance, operations and upgrades of the various facility components.

WWTP facility components include:

From left to right: Head works building; disinfection/ blower building; shed; sludge storage; and control building

WWTP approach from Railroad Avenue

Clarifiers

Aeration basins

Chlorine contact tank

Water Street Pump Station

The Water Street Pump Station (PS-6) is located at the western terminus of Water Street and immediately adjacent to the Maine Central Railroad. The location of PS-6 is also within the Town-owned parcel that includes the Commercial and Recreational Piers, a public boat launch and the harbor master's office. This building also served as an excursion stop for the Maine Eastern Railroad's seasonal service between Brunswick and Rockland and was anticipated to be expanded upon to serve a variety of multimodal transit interests.

The site topography at PS-6 and for the majority of the town-parcel is between 8.0 to 9.0 feet, referenced to NAVD88. PS-6 and the town-parcel are located entirely within the Federal Emergency Management Agency (FEMA) coastal flood zone. The coastal flood zone is classified as an AE zone with a known elevation of 10.0 feet. The facility has not had any flood events which have damaged equipment or which have impacted the ability of the operators to access the pump station.

PS-6 collects wastewater effluent flows from the Wiscasset Yacht Club and the Town Harbor Master's office, and pumps the effluent to a gravity collection system along Water Street which flows on to the treatment plant. The Town indicates that there is adequate capacity to serve these two users of the station. No near or long term changes in land use pattern are anticipated by the Town to significantly increase effluent flows to this pump station.

Power is supplied to the pump station through underground connection to the harbor master's building electrical, which is fed by overhead power from Water Street. Controls for the pump station are mounted immediately adjacent to, and approximately two feet above the pump station wet well and are not flood proofed.

Water Street Pump Station on the far left with the Recreational Pier in the background

Edgecomb Pump Station

The Edgecomb Pump Station is not owned, maintained or operated by the Town of Wiscasset. It is located across the Sheepscot River and within the Town of Edgecomb, and services nearby commercial and residential users. Technical information regarding this pump station is not known by the Town. The potential impacts to Wiscasset's wastewater facilities are included in subsequent chapters of this report, however no assessment of specific inundation effects at this pump station, nor mitigation options for the pump station itself are included in this report. The pump station sends effluent by force main across the Sheepscot River bottom to a connection point along Railroad Avenue and into the Town's gravity collection system. There is a gate valve at this connection which the Town can access to shutoff effluent flows from this pump station.

View from Edgecomb Pump Station site towards Wiscasset and across the Sheepscot River. Route 1 Bridge in the background

5 Potential Inundation Effects

This section of the report describes of the nature of the impacts due to inundation from flooding to the Committee's wastewater facilities. Tables for each of the facilities identify in this assessment to have the potential to be impacted by coastal flooding, whether certain specific infrastructure components of each facility may or may not be impacted individually follow the descriptions listed below. Any of the structures that could be impacted by inundation under any of the three elevation scenarios could also be impacted by storm surge tidal wave action and floating debris during the flood even, and until such debris could be cleared from the sites after inundation. These impacts are stated here and are not repeated for each structure below. Debris sources could include interior site materials such as external propane tanks, or materials from abutting properties.

Currently the WWTP currently experiences minor flooding impacts from several high tide events throughout each year and has pump systems in place to assist with discharge of effluent from the chlorine contact tank into the Sheepscot River in addition to flows through the plant's outfall system.

Wastewater Treatment Plant

- *Collection System*
  - The SMH located nearest to the WWTP along Railroad Avenue could be impacted by floodwater inflow entering this structure during the inundation period under all three elevation scenarios. This inflow of floodwater could be conveyed directly to the WWTP via gravity sewer main during any of the three of the elevation scenarios.
  - The next SMH located within Railroad Avenue heading away from the WWTP along Railroad Avenue could be impacted by floodwater inflow entering this structure during the inundation period under BFE +6. This inflow of floodwater could be conveyed directly to the WWTP via gravity sewer main during the BFE +6 elevation scenario.
  - The Edgecomb Pump Station sewage flows connect to the Town's sewer collection system along Railroad Avenue. A gate valve is in place to shut of these flows. Access to this valve could be limited during the inundation period under all three elevation scenarios. Should the Edgecomb pump station be impacted by any of the elevation scenarios, there is the potential that inflow of floodwater could be conveyed into the Town's WWTP if the pump station remains operational and the valve was not closed.
- *Site Access*
  - Access to the WWTP from Railroad Avenue could be limited during the period of inundation under all three elevation scenarios.

- *Power Supply*
  - If the Railroad Avenue and the access drive are impaired due to erosion, then there is also the potential for the utility poles and overhead power supply to be impacted during any of the three elevation scenarios
- *Shoreline and Interior Grounds*
  - Access throughout the entire site could be limited during the period of inundation under all three elevation scenarios.
  - Perimeter chain link fencing could be inundated during all three elevation scenarios. Fenced gate systems are mechanically operated and should remain operational after inundation unless impacted by floating debris.
- *Headworks Building*
  - Access to the headworks building could be limited during the inundation period under all three elevation scenarios.
  - The first floor could be inundated during the inundation period under all three elevation scenarios.
  - Interior electrical and mechanical systems within these areas could be compromised requiring replacement.
- *Blower Building*
  - Access to the Blower Building could be limited during the inundation period under all three elevation scenarios.
  - The entire basement floor area, and first floor are could be impacted by inundation under all three elevation scenarios. Interior equipment and store materials within these areas could be compromised requiring replacement.
- *Aeration Basins*
  - The Aeration Basins could be impacted during the inundation period under any of the three elevation scenarios. Inundation of this structure could introduce additional flows to the WWTP's process system, potentially exceeding treatment plant capacity and disrupting the biological digestion treatment process of the sewer effluent.
  - Electrical and mechanical controls mounted to the tank could be impacted during the inundation period under the BFE +4 and BFE +6 elevation scenarios.
- *Clarifiers*
  - The tanks could be impacted during the inundation period under any of the three elevation scenarios. Inundation of this structure could introduce additional flows to the WWTP's process system, potentially exceeding treatment plant capacity and disrupting the biological digestion treatment process of the sewer effluent.

- *Chlorine Contact Tank*
  - The tank could be impacted during the inundation period under any of the three elevation scenarios. Inundation of this structure could introduce additional flows to the WWTP's process system, potentially exceeding treatment plant capacity and disrupting the biological digestion treatment process of the sewer effluent.
  - Electrical and mechanical controls mounted to the tank could be impacted during the inundation period under the BFE +4 and BFE +6 elevation scenarios.
- *Sludge Storage Tank*
  - The top of the concrete tank is approximately at elevation 22.0-FT. This structure is not expected to be directly impacted by inundation, storm surge wave action and floating debris. Access to the building could be limited due to inundation of the surrounding site.
- *Utility Garage*
  - Access to the Garage could be limited during the inundation period under all three elevation scenarios.
  - The Garage could be inundated under all three elevation scenarios through doorway penetrations, impacting interior equipment and stored materials requiring replacement.
  - The structural integrity of the Garage structure could be compromised after the inundation period from all three elevation scenarios
- *Utility Shed*
  - Access to the Utility Shed could be limited during the inundation period under all three elevation scenarios.
  - The Utility Shed could be inundated under all three elevation scenarios through doorway penetrations, impacting interior equipment and stored materials requiring replacement.
  - The structural integrity of the Utility Shed structure could be compromised after the inundation period from all three elevation scenarios
- *Control Building*
  - Access to the Control Building could be limited during the inundation period under all three elevation scenarios.
  - The entire basement floor area, and first floor are could be impacted by inundation under all the BFE +6 elevation scenario. Interior equipment and store materials within these areas could be compromised requiring replacement.
  - Access to the 2nd floor via internal stairwells could be limited during the inundation period. under the BFE +6 elevation scenario.
  - The pad mounted propane tanks adjacent to the building could be displaced during BFE +4 and BFE +6 elevation scenarios.

WWTPF Infrastructure	Base Elevation of Structure in Feet	BFE +3 (13-FT) Yes / No	BFE +4 (14-FT) Yes / No	BFE +6 (16-FT) Yes / No
Collection System – Railroad Avenue SMHs	12.8 & 15.0	Y	Y	Y
Site Access – Railroad Avenue	8.0 to 10.0	Y	Y	Y
Shoreline & Interior Grounds	8.0 1to 12.0	Y	Y	Y
Metering Manhole	10.0	Y	Y	Y
Scum Well	10.0	Y	Y	Y
Headworks Building	10.6	Y	Y	Y
Blower Building – 1st Floor FFE	10.0	Y	Y	Y
Blower Building – Vents	14.0	N	Y	Y
Blower Building – Basement Floor FFE	(-) 2.0	Y	Y	Y
Aeration Basins	10.0	Y	Y	Y
Clarifiers	12.0	Y	Y	Y
Chlorine Contact Tank	12.0	Y	Y	Y
Sludge Storage Tank	22.0	N	N	N
Sludge Storage Tank – Stairs	11.0	Y	Y	Y
Garage - FFE	10.0	Y	Y	Y
Utility Shed - FFE	10.0	Y	Y	Y
Utility Shed – Windows & Vents	10.0	4	Y	Y
Control Building – Exterior Propane Tanks	13.5	N	Y	Y
Control Building – Basement FFE	(-) 2.3	Y	Y	Y

Control Building – Windows & Vents	18.0 & Above	N	N	N
Control Building – 1st Floor FFE	14.3	N	N	Y
Control Building – 2nd Floor FFE	30.0	N	N	N

Site Approach Along Railroad Avenue Looking North Towards The WWTP – BFE +3

Site Approach Along Railroad Avenue Looking North Towards The WWTP – BFE +4

Site Approach Along Railroad Avenue Looking North Towards The WWTP – BFE +6

(Left to Right) Headworks Bldg, Blower Bldg, Shed, Sludge Storage, Control Bldg – BFE +3

(Left to Right) Headworks Bldg, Blower Bldg, Shed, Sludge Storage, Control Bldg – BFE +4

(Left to Right) Headworks Bldg, Blower Bldg, Shed, Sludge Storage, Control Bldg – BFE +6

Aeration Basins Looking South – BFE +3

Aeration Basins Looking South – BFE +4

Aeration Basins Looking South – BFE +6

Chlorine Contact Tank Looking South – BFE +3

Chlorine Contact Tank Looking South – BFE +4

Chlorine Contact Tank Looking South – BFE +6

Clarifiers Looking East – BFE +3

Clarifiers Looking East – BFE +4

Clarifiers Looking East – BFE +6

Water Street Pump Station (PS #6)

- *Site Access*
  - Access to PS #6 from Water Street could be limited during the period of inundation under all three elevation scenarios.
- *Power Supply*
  - The electrical service and panels serving PS #6 from underground service connection to the Harbor Master's Building could be impacted by inundation at the panel or by inundation of the Harbor Master's Building under any of the elevation scenarios/
- *Wet Well*
  - The wetwell could be impacted by floodwater inflow entering this structure directly and from other impacted properties (The Wiscasset Yacht Club and the Harbor Masters Office building) contributing flows to PS #6 during the inundation period under all three elevation scenarios. The wetwell and pumps are submersible and should not be damaged by flood waters, however, inundation of the wetwell could introduce additional flows to the WWTP's collection system if PS #6 remains operational during any of the three elevation scenarios.
- *Controls*
  - PS #6 controls could be impacted by inundation under all three elevation elevation scenarios.

PS #6 Infrastructure	Base Elevation of Structure in Feet	BFE +3 (13-FT) Yes / No	BFE +4 (14-FT) Yes / No	BFE +6 (16-FT) Yes / No
Site Access – Water Street and Water Front Parking Lot	8.0 to 12.0	Y	Y	Y
Electrical Power Supply	12.0	Y	Y	Y
Wetwell	12.0	Y	Y	Y
Controls	12.0	Y	Y	Y

PS #6 Looking North – BFE +3

PS #6 Looking North – BFE +4

PS #6 Looking North – BFE +4

6 Adaptation Strategies

General Discussion

The Committee's wastewater facilities are known to the community in terms of the value of the public utility service they provide. The Committee suggested that an enterprise account should be setup to support financing of support of implementing adaptation strategies looking out at a 10 year horizon to accumulate savings. When considering the following adaptation strategies, suggested as technical design solutions below to address potential impacts from sea level rise and storm surge under the three elevation scenarios assessed, it is important to consider the financial, visual and functional (social) wastewater utility service impacts to the community at large when making prioritized decisions to invest further in these facilities. At the most basic level, the Committee should consider whether to maintain the existing facility, employ adaptation strategies to mitigation potential increased sea level rise and storm surge impacts or to relocate from these coastal areas. The majority of the WWTP equipment is beyond the typical life expectancy of 20 to 25 years since the last upgrade the plant. The Town has developed a capital improvement plan for critical equipment at the WWTP in need of near term replacement in the amount of approximately $3,000,000. The Committee should consider these costs for replacement of the equipment where it currently is located and building a sea wall, versus elevating the equipment as necessary to meet the new EP 11988 requirements and likely associated requirements of most of the federal and state funding agencies that would be likely partners with the Town on such projects.

The following adaptation strategies for improvements to the wastewater facilities assessed by this study to are offered as potential technical solutions to mitigate impacts from the elevation scenarios. Decisions regarding support of these structural adaptation strategies (e.g. non-structural means such as capital funding, emergency preparedness, impact ordinances, etc.) in combination with the structural adaptation measures provide a greater likelihood of success for maintaining these facilities over the long term.

As stated at the beginning of the assessment, the Committee's goal is to be able to make prioritized based on the findings and recommendations of this assessment for each of the wastewater facilities that could potentially be impacted by climate change predicted sea level rise and storm surge factors. Not all of these measures need to be incorporated together, as there may be more than one way to address impacts to the facility components under each of the elevation scenarios.

The cost estimates included in the appendices for relocation of the WWTP or PS #6 for this assessment are conceptual planning-level estimates. Conceptual cost estimates are based on limited technical information and have a broad range of accuracy (+40% to -25%). Planning-level costs for all other adaptation strategies to the existing wastewater facilities at their current locations are based on a greater level of technical information and have a narrower range of accuracy (+30% to -10%). These cost estimates should be refined as the Committee proceeds through this process and collects additional technical information.

(See Appendices for planning-level Construction Cost Considerations Matrix associated with the various adaptation strategies discussed below in relation to the three elevation scenarios assessed by this study discussed below)

Adaptation Strategies

The following are technical adaptation options for improvements to the various wastewater facilities, either as individual infrastructure components, or in some cases for the entirety of each respective facility. Not all of these measures need to be incorporated together, as there may be more than one way to address impacts to protect the facility's various infrastructure components under each of the three planning elevation scenarios.

Permanent Barrier Protection (Sea Walls and Flood Gates)

The Committee could consider surrounding the entire perimeter of the WWTP with a sea wall and flood gates at the access drive entrance to the site. This strategy should be considered versus the option to relocate the WWTP, or to making individual improvements to any or all of the WWTP components. The substantial costs for this strategy should also be weighed versus potential sum of costs for improvements to multiple WWTP components. Costs for additional height of this structure are relatively nominal, and it is recommended that the top of the structure consider the higher elevation scenarios of BFE +4 and BFE +6 because if a lower elevation wall is over topped, then significant capital investment in this measure may prove unsuccessful in mitigating impacts and associated costs with replacement and repair of any or all of the WWTP components located within the perimeter of the wall. If the wall is designed to an elevation that is not overtopped, stormwater discharge pumps should still be located with the perimeter of the facility at a low point were stormwater can be readily conveyed. Significant storms (i.e. hurricanes) with potentially significant rainfall precipitation are estimated to increase in frequency, intensity and during on the future based on climate change modeling estimates and the wall would effectively trap that source of stormwater within the site during coinciding flood events were the stormwater cannot be conveyed off the site through more traditional pipe outfalls.

Example of a concrete barrier sea wall (Source from Ohio Department of Natural Resources Office of Coastal Management)

Temporary Flood Barriers (Building Doors and Windows)

The following building structures are recommended to consider installation of temporary flood barriers on doors and windows:

- *Control Building*
  - Doors and windows at the first floor elevation of this structure should consider adding temporary flood barriers. This building is probably the most critical component of the WWTP, housing the boiler room pump room staff areas, a garage, electrical room, lime room lab, and dewatering room.
  - The concrete and masonry walls of this structure are estimated to be resistant to penetration of flood waters and to sustain impacts from storm surge.
  - This adaptation strategy is recommended in combination with providing additional flood proofing of building wall and floor penetrations.
- *Headworks Building*
  - The door at the first floor elevation of this structure should consider adding a temporary flood barrier.

- The concrete and masonry walls of this structure are estimated to be resistant to penetration of flood waters and to sustain impacts from storm surge.
- This adaptation strategy is recommended in combination with providing additional flood proofing of building wall and floor penetrations

· *Blower Building*

- Doors and windows at the first floor elevation of this structure should consider adding temporary flood barriers. This building has a basement area in addition to the first floor space and houses a chlorination room, dechlorination room and blower room.
- The concrete and masonry walls of this structure are estimated to be resistant to penetration of flood waters and to sustain impacts from storm surge.
- This adaptation strategy is recommended in combination with providing additional flood proofing of building wall and floor penetrations

This adaptation strategy is not recommended for existing stick built wooden frame building structures which are recommended to be replaced / reinforced to withstand impacts from storm surge, penetration by flood waters and potential floating prior to installation of this adaptation strategy on any of their doors and windows.

Examples of temporary flood barriers for doors
(Image from Flood Control International)

Examples of Temporary Flood Barriers for Windows
(source from R S Flood Control)

Flood Proof Building Penetrations (Vents and Wall/Floor Penetrations)

The following building structures are recommended to consider installation of temporary flood barriers on doors and windows:

- *Control Building*
- *Headworks Building*
- *Blower Building.*

For the Control Building and Blower Buildings floor drain systems currently collect in the basement and a sump pump is in place to discharge water collected in these drains outside of the building. A check valve should be installed in the discharge line to prevent flood waters from back flowing into the basement area.

All floor penetrations from infrastructure such as subsurface electrical conduit and conductors to the buildings from the exterior electrical service control panel should be checked to make sure that they are still water tight.

The walls of these structure are estimated to be resistant to penetration of flood waters and to be able to structurally withstand impacts from storm surge.

This strategy is recommended in combination with providing temporary flood protection of the buildings doors and windows.

This adaptation strategy is not recommended for existing stick built wooden building structures which would be recommended to be replaced / reinforced to withstand impacts from storm surge, penetration by flood waters and potential floating prior to installation of this adaptation strategy on any of their doors and windows.

Reconstruction / Reinforcement of Buildings

The following building structures are recommended for consideration of reconstruction from stick built wood frame structures to concrete masonry buildings, or if maintained / rebuilt with wood materials, the structures should be elevated so that the first floor finish elevations are raised to the Committee's selected elevation scenario. Situations that may raise the consideration of this adaptation strategy could include when they have reached their useful life expectancy, or are in need of upgrade as may be necessary to accommodate additional building functions as may be desired by the Committee, or may be required by regulations governing the operation and maintenance of the wastewater facilities:

- *Garage*
  - Reconstruction of the building should consider a concrete and masonry structure.
  - Operations and maintenance equipment and tools should be stored above the three flood event scenarios to the extent feasible.
  - Interior electrical and mechanical systems should also be raised above the selected elevation scenario to the extent feasible.
  - Flow through vents for this structure could potentially reduce impacts to the structural integrity of the building in combination with elevation of the other building components listed above.
- *Shed*
  - The same comments regarding coordination of elevation of this structure in a manner that is functionally and aesthetically compatible with the Town's waterfront commercial center and abutting property interests as noted for elevation of the PS #4 noted elsewhere in this section apply to this building structure should the adaptation strategy be selected by the Committee.
- *Process Building and Blower Building*

Given the critical importance of these facilities within the overall WWTP infrastructure operations, secondary considerations for elevation of critical equipment, materials and tools within the basement area and the first floor areas to the second floor should be considered where feasible. Should temporary flood barriers fail, either structurally or by human error, the entire basement and first floor areas of this building would be susceptible to substantial impacts from flood waters and repairs / replacement would be costly.

Elevate Structures, Tools and Equipment

The following wastewater facilities, tools and equipment structures should be considered for elevation to the Committee's selected elevation scenario:

- *Water Street (PS-6) electrical panels, controls*
- *Aeration Basin Tanks*
- *Clarifier Tanks*

- *Chlorine Contact Tank*
  - The top of this concrete tank structure is at the same elevation as the highest elevation scenario at the WWTP. The Committee should consider the costs for elevating this structure above BFE +6 versus cleanup efforts associated with inundation of the tanks by coastal flood waters and potential floating debris during the inundation period.

Flood Proof Structures

- *Collection System*
  - Consider flood proofing manhole structures for the two manhole structures along Railroad Avenue area of the collection system which fall within any of the three flood event elevation scenarios. The Committee indicates that none of the sewer manhole structures have flood proof hatches and this is likely in consideration that I&I would likely get into the system from impacted properties with sewer services connected into the system near these manholes, making flood proof hatches for the manholes potentially unsuccessful in keeping I&I from flood waters out of the collection system. There are minimum properties in Wiscasset that would likely be subject to impacts from the three elevation scenarios however to either elevating the sewer manholes or providing flood proof covers may be worth the effort.
- *Metering Manhole*
  - Installation of a flood proof hatch on this could prevent I&I during the inundation period which could back flow into the wastewater treat process system under all three flood event elevation scenarios.
- *Scum Well*
  - Installation of a flood proof hatch on this could prevent I&I during the inundation period which could back flow into the wastewater treat process system under all three flood event elevation scenarios.

Add / Improve Permanent Emergency Generator Capacity

New permanent emergency power generators are suggested at the following facilities:

- *WWTP (The Committee should evaluate options for two generators (One at the blower building and one at the control building, meeting current electrical supply conditions, versus a single generator with enough capacity to power the entire WWTP, including necessary electrical distribution reconfiguration to a single source at the site.)*
- *Water Street Pump Station (PS #6)*

Aesthetics and integrity of the structures to withstand impacts from storm surge should be considered at the Water Street pump station within the Town's Historic Village District with a prominent visual presence on the waterfront.

Examples of elevated structures to house electrical supply and controls systems, as well as emergency power generator and fuel storage. Ogunquit, ME on left. Skowhegan, ME on right

Relocate

The Committee may want to consider relocating or discontinuing the Water Street Pump Station at a point where any of the three flood event elevation scenarios creates scenarios where protection of the facilities is cost prohibitive or the surround areas that they serve are likely to become uninhabitable due to impacts from increased sea level rise and storm surge.

The Committee may also want to consider relocation of the WWTP at point where the cost of significant upgrade to the facility, either for needed replacement or to protect it from increased sea level rise and storm surge impacts become cost prohibitive. It does not appear that a significant portion of the community served by this facility would be impacted by any of the three elevation scenarios so protecting the WWTP where it is currently located may be worth the costs which are estimated to be less that relocation of the entire facility.

If the WWTP is relocated it is recommended that a site be found to the north and/or east of the current location as only three pump stations would need to be reconstructed to accommodate this new location, versus 16 to the south and west of the WWTP.

7 Potential Funding Sources

USDA Rural Development Emergency Community Water Assistance Grants (ECWAG)

The Department of Agriculture provides from $150,000 to $500,000 to assist a rural community that has experienced a significant decline in quantity or quality of drinking water due to an emergency. Grants cover projects to obtain or maintain adequate quantities of water that meet the standards set by the Safe Drinking Water Act. Eligible emergencies include drought, earthquake, flood, tornado, hurricane, disease outbreak or chemical spill, leakage, or seepage.

EPA Federal and State Clean Water Revolving Funds (CWSRF)

MaineDEP administers these Federal and State Revolving loan Fund. States make low interest loans or other assistance to publicly owned wastewater collection and treatment systems, stormwater systems and nonpoint source pollution control and estuary management projects.

HUD CDBG and Section 108 Guaranteed Loans

HUD Community Development Block Grants (CDBGs) federal funds as administered by the Maine Department of Economic and Community Development (MaineDECD). Communities must spend at least 70% of these funds for activities that benefit low- and moderate-income persons. Utilities have used these block grants to improve treatment and collection system facilities.

SBA Disaster Loans

Through its Office of Disaster Assistance, the U.S. Small Business Administration (SBA) can provide low-interest, long term loans to businesses and private nonprofits of all sizes following a disaster. This includes infrastructure assistance to private for-profit (PFP) and private nonprofit (PNP) utilities to restore them to their pre-disaster operability.

FEMA Pre-Disaster Mitigation Grant Program

The PDM Program is designed to assist States, U.S. Territories, Federally-recognized tribes, and local communities in implementing a sustained pre-disaster natural hazard mitigation program. The goal is to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding in future disasters. This program awards planning and project grants and provides opportunities for raising public awareness about reducing future losses before disaster strikes. Mitigation planning is a key process used to break the cycle of disaster damage, reconstruction, and repeated damage. PDM grants are funded annually by Congressional appropriations and are awarded on a nationally competitive basis.

Local Funds

Some amount of local funds will be required to make many of the suggested improvements. The wastewater facilities are owned and operated by the Town, and the significant capital costs that the tax payers could bear, should be vetted to the public to reach clear consensus support to maintain these facilities, maintaining community-wide value for the relatively small portion of the village area that is served.

Appendices

A- Overview Map of Wastewater Treatment Facilities

B- Wastewater Treatment Facility Plan and Profile

C- Pump Station Inundation Plan and Profile

D- Adaptation Strategies - Cost Considerations Matrix

E- FEMA Flood Insurance Rate Maps

F- Reference Resources

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PROJECT NO. 11370

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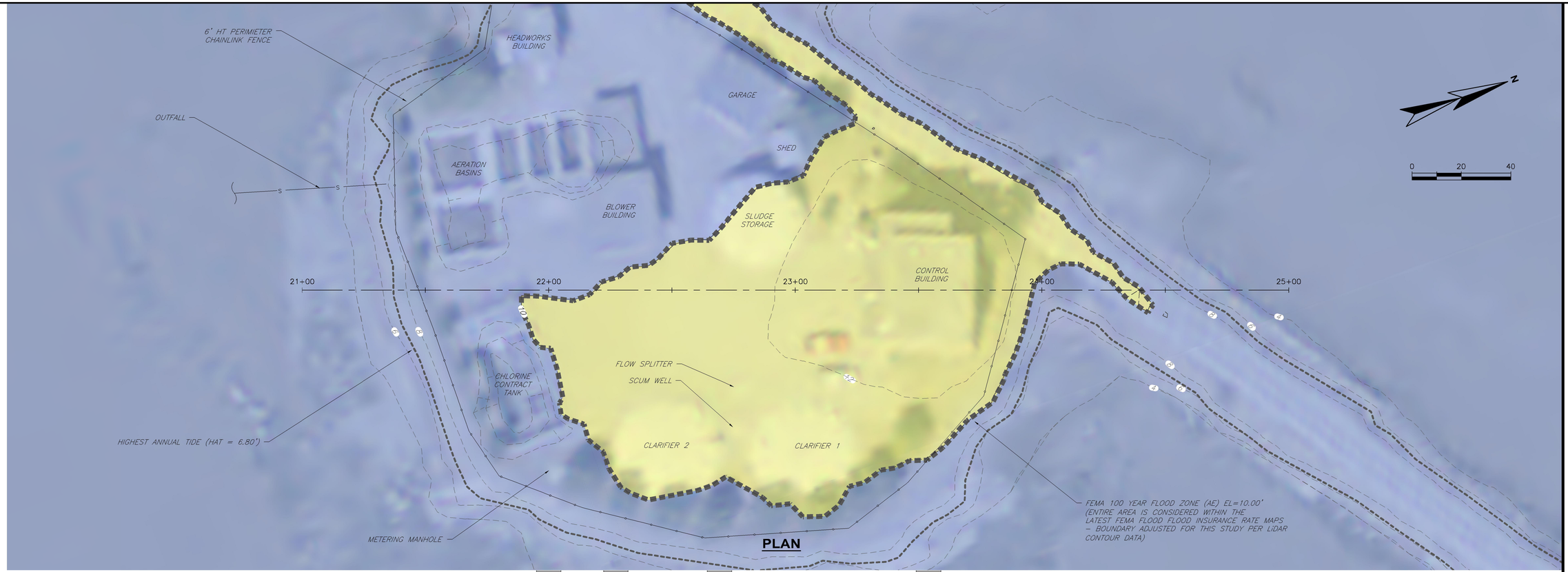
TOWN OF WISCASSET
WWTP COASTAL HAZARD RESILIENCE PROJECT
WISCASSET, MAINE

PROJECT OVERVIEW MAP

DRAWING
FIG-1



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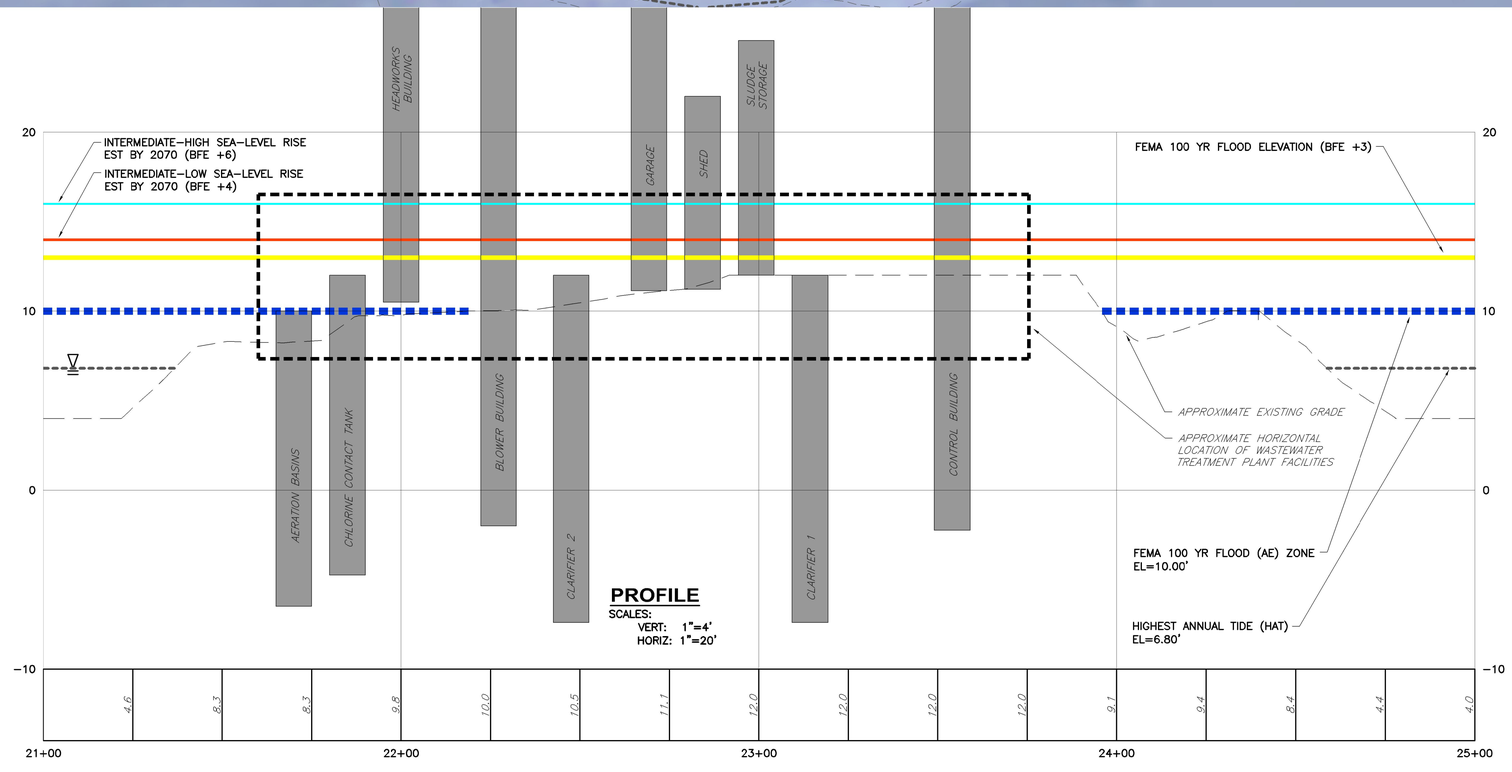

PROFILE
SCALES:
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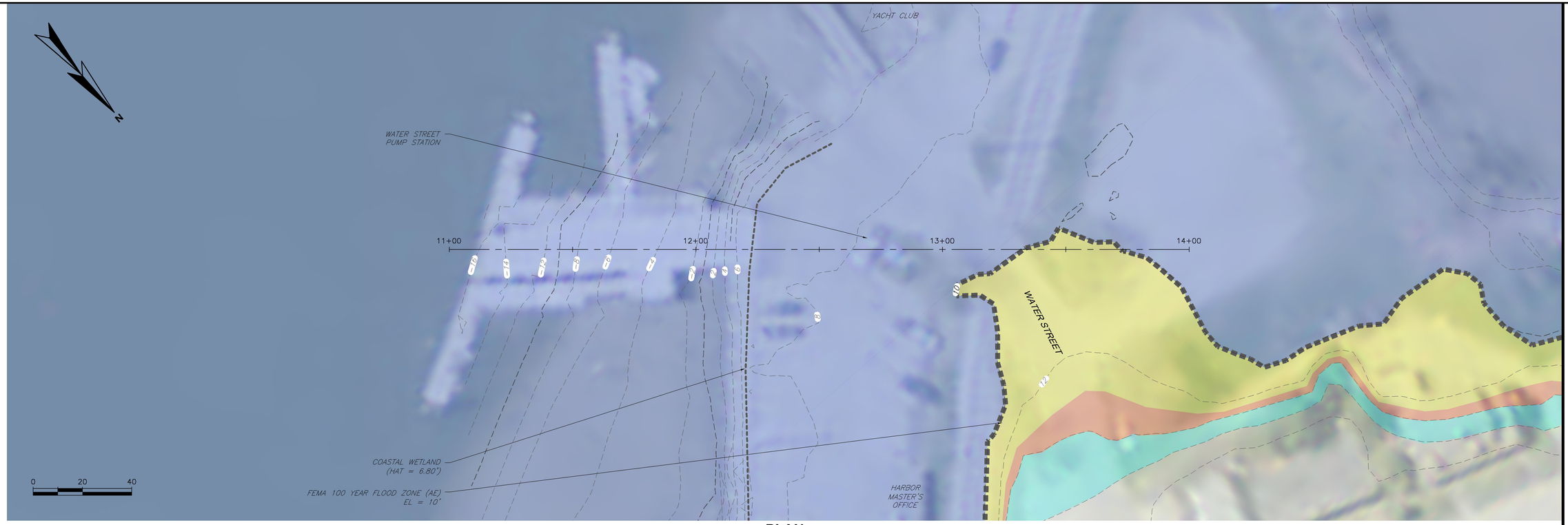
TOWN OF WISCASSET
WISCASSET WWTP COASTAL RESILIENCY STUDY
WISCASSET, MAINE

PLAN & PROFILE
WASTE WATER TREATMENT PLANT

DRAWING
FIG–2



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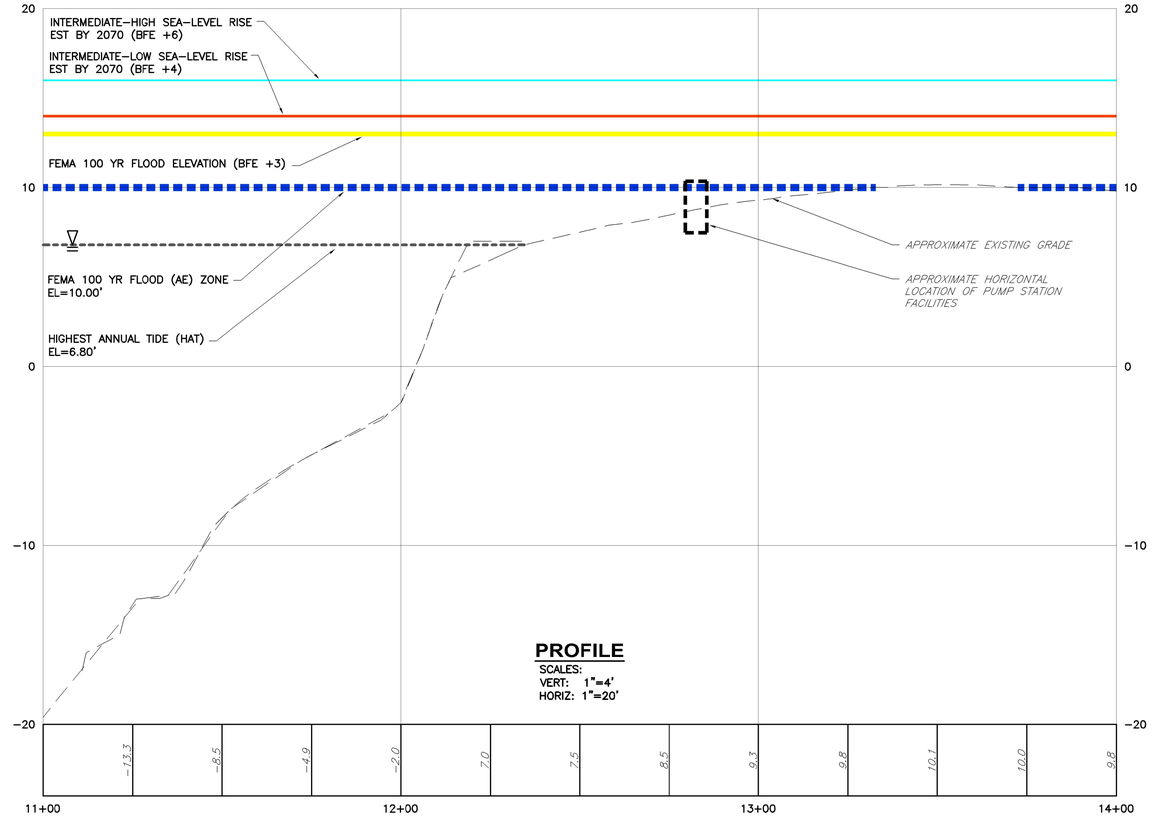

PROFILE
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VERT: 1"=4'
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TOWN OF WISCASSET
WISCASSET WWTP COASTAL RESILIENCY STUDY
WISCASSET, MAINE

PLAN & PROFILE
WATER STREET PUMP STATION

DRAWING
FIG–3

Adaptation Strategy Permanent Barrier Projection	Planning Level Construction Costs BFE +3-FT + 1-FT SLR	 BFE + 3-FT + 2-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
WWTF Perimeter	$1.1 M – 1.25 M	1.25 M - 1.4 M	1.5 M – 1.65M	Sheet Pile or Concrete Sea Wall with (2) Gates at the Entrance Drives Entering the Site from Sea St. This strategy should be considered versus the potential sum of costs for multiple infrastructures improvements within the WWTF

Adaptation Strategy Temporary Flood Barriers (Building Doors and Windows)	Planning Level Construction Costs BFE +3-FT + 1-FT SLR	 BFE + 3-FT + 2-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
Individual Single Door	$5,000			Costs for this adaptation strategy are the same under all three of the planning elevation scenarios
Individual Double Door	$7,500 - $7,500			Costs for this adaptation strategy are the same under all three of the planning elevation scenarios
Individual Garage Door	$10,000 - $15,000			Costs for this adaptation strategy are the same under all three of the planning elevation scenarios
Individual Window	$2,500 - $5,000			Costs for this adaptation strategy are the same under all three of the planning elevation scenarios

Adaptation Strategy Flood Proof Building Penetrations Vents and Wall / Floor Penetrations	Planning Level Construction Costs BFE +3-FT + 1-FT SLR	 BFE + 3-FT + 2-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
Control Building	$100,000 - $300,000			Costs for this adaptation strategy are the same under all three of the planning elevation scenarios
Headworks Building	$100,000 - $300,000			Costs for this adaptation strategy are the same under all three of the planning elevation scenarios
Blower Building	$100,000 - $300,000			Costs for this adaptation strategy are the same under all three of the planning elevation scenarios

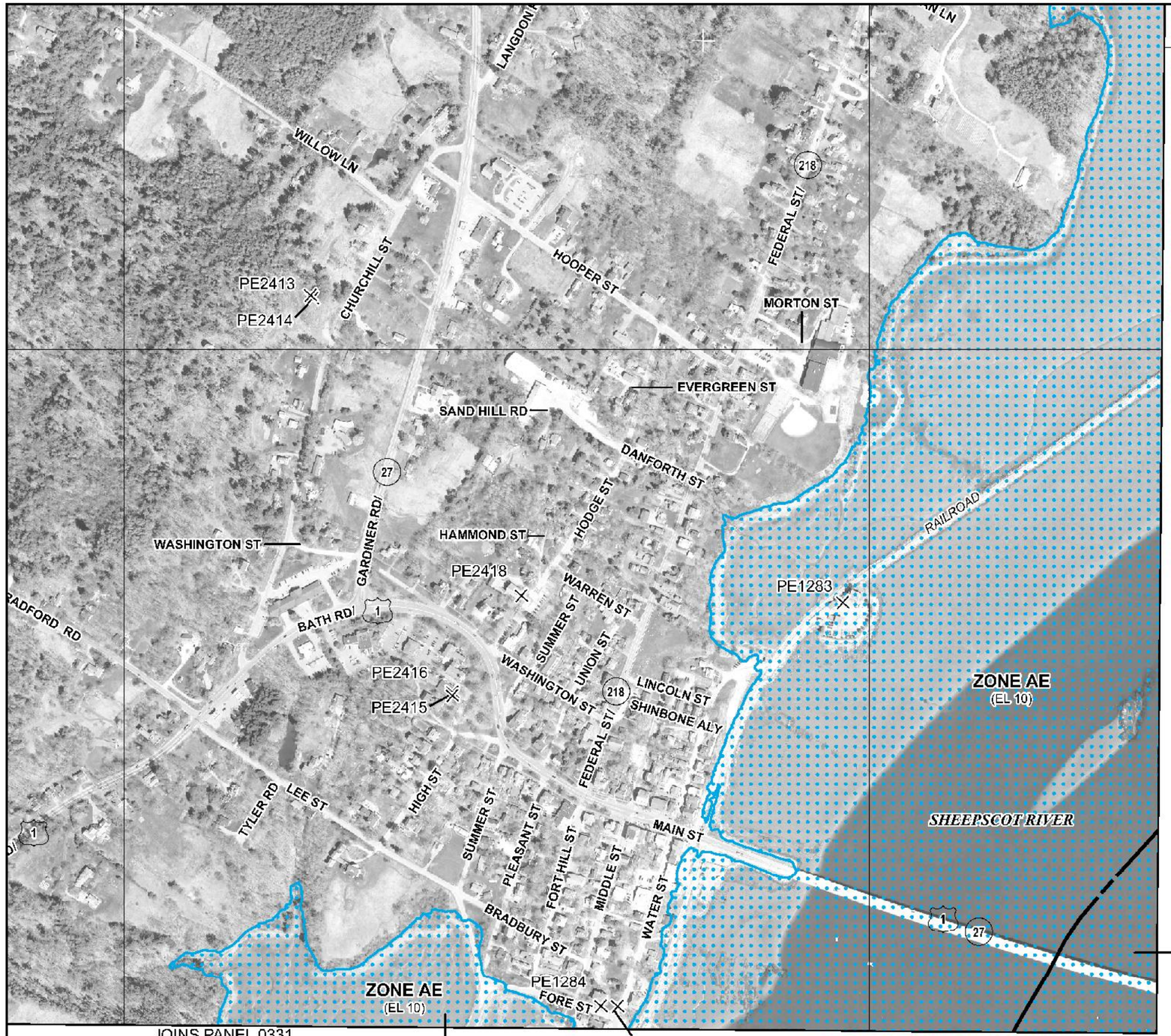
Adaptation Strategy Reconstruction / Reinforcement of Buildings	Planning Level Construction Costs BFE +3-FT + 1-FT SLR	 BFE + 3-FT + 2-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
Garage	$350,000 - $500,000	$450,000 - $600,000	$550,000 - $700,000	
Shed	$200,000 - $225,000	$225,000 - $250,000	$250,000 - $275,000	
Process Building	$750,000 - $1,500,000			Costs for protection of basement and first floor interior infrastructure are the same under all three of the planning elevation scenarios
Blower Building	$500,000 - $750,000			Costs for protection of basement and first floor interior infrastructure are the same under all three of the planning elevation scenarios

Adaptation Strategy Elevate Structures, Tools and Equipment	Planning Level Construction Costs BFE +3-FT + 1-FT SLR	 BFE + 3-FT + 2-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
Water Street PS Electrical and Control Panels	$50,000 - $75,000	$60,000 - $85,000	$70,000 - $95,000	Assumes that the equipment will be mounted on stainless steel support posts and framing with a wooden back board in the same manner as the current Union Street PS #1 upgrades.
Aeriation Basins	$150,000 - $200,000	$175,000 - $225,000	$200,000 - $250,000	Assumes that the equipment will be mounted on stainless steel support posts and framing with a wooden back board in the same manner as the current Union Street PS #1 upgrades.
Clarifiers	$150,000 - $200,000	$175,000 - $225,000	$200,000 - $250,000	Assumes that the equipment will be enclosed in a building structure to fit within the aesthetic setting of the Town's commercial waterfront area
Chlorine Contact Tank	$150,000 - $200,000	$175,000 - $225,000	$200,000 - $250,000	Top of existing structure is at the same elevation as BFE +6 at the WWTF.

Adaptation Strategy Flood Proof Structures	Planning Level Construction Costs BFE +3-FT	 BFE + 3-FT + 1-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
Collection System Individual Manhole	$2,500 - $5,000			Costs are expected to be on the same order of magnitude for each of the three flood event planning scenarios.
Metering Manhole	$4,000 - $6,000			Costs are expected to be on the same order of magnitude for each of the three flood event planning scenarios.
Temporary Flood Protection of WWTP Building Penetrations (Doors & Windows) .	$5,000 - $7,500			Costs are expected to be on the same order of magnitude for each of the three flood event planning scenarios.

Adaptation Strategy Add / Improve Permanent Emergency Generator Capacity	Planning Level Construction Costs BFE +3-FT	 BFE + 3-FT + 1-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
Individual Pump Station On Open Air Support Structure	$200,000	$225,000	$250,000	No pre-emptive capital improvement costs. Damage / Repair costs could be significant.
Individual Pump Station within Building Enclosure (Existing at the WWTP or New)	$400,000	$450,000	$500,000	Costs are expected to be on the same order of magnitude for each of the three flood event planning scenarios. Costs most likely to vary depending on land acquisition needs and if a support structure is needed, which type is selected.
Individual WWTP Stations On Open Air Support Structure at the Blower and Control Buildings	$500,000	$550,000	$700,000	No pre-emptive capital improvement costs. Damage / Repair costs could be significant to entire WWTP if power is lost at any of the elevation scenarios.
Individual WWTP Station On Open Air Support Structure for Entire WWTP	$250,000	$300,000	$350,000	No pre-emptive capital improvement costs. Damage / Repair costs could be significant to entire WWTP if power is lost at any of the elevation scenarios.
Individual WWTP Stations within Building Enclosure at the Blower and Control Buildings	$600,000	$700,000	$800,000	No pre-emptive capital improvement costs. Damage / Repair costs could be significant to entire WWTP if power is lost at any of the elevation scenarios.
Individual WWTP Station within Building Enclosure for Entire WWTP	$300,000	$350,000	$400,000	No pre-emptive capital improvement costs. Damage / Repair costs could be significant to entire WWTP if power is lost at any of the elevation scenarios.

Adaptation Strategy Relocate	Conceptual Level Costs BFE +3-FT	 BFE + 3-FT + 1-FT SLR	 BFE + 6 Ft + 3-FT SLR	General Considerations Comments
WWTP	$13,000,000 to $17,000,000			If this option is considered, the WWTP should be relocated to a site that does not require protection from coastal flooding impacts. The conceptual level cost estimate for this scenario provided assumes such a relocation scenario to the north and east of the current WWTP location, only effecting 3 pump stations.
Individual Pump Station	$750,000 to $950,000			If this option is considered, any of the pump stations relocated should be to a nearby site from the current location that does not require protection from coastal flooding impacts. The conceptual level cost estimate for this scenario provided assumes such a relocation scenario.



MAP SCALE 1" = 500'

250 0 500 1000 FEET METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0243D

FIRM

FLOOD INSURANCE RATE MAP

LINCOLN COUNTY, MAINE
(ALL JURISDICTIONS)

PANEL 243 OF 525
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

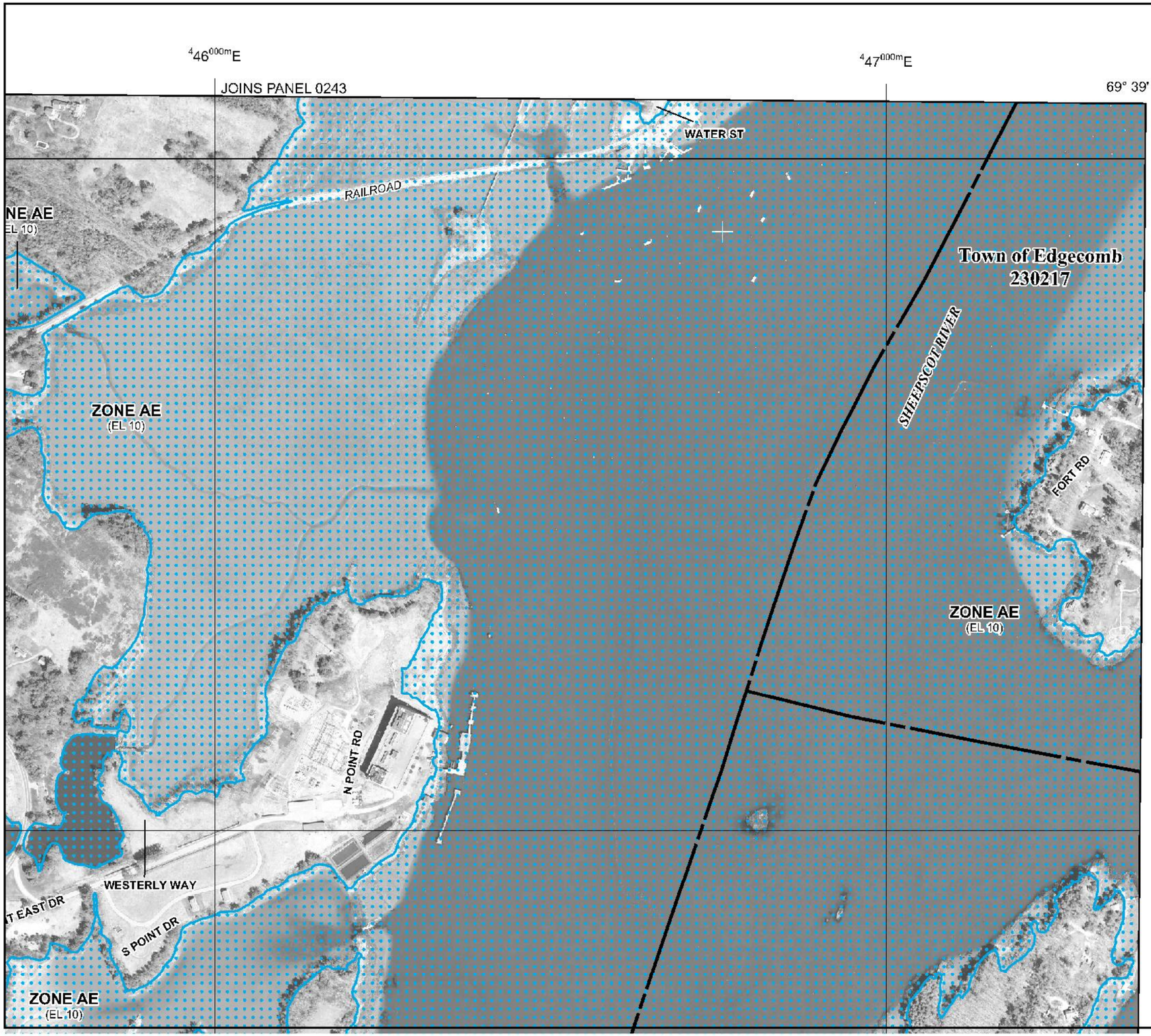
COMMUNITY	NUMBER	PANEL	SUFFIX
EDGECOMB, TOWN OF	230217	0243	D
WISCASSET, TOWN OF	230223	0243	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
23015C0243D

EFFECTIVE DATE
JULY 16, 2015

Federal Emergency Management Agency



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0331D

FIRM

FLOOD INSURANCE RATE MAP

LINCOLN COUNTY, MAINE

(ALL JURISDICTIONS)

PANEL 331 OF 525

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EDGECOMB, TOWN OF	230217	0331	D
WESTPORT ISLAND, TOWN OF	230222	0331	D
WISCASSET, TOWN OF	230223	0331	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
23015C0331D

EFFECTIVE DATE
JULY 16, 2015

Federal Emergency Management Agency

Reference Resources:
The following resource information supporting this report is as follows:

Sea, Lake, and Overland Surges for Hurricanes (SLOSH)

http://www.nhc.noaa.gov/surge/slosh.php
NOAA Tides and Currents

https://tidesandcurrents.noaa.gov/

USACOE Sea Level Rise Calculator

http://www.corpsclimate.us/ccaceslcurves.cfm

MaineDEP Highest Annual Tide Level for 2016

https://www1.maine.gov/dep/land/slz/predictions.pdf

FEMA Flood Zone

https://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping

New England Interstate Water Pollution Control Commission

http://www.neiwpcc.org/

Maine Geological Survey

http://www.maine.gov/dacf/mgs/

EPA Flood Resilience Guide

https://www.epa.gov/waterutilityresponse/flood-resilience-basic-guide-water-and-wastewater-utilities

EPA Climate Resilience Evaluation and Awareness Tool (CREAT)

https://www.epa.gov/sites/production/files/2016-05/documents/creat_3_0_methodology_guide_may_2016.pdf

WRIGHT-PIERCE
Engineering a Better Environment

Water
Wastewater
Infrastructure