WOODARD &CURRAN

Ogunquit Sewage Treatment Plant PRELIMINARY ENGINEERING REPORT

Adaptation Options to Protect the Ogunquit Sewage Treatment Plant against Floods, Storm Surges, and Sea Level Rise

225587

Southern Maine Regional Planning Commission

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woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS

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GLOSSARY OF ACRONYMS

ACRE	- Applied Coastal Research and Engineering, Inc.
CBRA	- Coastal Barrier Resource Act
CBRS	- Coastal Barrier Resource System
CHRT	- Coastal Hazard Resiliency Tools
CMOM	- Capacity, Management, Operations, and Maintenance
HAT	- Highest Annual Tide
I/I	- Infiltration and Inflow
IPCC	- Intergovernmental Panel on Climate Change
LiDAR	- Light Detection and Ranging
MaineDEP	- Maine Department of Environmental Protection
MGD	- Million Gallons per Day
MGS	- Maine Geological Survey
NPDES	- National Pollutant Discharge Elimination System
NRPA	- Natural Resource Protection Act
PS	- Pump Station
SLR	- Sea Level Rise
SMRPC	- Southern Maine Regional Planning Commission
UV	- Ultraviolet
WWTP	- Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Ogunquit Wastewater Treatment Plant (WWTP) is located in a Coastal Sand Dune System between the Ogunquit River estuary and the Gulf of Maine. In addition to being located in a Coastal Sand Dune System, which is regulated by the Maine Department of Environmental Protection (MaineDEP), the facility is also located within a Coastal Barrier Resource System (CBRS), which is a habitat for endangered species. The WWTP and its associated coastal pump stations have experienced flooding from major storm events, such as the Patriot's Day Storm of 2007, and are facing increasing risks from such events because of Sea Level Rise (SLR) and increasing storm frequency. Adaptation options to protect the WWTP and associated pump stations against floods, storm surges, and SLR had to be identified. This report was developed to outline mitigation strategies based on an assessment of the aforementioned risks, in conjunction with other high-level risks such as: anticipated changes in regulatory requirements, aging infrastructure, changes in population demographics, and competition for funding.

SLR at the Ogunquit WWTP is estimated to be about one foot by the year 2050 and 3.2-feet by the year 2100. These estimates represent a conservative upper bound to SLR predictions, which accounts for the contribution of ice sheets. SLR could be exacerbated by ice cap melting, causing it to accelerate over time in a non-linear fashion. The following figure shows a graph of the various SLR estimates for Ogunquit from 2012 to 2100.

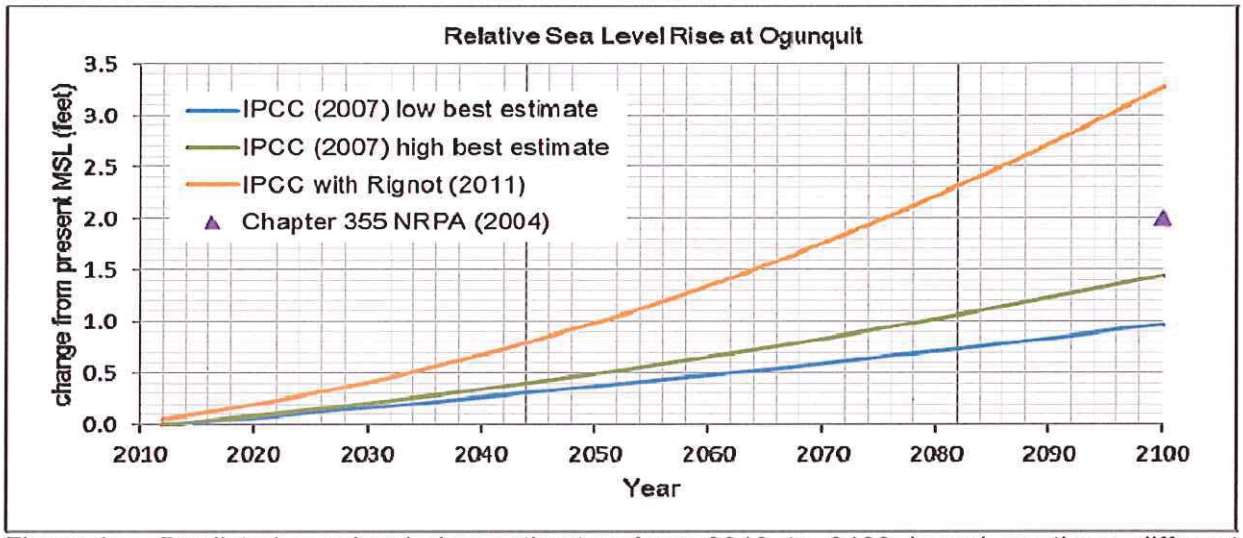


Figure 4. Predicted sea-level rise estimates from 2012 to 2100 based on three different methods: the IPCC high and low best estimates from 2007, and the IPCC high estimate with the updated contributions from ice sheets from Rignot *et al.* (2011). The anticipated rise in sea-level of 2 feet by 2100 described in Chapter 355 of NRPA also is shown.

The access road to the Ogunquit WWTP, and a portion of the site, are susceptible to flooding during major storm events. By 2050, it is anticipated that a 100-year storm event would cover the access road, and perhaps some of the low lying portions of the site. By 2100, a 100-year storm surge may inundate the majority of the site and be very close to inundating the outside process tanks. **If the facility becomes inundated, or needs to shut down for lack of power, the beach will be closed.** In addition to SLR, dune erosion represents a certain risk to the WWTP. The dune, and sea wall contained within it, is essential for protecting the facility. The eroding dune will become more susceptible to failing during storm events over time and it is estimated that the dune will deteriorate completely in the next 30 to 50 years. These projections indicate that the WWTP is at high risk from a combination of SLR and shoreline change within the next 20 to 30 years, potentially sooner if SLR and flooding increase more rapidly.

The challenges with the Ogunquit WWTP are exacerbated because the site is located in a Coastal Sand Dune System, which is regulated by the MaineDEP and has restrictions such as lot coverage; construction within these systems requires a Maine Natural Resource Protection Act (NRPA) Permit. Frontal dune systems have stricter regulations than back dune systems, such that no new seawalls or expansions of the existing seawall would be permitted. It is important to note that, due to coastal erosion and dune recession, the frontal dune system will eventually progress to engulf larger areas of the project site, so that it will become increasingly difficult to permit any activities that may be needed to maintain or upgrade the facility. Additionally, the State recently accepted the federal designation of a CBRS, prohibiting state funding or financial assistance for any development activities within the CBRS, unless the project involves the maintenance, replacement, reconstruction, repair, or in limited circumstances, expansion of state-owned or state-operated structures, facilities or roads. The project site is also adjacent to marshlands, which are also regulated by MaineDEP and may require NRPA permitting. This area, indicated by the 100-year flood elevation, will also begin to engulf more of the site over time, so that permitting certain activities will become more difficult.

With the last major upgrade to the Ogunquit WWTP facility occurring in 1993, rehabilitation and/or replacement of components of the facility will be required in the upcoming years. In the next five years alone, it is anticipated that the pump room will require work, and an ultraviolet (UV) disinfection system will be installed. The WWTP currently provides secondary treatment; it is likely that nutrient removal will be required, as this is anticipated to be applied to all plants as a standard requirement. Such upgrades will likely require a significant investment. Another planning consideration will be understanding what needs will emerge for implementing improvements to the Ogunquit collection system (pipes, pump stations, manholes, etc.), as there is a significant amount of infiltration and inflow (I/I) that flow to the WWTP. Such I/I will need to be reduced significantly to make a new WWTP more affordable. Additionally, CMOM (Capacity, Management, Operations, and Maintenance) regulations requiring higher levels of collections system performance are now a requirement of the National Pollutant Discharge Elimination System (NPDES) permit renewal process.

Regionalization with another neighboring facility is an option for mitigating these risks. The Wells wastewater system extends up to the Wells/Ogunquit town line, which provides opportunities to connect to the Wells system, and has therefore been evaluated. The Wells WWTP has not experienced issues with flooding, as most components are at a higher mean elevation than Ogunquit, assets are maintained inside of an elevated building structure, and the plant site lies further inland off the barrier structure. Major upgrades are not expected in the next 5-10 years. The Wells WWTP does not currently have adequate capacity to accept the sewage flows from Ogunquit; however, the Wells WWTP staff anticipates expanding to add new pump stations for growth north of Route 95, and there are extra tanks and adequate land for considerable expansion. Additionally, the Wells WWTP is not located within a Coastal Sand Dune System or a CBRS. It is therefore anticipated that the Wells WWTP will not face the same construction or funding challenges that Ogunquit will have. It should be noted that other regional alternatives may also exist.

Even under the best scenarios, there appears to be no practical long-term solution that would feasibly allow the Town to continue utilizing the existing WWTP site beyond 2032-2052 given current projections. Woodard & Current believes that the best strategy for the WWTP is to move off the existing site, once the existing site reached the end of its useful life in 20-50 years. The Ogunquit Sewer District should begin preparing a 20-50 year Strategic Plan that will explore the options available to determine the most cost effective plan and timeline. In this way, the District will be able to explore options and set sustainable rates in the coming years to fund investments that will be necessary for the transition. Options to explore may include the formation of an enterprise fund or other capital reserve funding measure. The following is an outline of a potential strategy to be considered moving forward:

0-15 years

- Conduct engineering evaluation of existing structures & identify temporary safeguards for future coastal flood events
- Reduce I/I
- Conduct river flooding study
- Apply for grants & evaluate funding options
- Prepare financial plan

15-25 years

- Decide whether to regionalize or construct new facility
- Evaluate potential sites
- Evaluate ordinance & conduct town negotiations
- Begin permitting process

1. INTRODUCTION

1.1 BACKGROUND

The Ogunquit Wastewater Treatment Plant (WWTP) is located in a Coastal Sand Dune System between the Ogunquit River estuary and the Gulf of Maine. In addition to being located in a Coastal Sand Dune System, which is regulated by the Maine Department of Environmental Protection (MaineDEP), the facility is also located within a Coastal Barrier Resource System (CBRS), which is also a habitat for endangered species. The facility and its associated coastal pump stations have experienced flooding from major storm events, such as the Patriot's Day Storm in April of 2007, and are facing ever increasing risks from such events because of rising sea levels and increasing storm frequency.

The Ogunquit WWTP, which provides secondary treatment for approximately 1.28 million gallons per day of sanitary wastewater, operates 12 pumping stations and approximately 20 miles of sewer lines, is a critical piece of infrastructure for the community, protecting both public health and the health of the coastal environment, which supports an abundance of wildlife and a large portion of the economy in the Town of Ogunquit. The Ogunquit WWTP is a mature facility with the last major upgrade occurring in 1993. While the facility is currently in compliance with MaineDEP requirements, scheduled upgrades are on the horizon to update major equipment and to deal with the potential of changing regulations.

1.2 PROJECT NEED

In 2011, the Maine Geological Survey (MGS) and the Southern Maine Regional Planning Commission (SMRPC) collaborated with the Town of Ogunquit on the Coastal Hazard Resiliency Tools (CHRT) project, which identified the Ogunquit WWTP as vulnerable to Sea Level Rise (SLR). The MGS generated simulations for the CHRT demonstrating the facility's vulnerability to both SLR and storm surges.

Faced with these risks, adaptation options to protect the WWTP and associated wastewater pump stations against floods, storm surges, and SLR had to be identified. To meet this goal, this preliminary engineering report was developed to outline mitigation strategies based on an assessment of the aforementioned risks, in conjunction with other high-level risks such as: anticipated changes in regulatory requirements, aging infrastructure, changes in population demographics, and competition for funding.

2. PREDICTIONS OF SEA LEVEL RISE, FLOODS, AND STORM SURGE

Applied Coastal Research and Engineering, Inc. (ACRE) developed a report outlining their analysis of Sea Level Rise (SLR) and coastal processes for the Ogunquit WWTP. Their report, dated July, 2012, has been provided in Appendix A of this report for your reference. The following is a summary of their findings.

2.1 SEA LEVEL RISE

Sea Level Rise (SLR) is estimated to range from an additional one foot increase by the year 2050 and a 3.2-foot increase by the year 2100. These estimates represent a conservative upper bound to SLR predictions, which accounts for the contribution of ice sheets to SLR. Ultimately, SLR could be exacerbated by ice cap melting, causing it to accelerate over time in a non-linear fashion. Figure 4 of Appendix A shows a graph of the various SLR estimates for Ogunquit from 2012 to 2100.

2.2 FLOODING FROM STORM SURGE

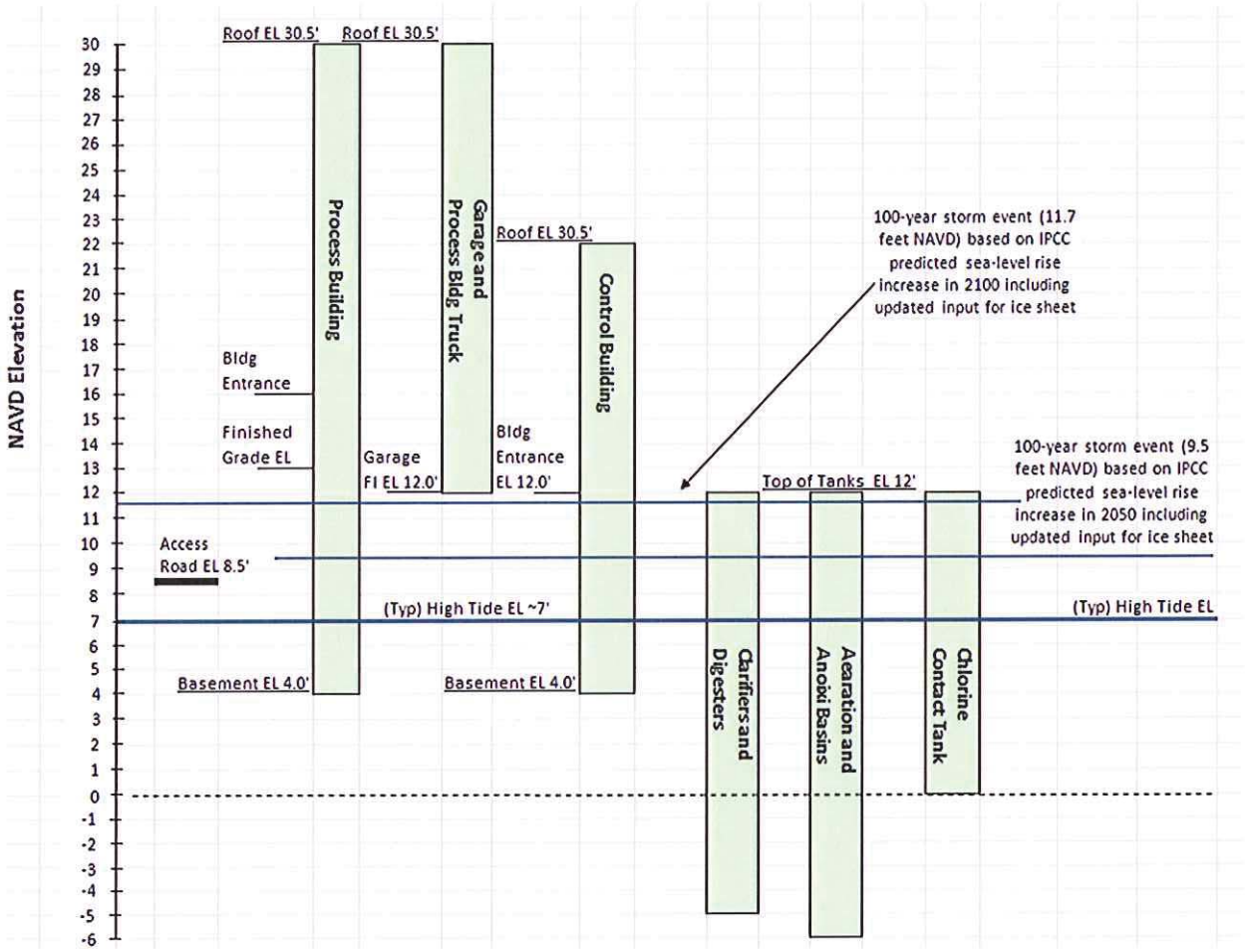
The access road to the Ogunquit WWTP, and a portion of the site itself, are currently susceptible to flooding during major storm events. An additional 5-inches of flooding is anticipated during 100-year storm events by 2050. This would cover the access road to the plant[1]. If the potential for ice sheet melting is included (Rignot, et al. 2011) the storm surge in 2050 could be as high as 9.5-feet, which is one foot above the current 100-year storm surge. This would exacerbate flooding of the access road, and perhaps some of the low lying portions of the site. The estimate for the 2100 100-year storm surge, when considering contributions from the ice sheets, may be as high as 11.75-feet, which is 3.25-feet above the current 100-year storm surge; this would inundate the majority of the site and be very close to inundating the outside process tanks. Refer to Figures 8 through 11, contained in Appendix A, for aerial photographs of the site showing anticipated flood areas from the 100-year storm based on alternate predictions of SLR in 2050 and 2100. Figure 7 of Appendix A shows present day inundation during the 100-year storm.

Ultimately, SLR and storm surge are directly correlated and the increase in SLR will exacerbate storm surge, causing the frequent minor storm events experienced in the present day to appear more severe and just as frequent in the future, much like ice cap melting accelerates SLR. Figure 5 of Appendix A shows a graph of the predicted 100-year flood elevations, which account for the various SLR estimates, for Ogunquit from 2012 to 2100.

The analysis for SLR indicates that the structures within the Ogunquit WWTP will not be at severe risk from a 100-year storm until 2100. At that time, if ice sheet contribution has accelerated SLR to the extent predicted by Rignot, et al. (2011), the plant would be inundated in such a storm. Based on these predictions, it is likely that access to the plant during 100-yr storm will be in jeopardy by 2050. This is illustrated in Figure 2-1.

[1] It is important to note that the Ogunquit WWTP currently has backup power and fuel storage sufficient for one week's supply; fuel trucks will need adequate access to the site in order to keep the facility running. Without power, the facility cannot operate. The beach will need to close when the plant is not running due to inadequate treatment. Each day that the beach is closed will ultimately cost the Town significant amounts of money.

Figure 2-1 - Ogunquit WWTP Structures Elevations



2.3 SHORELINE CHANGE

Shoreline erosion will continue to result in a decreased width of the existing dune system, which currently helps to protect the facility from storm surge. The eroding dune will become more susceptible to failing during storm events over time. Regardless of SLR, dune erosion represents the most certain risk to the Ogunquit WWTP. Dune or shoreline movement is historically demonstrated and will continue. SLR will only exacerbate the issue of dune erosion. It is estimated that the dune will deteriorate completely in the next 30 to 50 years.

2.4 CONCLUSION

We consider the Ogunquit WWTP to be at high risk from a combination of SLR and shoreline change within the next 20 to 30 years, potentially sooner as SLR and flooding increase over time. Depending on the risk tolerance of the Ogunquit Sewer District, the risks associated with site flooding will likely become unacceptably high to remain on the exiting site without considerable mitigation measures 20-30 years into the future. Based on this analysis, it is the assessment of Woodard & Curran that the Ogunquit Sewer District should begin a Strategic Planning effort to identify alternatives to the current WWTP location. The basic options will be to build a new treatment facility in Ogunquit, or to regionalize with Wells and/or perhaps with York. Because risk will increase slowly over time, there will be ample opportunity to coordinate planning with growth, infrastructure renewal and other issues of concern.

3. REGIONALIZATION: ASSESSMENT OF WELLS FACILITY AS AN ALTERNATIVE TREATMENT SITE

ACRE developed a memorandum outlining their analysis of increases in the 100-year storm flooding elevations for the Wells WWTP, utilizing the same assumptions and methods outlined in the report they developed for the Ogunquit WWTP. Their memorandum, dated August 6, 2012, has been provided in Appendix B of this report for your reference. The following is an assessment of the Wells WWTP as a potential alternative treatment site for the Town of Ogunquit, which was conducted due to the proximity of the two facilities; other sites for regionalization may be possible, and can be evaluated at a future date.

3.1 WELLS WWTP BACKGROUND

The Wells WWTP is located on a 10-acre site. The collection system consists of 10 pump stations and approximately 50 miles of newer (approximately 35 years old), large, deep PVC and concrete pipes. This system currently ranges right up to the Wells/Ogunquit town line, which provides opportunities to connect to the Wells Collection system or redirect the flows from the Ogunquit WWTP.

The Wells WWTP has not experienced issues with flooding, as most components are at a higher mean elevation than Ogunquit, assets are maintained inside of an elevated building structure, and the plant site lies further inland off the barrier structure. The pump stations, which have been equipped with flood gates as necessary, have not experienced flooding issues.

3.1.1 Aging Infrastructure

The Wells WWTP was built in 1970. It has been approximately 12 years since the last major upgrade at the Wells WWTP. HVAC upgrades are currently underway. Major upgrades are not expected in the next 5-10 years.

3.1.2 Changing Regulations

The Wells WWTP currently provides secondary treatment for the Town's wastewater and discharges to the ocean, similarly to the Ogunquit WWTP. It is anticipated that any changes in regulations that will impact the Ogunquit WWTP, as discussed in Section 4.1.3 of this Report, will also impact the Wells WWTP. It is anticipated that providing nutrient removal will be a future requirement for all WWTPs. In the event that this happens, the Wells facility has ample space on-site for necessary additions, as discussed in the following sections of this Report.

3.1.3 Growth & Increased Demands

The Wells WWTP has a 2 million gallon per day (MGD) license, and currently receives approximately 1.2 MGD. The Wells WWTP does not currently have adequate capacity to accept the sewage flows from Ogunquit; however, the Wells WWTP staff anticipates expanding to add new pump stations for growth north of Route 95. There are extra tanks and adequate land for considerable expansion. Because the facility does not have charter restrictions, accepting sewage flows from other Towns, such as Ogunquit, would be permissible. The size and layout of the Wells Sewer Collection System would likely accommodate the additions that would be necessary to accept flows from Ogunquit during dry weather periods.

3.1.4 Competition for Funding

The Wells WWTP is a District-owned facility, similarly to the Ogunquit WWTP; however, it is not located within a Coastal Barrier Resource System. It is therefore anticipated that the Wells WWTP will not face the same funding challenges that Ogunquit will have, as discussed in Section 4.1.5 of this Report.

3.2 CONCLUSION

ACRE's analysis shows some on-site flooding during a 100-year event in the year 2100, but the level of flooding does not appear to have a considerable impact on the process. Furthermore, the size of the existing site, and need for additional capacity if the Wells WWTP were to take flows from Ogunquit, would permit construction of new facilities that could be located to mitigate the future flood risks.

We have looked at the collection system of the Wells plant in regards to Ogunquit, and there appear to be opportunities to connect to the Wells Collection system and redirect the flows from the Ogunquit WWTP to the Wells WWTP. Wells has indicated that the amount of infiltration and inflow in the Ogunquit collection system will need to be addressed. Given the risks associated with the Ogunquit WWTP site, discussed in Sections 2 and 4 of this Report, we do not recommend converting the existing plant into a pump station, so as to redirect flows to the Wells WWTP. A specific tie-in point to the Wells Collection System, and a reassessment of the Ogunquit Collection System, should be evaluated in regards to costs and risks at a future date.

4. OTHER SIGNIFICANT RISKS TO THE OGUNQUIT WWTP

4.1 FACILITY CONCERNS

As stated previously, there are significant long-term risks to the Ogunquit WWTP related to dune erosion and SLR. The timeframe for planning and addressing these threats is estimated to be 20 to 50 years. There are also other risks to consider during planning efforts, some of which will need to be mitigated more immediately. It is suggested that they be considered in parallel with the decision about how long to keep investing in the operability of the current plant at the current site.

Yet another planning consideration will be understanding what needs will emerge for implementing improvements to the collection system (pipes, pump stations, manholes, etc.), as there is a significant amount of infiltration and inflow (I/I) to the Ogunquit WWTP. If investing in a new WWTP or sending flow to a neighboring plant, such I/I will likely need to be reduced significantly. This will be driven by economics and in the form of regulations. CMOM (Capacity, Management, Operations, and Maintenance) regulations requiring higher levels of collections system performance are now a requirement of the National Pollutant Discharge Elimination System (NPDES) permit renewal process. When discussing the potential for regionalization with the Wells Sewer District, it was evident that the Wells plant would have great difficulty in dealing with the I/I currently associated with the Ogunquit collection system.

4.1.1 Pump Stations

At a kickoff meeting held on April 9, 2012, at the Ogunquit WWTP, between Woodard & Curran, the OSD, SMRPC, and MGS, concern was expressed for the facility's pump stations; specifically, Pump Stations (PS) #1, #4, and #12. PS#1 and PS#12 are both located in the proximity of the plant site, as shown in Figure 4-1. PS#1 has already experienced issues with flooding during such storm events as the Patriot's Day Storm on April 16, 2007, as shown in the photograph presented as Figure 4-3. Figure 4-4: Existing 100-Year Storm Surge at PS#1 & PS#12 shows how the rim elevations of PS#1 and PS#12 compare to the present day 100-year storm flood elevation, confirming existing flooding issues. As discussed in Section 2 of this Report, this flooding will only get worse over time and exacerbate an existing issue.

PS#4 is located in Perkins Cove, as shown in Figure 4-2, and also has issues with flooding; however, due to the scope of this analysis, this pump station, and others further inland and away from the WWTP, is outside the range of the analysis conducted by ACRE. Data on specific flooding and storm surge impacts is unavailable. However, based on the available storm surge elevations, it is anticipated that the storm surge elevations in Perkins Cove are similar to other nearby coastal areas. While no protective dune exists in this area and the landform along the eastern side of the cove is relatively low-lying, this region is relatively protected from open ocean waves and it should not be subjected to direct impacts from waves, even at the higher water levels predicted by the relative sea-level rise analysis; this would need to be confirmed by modeling.

4.1.2 Aging Infrastructure

With the last major upgrade to the Ogunquit WWTP facility occurring in 1993, certain rehabilitation and/or replacement of some components of the facility will be required in the upcoming years. The costs to maintain and renovate the existing facility long-term may ultimately outweigh the benefits. In the next five years alone, it is anticipated that the pump room will require some work, and an ultraviolet (UV) disinfection system will be installed to maintain the quality of the treatment plant.

4.1.3 Changing Regulations

The Ogunquit WWTP currently provides secondary treatment for the Town's wastewater, and discharges through an ocean outfall several hundred feet off-shore, at a depth of about 30-feet. Although the impact of nutrients (nitrogen and phosphorus) in the Ogunquit WWTP effluent to the receiving waters is not fully understood, it is likely that nutrient removal will be required as a future limitation, as this is anticipated to be applied to all treatment plants as a standard treatment requirement. In the event that this happens, the site has adequate space to add tankage and equipment within the plant boundary limits, in addition to existing tankage that may be repurposed for nutrient removal (see Figure 4-6). However, it should be noted that such upgrades will likely require a significant investment by the Sewer District, and state regulations, as discussed in Section 4.2 of this Report, may restrict the construction of additional structures.

4.1.4 Growth & Increased Demands

Changes in population demographics, including seasonal residents and visitors, can increase sewer usage patterns and put a higher demand on the Ogunquit facility. Summer is a peak season for the Town of Ogunquit, and flows spike considerably. Population growth and sewer system expansion are not anticipated to greatly increase wastewater flows to the WWTP in the short term, but must be considered in any facilities planning for the next 20 years.

4.1.5 Competition for Funding

The Coastal Barrier Resource System (CBRS) the facility is located within has regulations that could affect funding for any proposed work. In accordance with the Coastal Barrier Resources Act (CBRA) of 1982, certain activities to develop or rebuild within CBRSs cannot be funded using federal subsidies. Consultation with the U.S. Fish and Wildlife Service may grant the use of federal monies for certain exempted activities within a CBRS, such as emergency assistance. Additionally, if the facility attained federal flood insurance before 1982, the policy may not be renewed upon substantial improvements or damages to the facility.

The State of Maine has recently accepted the federal designation of a CBRS, and created the Maine Revised Statute Title 38, Chapter 21: Coastal Barrier Resource System. The governing statute prohibits state funding or financial assistance for any development activities within the Coastal Barrier Resource System (CBRS), unless the project involves the maintenance, replacement, reconstruction, repair, or in limited circumstances, expansion of state-owned or state-operated structures, facilities or roads identified in §1903(1)(A) of the Act. The Ogunquit WWTP may therefore have trouble attaining funds for certain types of projects on the current site.

4.2 STATE REGULATIONS

On June 6, 2012, staff from Woodard & Curran, OSD, SMRPC, ACRE, and MGS met with Marybeth Richardson of the Maine Department of Environmental Protection (MaineDEP), to discuss initial thoughts on sea level rise, storm surge, and flooding impacts, and what work to mitigate these threats the MaineDEP thought could be permitted within the Coastal Sand Dune System that the Ogunquit WWTP is located wholly within. Coastal Sand Dunes are regulated by Chapter 355 of the MaineDEP Rules, which outlines specific standards for projects within these systems, such as lot coverage restrictions, and construction within these systems typically requires a Maine Natural Resource Protection Act (NRPA) Permit.

It should be noted that Section 5.C. of Chapter 355 stipulates that "A project may not be permitted if, within 100 years, the property may reasonably be expected to be eroded as a result of changes in the shoreline such that the project is likely to be severely damaged after allowing for a two foot rise in sea

level over 100 years. Beach nourishment and dune restoration projects are excluded from this requirement." As demonstrated in Section 2 of this Report, this scenario is entirely likely.

It was determined that no new seawalls or expansions of the existing seawall would be permitted within the frontal dune system; however, beach nourishment and dune creation, similar to the existing man-made dune which fronts the facility, would be allowed. Refer to Figure 4-5 of this report for an aerial photograph showing the limits of the dune system; note that the D1 area represents the frontal dune, and the D2 area is representative of the back dune system.

The back dune system could also potentially be an area where more work could be permitted. The MaineDEP also indicated that tide gates were not a favorable option due to maintenance requirements.

Frontal dune systems have stricter regulations than back dune systems. It was noted that due to coastal erosion and dune recession (which is mapped every 10 years) the frontal dune system will eventually progress to engulf larger areas of the project site, so that it will become increasingly difficult to permit any activities that may be needed to maintain or upgrade the facility.

It was noted that the project site is also adjacent to marshlands, indicated by the Highest Annual Tide (HAT) line or 100-year flood elevation, which are regulated by Chapter 310 of the MaineDEP Rules. Activity in an around this resource may require NRPA permitting. As previously discussed, this area will ultimately begin to engulf more of the site over time, so that permitting certain activities will become more difficult. Refer to Figure 4-6 for a layout of the site with respect to the current HAT.

4.3 MUNICIPAL CONSIDERATIONS

Parcel coverage issues could also restrict the level of permitted site work, as the OSD owns the parcel that the facility is located on, but the land abutting that parcel is owned by the Town of Ogunquit. The rights to construct any work outside of the boundaries of the OSDs parcel would need to be granted by the Town. If the Town of Ogunquit were to utilize the Wells site, or any other neighboring facility, varying municipal requirements may be another factor to consider in that the Town's Ordinance may need to be evaluated and revised to accommodate another Town's potentially more stringent requirements.

4.4 STRUCTURAL CONCERNS

The Wright-Pierce record drawings for the 1990 facility upgrade indicate that the Control Building has a finished floor elevation of 12.5 feet and most tank structures have grade elevations in the range of 10 to 12 feet. The outfall plan and profile record drawings indicate that the Extreme High Water Line at the time of the design was approximately 7.9 feet, and by the year 2050 this is expected to increase to as much as 9.5 feet during a 100-year storm event. Due to water damage to the structural record drawings, it is unclear what specific assumptions for design ground/sea water elevations were used for the structural design of tanks and building foundations at the facility.

Increased Sea Level Rise (SLR) and storm surge could result in a higher risk of leakage into inhabited basement spaces, as well as floatation of structures. Leakage into the basement of the Control Building, for example, could result in severe damage to critical electrical and process equipment (refer to Figure 4-6 for the location of the Control Building). Due to these expected increases in groundwater elevations (likely above those used as a basis for the original design), it is recommended that floatation checks be performed by a structural engineer for all structures to ensure that structures are not at risk for flotation, in the case that the Town of Ogunquit elects to continue utilizing the existing treatment site. It is further recommended that a structural condition assessment be performed to evaluate the current condition of structures and the presence of leakage, moisture damage, cracking, deterioration, etc. The results of this further evaluation will provide a more thorough understanding of how much and what type of impact the increased SLR will have on the structures at this facility.

Figure 4-1: Map of PS#1 & PS#12

Figure 4-2: Map of PS#4

Figure 4-3: Photograph of PS#1 during Present Day Flooding

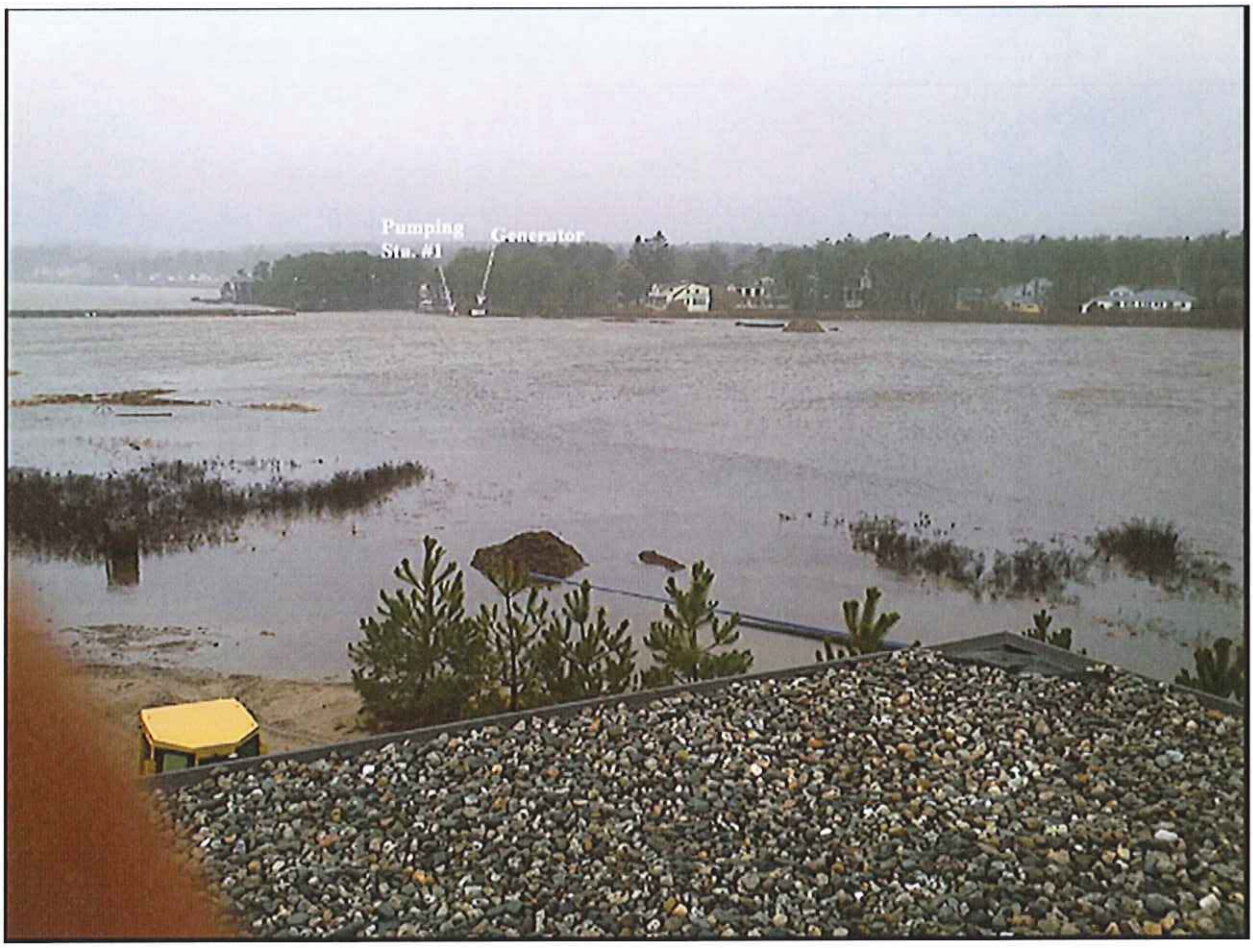


Figure 4-4: Existing 100-Year Storm Surge at PS#1 & PS#12

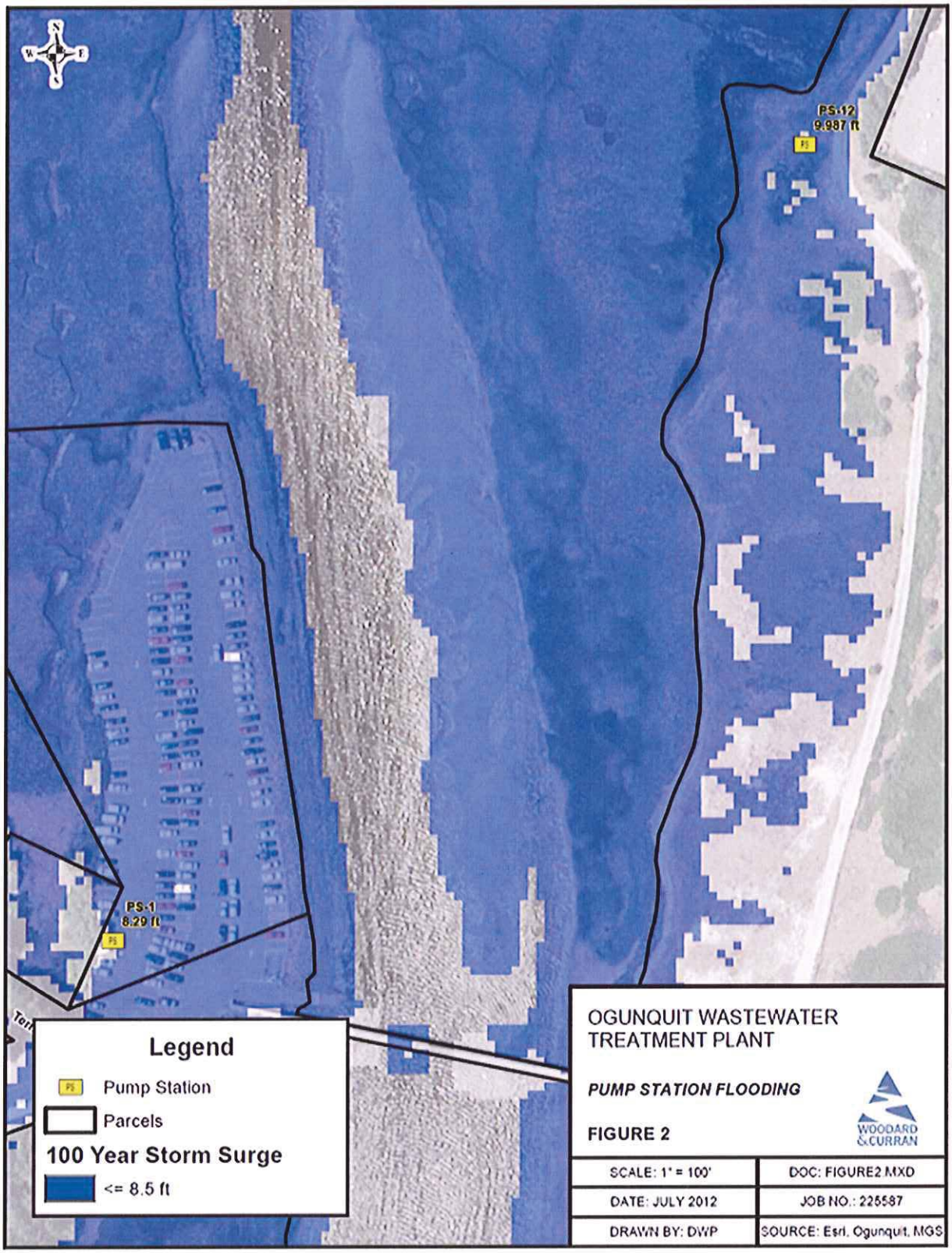
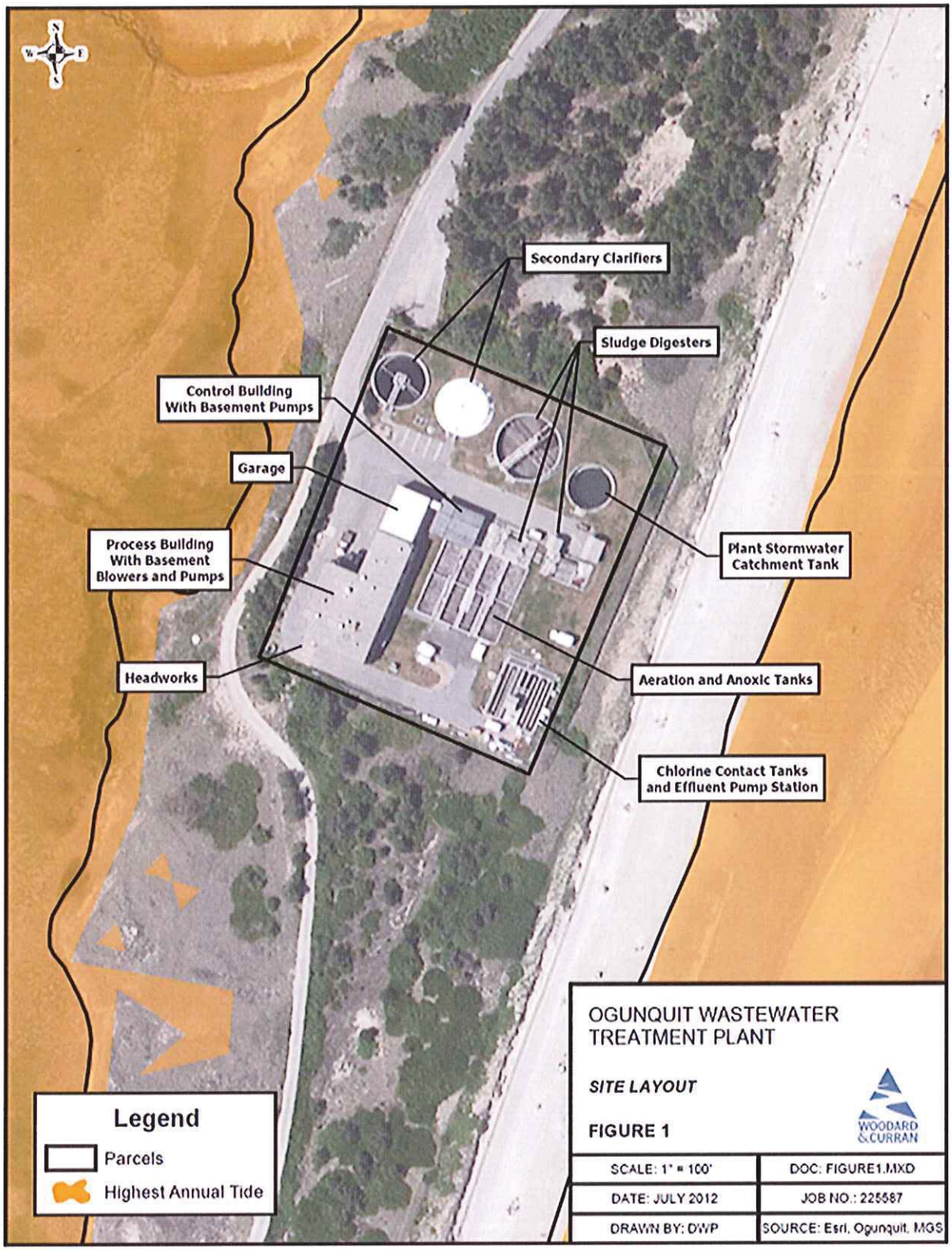


Figure 4-5: Maine Geological Survey Coastal Sand Dune Geology

Figure 4-6: Ogunquit WWTP Site Layout



5. ADAPTATION RECOMMENDATIONS

Several mitigation strategies were considered in this assessment, such as elevating equipment, installing dune retention systems, relocating equipment, relocating the WWTP, and redirecting sewage flows from Ogunquit to Wells.

Ultimately, even under the best case scenarios, there appears to be no practical long-term solution that would feasibly allow the Town to continue utilizing the existing treatment site without mitigation measures that would involve major permitting, funding, and construction efforts, such as elevating the site's assets and/or dune nourishment (rehabilitating a man-made dune retention system) in the frontal dune, and salt marsh enhancement in the back dune. If the facility becomes inundated, or needs to shut down for lack of power, the beach will be closed.

Woodard & Current believes that the best long-term strategy for the Ogunquit WWTP is to move off the existing site. This Report is a preliminary evaluation of potential strategies; however, the Ogunquit Sewer District should begin preparing a 20-50 year Strategic Plan that will explore the options available to the District. This planning effort must consider the assets of the entire collection, conveyance and treatment system to determine the most cost effective transition plan and timeline. This will enable the District to develop the financial plan or model to determine the impact to sewer rates. In this way, the District will be able to explore options and set sustainable rates in the coming years to fund the short term plant investments, as well as longer term investments that will be necessary for the transition to a regional solution or a new treatment plant. Options to explore may include the formation of an enterprise fund or other capital reserve funding measure.

Summaries of the risks we have outlined in this Report, an analysis of the costs associated with the two options (constructing a new Ogunquit WWTP, or regionalizing with a neighboring town) and potential strategies to consider are contained in the following sections.

5.1 SUMMARY OF RISKS

Table 5-1 is included below as a visual illustration of the various risk factors as they apply to specific facility assets or processes. This table provides a rough comparative or relative risk assessment based on the criticality of the asset or process against the various vulnerabilities to be considered. In this risk assessment model, the risk number is simply determined by multiplying the relative criticality ranking with the highest relative vulnerability ranking.

Table 5-1: Vulnerabilities & Associated Risks on the Short, Mid, & Long-term Horizons

Ogunquit WWTP Assets/Process	Asset Criticality	Vulnerability												Comparitive Risk		
		Growth & Expansion Risk			Sea Level Rise/Beach Erosion/Storm Risk			Regulatory Risk			Age Related Degradation Risk					
		S	M	L	S	M	L	S	M	L	S	M	L	S	M	L
Headworks	2	1	1	3	1	2	4	1	2	2	1	3	3	2	6	8
Aeration Tanks	3	1	1	2	1	2	4	1	2	2	1	2	3	3	6	12
Clarifiers	3	1	2	2	1	2	4	1	1	2	1	2	3	3	6	12
Disinfection and Eff Pumping	3	1	1	2	1	2	4	1	2	2	1	3	3	3	9	12
Ocean Outfall	3	1	1	2	1	1	4	1	2	2	1	1	2	3	6	12
Sludge Digesters	2	1	1	1	1	2	4	1	1	1	1	2	3	2	4	8
Back up Power	3	1	1	1	1	3	4	1	2	2	1	3	3	3	9	12
Sludge Dewatering	2	1	1	2	1	2	4	1	1	2	1	2	3	2	4	8
Garages	1	1	1	1	1	2	4	1	1	1	1	1	1	1	2	4
Control Building	3	1	1	1	1	3	4	1	1	1	1	1	2	3	9	12
Process Building	3	1	1	1	1	3	4	1	1	1	1	1	2	3	9	12
Site Piping	3	1	1	1	1	2	4	1	1	1	1	2	3	3	6	12
Pumping Stations	3	1	1	2	1	2	3	1	1	1	1	2	3	3	6	9
Collection System	3	1	1	2	1	2	2	1	2	3	2	3	4	6	9	12

Asset Criticality is rated 1-3 (3 highest) and color coded (1=green, 2=orange, 3=red)
S= Short Term (1-10 yrs), M = Mid-Term (10 – 25 yrs), L = Long Term (25 – 50 yrs)
Vulnerability is rated 1-4 (4 greatest) and color coded (1=green, 2=orange, 3=purple, 4=red)
Comparitive Risk is rated 1-12 (12 highest) and color coded (1-3=green, 4-6=orange, 7-9=purple,10-12=red)

5.2 COST ANALYSIS

The capital cost for a new facility the size of the Ogunquit WWTP is roughly $20 million. Without additional information and further study at the Wells facility, it is not certain what the costs will be to upgrade the Wells facility to be a regionalized (Wells and Ogunquit) facility. It is possible that the application of technologies such as integrated fixed film or ballasted flocculation systems will be able to maximize the use of existing tankage. A rough estimate for construction costs at the Wells facility would be in the range of $4-12 million.

One issue that will impact the overall construction cost for either a new plant or an upgraded Wells facility will be addressing infiltration and inflow (I/I) and other upgrades to the collection system. There will be expenses for upgrading the collection facilities, which are necessary to maintain the system. These investments may reduce the capital expenditure of a new plant or a combined facility at Wells. Without the benefit of a clearer understanding of the magnitude of the I/I issues at the Ogunquit facility, it is not possible to accurately assess the cost impact of I/I issues.

If a new WWTP is built, the operating costs of the new Ogunquit facility are expected to be similar to the operating costs of the existing facility. The current operation is well managed, the staffing level and annual expenditure level is good, and it is not expected to change significantly if a new facility is built. The 2011 audited operating expense for the District was $1,281,847. If a combined facility is established at Wells, the staffing level will need to increase to accommodate the Ogunquit collection system. Currently, the Wells Sewer District has a similar staffing level to Ogunquit, and a combined facility is anticipated to require only two or three more employees at Wells. Therefore, a combined facility is anticipated to have three to four fewer employees than two separate facilities. Fewer employees and operating expenses for one combined facility will realize savings in comparison to operating two separate facilities.

At this time, the impacts to the sewer rates for Ogunquit have not been studied for either scenario. It is certain that, within 20 to 30 years, either a new plant will be built in Ogunquit or a combined facility at

Wells will be established, and there will be significant expenses associated with either alternative. Ultimately, it appears that building a new plant for Ogunquit will likely be the highest cost alternative in both capital and overall operational costs.

5.3 POTENTIAL STRATEGY

Included below is an outline of a potential strategy to be considered moving forward. This list includes various issues and additional studies that this Report has discussed, and which will need to be resolved or completed.

0-15 years

- Conduct engineering evaluation of existing structures & identify temporary safeguards for future coastal flood events
- Reduce I/I
- Conduct river flooding study
- Apply for grants & evaluate funding options
- Prepare financial plan

15-25 years

- Decide whether to regionalize or construct new facility
- Evaluate potential sites
- Evaluate ordinance & conduct town negotiations
- Begin permitting process