Correspondence:

Correspondence:

- US Department of the Interior, Fish and Wildlife Service: Comments on Bergen Point Outfall Replacement Project
- Regina Seltzer, Esq., Long Island Pine Barrens Society: Memorandum of Law Pertaining to Proposed Sale of Land by Suffolk County
- NY State office of Parks, Recreation and Historic Preservation: Comments on Bergen Point Outfall Replacement Project
- Cornell Cooperative Extension: Email regarding SPDES MS4 permit requirements

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Long Island Field Office
3 Old Barto Road
Brookhaven, NY 11719
Phone: (631) 776-1401 Fax: (631) 776-1405
http://www.fws.gov/northeast/nyfo

To: Michael P. Maiz Date: August 30, 2012

USFWS File No: 12164C

Regarding your: ☐ letter ☐ FAX ☐ E-mail dated: July 9, 2012
☒ Memorandum

For project: Proposed Bergen Point WWTP Outfall Replacement

Located: Great South Bay

In Town/County: Suffolk County

Pursuant to the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), the U.S. Fish and Wildlife Service:

☒ Acknowledges receipt of your "no effect" determination. No further ESA coordination or consultation is required.

☐ Acknowledges receipt of your determination. Please provide copy of your determination and supporting materials to any involved Federal agency for their final ESA determination.

☐ Is taking no action pursuant to ESA or any other legislation at this time but would like to be kept informed of project developments.

As a reminder, until the proposed project is complete, we recommend that you check our website (http://www.fws.gov/northeast/nyfo/es/section7.htm) every 90 days from the date of this letter to ensure that listed species presence/absence information for the proposed project area is current. Should project plans change or additional information on listed or proposed species or critical habitat become available, this determination may be reconsidered.

Pursuant to the Fish and Wildlife Coordination Act (FWCA) (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*),

☐ Requests additional time for review.

☐ Is providing FWCA comments (see attached).

☐ Will provide FWCA comments separately.

☐ Is taking no action pursuant to FWCA due to lack of funding.

☐ Has no objection pursuant to the FWCA.

☐ Is taking no action pursuant to the FWCA at this time but would like to be kept informed of project developments.

USFWS Contact(s): Steve Papa Date August 30, 2012

Supervisor: ____________________ Date ____________

MEMORANDUM OF LAW

Pertaining to Proposed Sale of Land by Suffolk County

by Regina Seltzer, Esq., Long Island Pine Barrens Society

The proposed sale of county-owned land in Yaphank, entirely within the Carmans River Watershed, represents a significant threat to drinking and surface water quality and to critical habitat. Moreover, the use of one-shot revenue sources cannot overcome the county's failure to balance its budget, because such revenue sources cannot be replicated in the future. In addition, real estate development on an island is, by definition, unsustainable and thus cannot remedy the county's economic plight.

Regardless of these important public policy issues, the information contained in this Memorandum of Law provides irrefutable evidence that the transaction, as it has been advanced, is inconsistent with federal, state and county law.

Legal Arguments

Pursuant to the authority conferred upon it by the State Constitution, the state legislature has provided for the organization and government of counties, and has assigned to counties various powers and duties, making ample provision for the transaction of county business. The fact that counties are within the complete control of the state legislature makes them subject to the laws of that body. Since counties are legislative creatures of the state, they may not adopt any legislation that is inconsistent or contrary to state law.

Violates County Law Section 215

New York State County Law section 215 titled "County Property;" general provisions, contains a list of 18 specific actions the county may or may not perform with respect to county property. Provision Number 5 states that two-thirds vote of the total membership of the county legislature is needed to declare county property surplus. Provision Number 6 reads "such property may be sold or leased only to the highest responsible bidder after public advertisement." Provision Number 7 lists gifts of county property and Provision Number 10 states that the county is not authorized to sell or lease any county property where such disposition is prohibited by law.

The law is unambiguous. If the County, by a vote of two-thirds of the legislature, adopts a resolution declaring that property is surplus, then it may sell or lease the property but it may do so only to the highest bidder. The county has the right to reject the highest bidder, see GLG Mini Storage Inc. v Nassau County, 251 AD2d 329, but it can not forgo the bidding process, even by waiver.

Here, the county has admitted that there has been no bidding process. An informal poll cannot be substituted for a formal Request For Proposal. Thus, by law Suffolk County cannot proceed with the proposal to sell its property to BRT.

Violates SEQRA

SEQRA was enacted in 1975 and was termed an "alarm bell" whose purpose is to alert responsible public officials to potential environmental problems resulting from their actions, prior to the point of no return. The central practical means set forth by the act for the implementation of its policies includes the requirement of ECL 8-0109(2) that all agencies (within the meaning of which term the County is included) shall cause to be prepared, an EIS with respect to any action (within the meaning of which term the proposed sale is included), which may have a significant effect on the environment.

SEQRA itself provides few guidelines as to which types of actions may have a significant effect, however, regulations prepared pursuant to SEQRA, provide the necessary guidelines. See 6 NYCRR. If the action falls within the 37 actions not subject to review (617.5), titled Type II actions, then an EIS is not needed.

The proposed sale does not fall within the listed actions in 6NYCRR section 617.5 and so, pursuant to 617.6, an action-specific EIS is required before the property can be sold. An EIS, prepared for a previously proposed action is insufficient. Therefore, the County's EIS, prepared for the proposed sale of county land for the proposed Legacy Village, will not substitute for an EIS prepared for the sale currently being considered by the legislature. See Devitt v Heimbach, 89 AD2d 920.; Billerbeck v Brady, 224 AD2d 937.

Moreover, a Declaration of Environmental Significance must relate to the specific environmental impacts anticipated as a result of such sale. Inasmuch as neither the county nor the buyer has indicated anything at all about the intended use, any valid Determination of Significance is not possible. The county cannot ascertain whether a positive or negative declaration is appropriate without knowing the intended use, thus the county may not arbitrarily issue a negative declaration without a rational basis for doing so.

Applicability of Federal Railroad Act

Allegations that this action falls within the Federal Railroad Act have no foundation in fact or law. That act does not apply here. Initially, even a common carrier railroad may be subject to local zoning regulation. Here, since BRT, the putative buyer, is a private entity, the firm's railroad operations do not fall under the Federal Railroad Act and are, thus, not exempt from state, county or local jurisdiction. Under the Federal Railroad Act, the status of the railroad depends upon the character of its traffic and simply because it provides its services by rail, it does not automatically meet the exemption parameters of the Federal Railroad Act.

Legislative Process

Finally, the legislature erred when it approved the sale of 39 acres of the Yaphank property, prior to its having declared these 39 acres legitimately surplus property. The declaration of those 39 acres as surplus property had to have been established, prior to its approval for sale.

Regardless of the absence of a sound rationale for selling the property, the sale's adverse environmental impacts or the alleged fiscal need of the county, the process by which the county has moved to sell the property is in violation of federal, state and county law.

OFFICE OF PARKS, RECREATION, HISTORIC PRESERVATION
NEW YORK STATE

New York State Office of Parks, Recreation and Historic Preservation

Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

PLANNING DEPT.
'12 AUG 31 PM 10:30

Andrew M. Cuomo
Governor

Rose Harvey
Commissioner

August 27, 2012

Michael P. Mule
Suffolk County Dept. Economic Development & Planning
H. Lee Dennison Building, 4th Fl
100 Veterans Memorial Hwy
Happauge, New York 11788

Re: SEQRA
Bergen Point Bergen Wastewater Treatment
Plan Outfall Replacement
600 Bergen Ave, W. Babylon,/BABYLON,
Suffolk County
12PR03301

Dear Mule:

Thank you for requesting the comments of the Office of Parks, Recreation and Historic Preservation (OPRHP). We have reviewed the project in accordance with the New York State Historic Preservation Act of 1980 (Section 14.09 of the New York Parks, Recreation and Historic Preservation Law). These comments are those of the Division for Historic Preservation and relate only to Historic/Cultural resources. They do not include potential environmental impacts to New York State Parkland that may be involved in or near your project. Such impacts must be considered as part of the environmental review of the project pursuant to the State Environmental Quality Review Act (New York Environmental Conservation Law Article 8) and its implementing regulations (6 NYCRR Part 617).

Based upon this review, it is the OPRHP's opinion that your project will have No Impact upon cultural resources in or eligible for inclusion in the State and National Register of Historic Places.

If further correspondence is required regarding this project, please be sure to refer to the OPRHP Project Review (PR) number noted above.

Sincerely,

Ruth L. Pierpont

Ruth L. Pierpont
Deputy Commissioner for Historic Preservation

From: Carolyn Sukowski [mailto:cs424@cornell.edu]
Sent: Wednesday, September 12, 2012 9:10 AM
To: Mule, Michael
Cc: 'Emerson Hasbrouck'; 'Lorne Brousseau'
Subject: Comments on SPDES MS4 Permit

Dear Mr. Mulé,
I am a member of the Cornell Cooperative Extension of Suffolk County's Stormwater Management Program. Earlier this year Michael Kaufman requested that we alert the CEQ of any opportunities to comment on new SPDES MS4 permit requirements. We were directed to contact you if the opportunity to comment ever arose. The NYSDEC just posted a draft document entitled "Retrofit Program Plan Guidance Document for Pathogen Impaired Watershed MS4s on Long Island" which currently is available for comment. The requirements outlined in this document are not official permit modifications yet, however the details presented may eventually be incorporated into the permit. Below is the posting taken from the NYSDEC's Environmental Notice Bulletin and should supply all contact information for comments:

ENB – Statewide Notice – 9/5/2012:
Notice of Availability of draft Retrofit Program Plan Guidance Document for Pathogen Impaired Watershed MS4s on Long Island
The New York State Department of Environmental Conservation (NYS DEC) is making a draft of the "Retrofit Program Plan Guidance Document for Pathogen Impaired Watershed MS4s on Long Island" available for public review and comment. The guidance clarifies information that should be submitted by MS4s to meet the permit requirements for submission of a retrofit plan by September 30, 2012 as specified in Part IX.C of the SPDES General Permit for Stormwater Discharges from Municipal Separate Storm Sewer Systems (GP-0-10-002).
The draft guidance document is available on the NYSDEC's website at: http://www.dec.ny.gov/chemical/41392.html.
Availability for public comment: Comments on the draft guidance document will be accepted by fax or mail or email until the close of business on October 3, 2012 or on the 30th day after publication in the Environmental Notice Bulletin (ENB), whichever is later. Comments should be filed with the contact listed below.
Contact: Carol Lamb-LaFay, NYS DEC - Division of Water, Bureau of Water Permits, 625 Broadway, 4th Floor, Albany, NY 12233-3505, Phone: (518) 402-8123, Fax: (518) 402-9029, E-mail: calambla@gw.dec.state.ny.us.

Please let me know if you have any questions on this matter.
Carolyn Sukowski
Water Quality Program Coordinator
Marine Program at Coindre Hall
Cornell Cooperative Extension of Suffolk County
P.O. Box 554
Huntington, NY 11743
Phone: (631) 239-1800 ext. 21
Fax: (631) 239-1797

PROJECT INFORMATION

CDM Smith

Memorandum

To: *Michael Mulé, CEQ*

From: *Mary Anne Taylor, P.E.* MAT

Date: *September 5, 2012*

Subject: *Sewer District No. 3 – Southwest*
Bergen Point Wastewater Treatment Plant Outfall Replacement Project
Response to Issues Identified by CEQ

Enclosed, please find 15 paper copies and one electronic copy of our response to issues raised by the Council on Environmental Quality (CEQ) at the July 18, 2012 meeting concerning the proposed Sewer District No.3 -Southwest Bergen Point Wastewater Treatment Plant Outfall Replacement project.

We would appreciate the project being discussed at the September 19, 2012 CEQ meeting.

cc: Gil Anderson, P.E. Commissioner
Janice McGovern, P.E., Associate Civil Engineer
Ben Wright, P.E., Principal Civil Engineer

Document code

Bergen Point WWTP Outfall Replacement Project
Response to Issues Identified by Suffolk County CEQ in July 2012

1. Disposal options and their impacts for excavated tunnel material

There are a variety of potential disposal options that could be implemented for the material removed from the tunnel alignment. It is possible that more than one option will be implemented; depending upon the characteristics of the material removed from the tunnel route, County needs at the time of construction, and cost implications. Some potential options include:

- Stockpiling of excavated materials for beach nourishment
- Direct use of excavated material to close a breach of the barrier island
- Use of excavated material as cover material for dredged materials from the County's navigational dredging program
- Contractor removal of some/all excavated material from the site, if there is no immediate beneficial reuse consistent with the material characteristics

Standards exist for materials to be used for beach nourishment; these requirements are reportedly beach-specific. The tunnel muck would have to be tested, most likely on a daily basis, to assess material suitability for each potential application. Material suitable for beach nourishment would be a benefit to the County; however incorporation of daily testing requirements into the contract documents would add cost to the project. Identification of the disposal site (s) prior to issuing the contract would allow for the inclusion of all costs associated with the disposal of the excavated material in the contract.

The requirements for materials to be used on an emergency basis to close a barrier island breach are believed to be more flexible; the material could potentially be stockpiled for potential future use.

In some cases, NYSDEC has required that material dredged as part of the County's navigational dredging program must be covered with clean material; the material removed from the tunnel alignment could potentially be utilized for this purpose.

The contractor's primary objective with regards to excavating soil is to perform this task as cost efficiently and safely as possible. To achieve that goal, changes in the characteristics of the material being excavated and the abrasive wear that natural soil has on the tunnel boring machine (TBM) must be evaluated and the excavation approach modified accordingly. The modifications consist of adding conditioners to the soil to reduce the stickiness of the plastic clays and to reduce the abrasiveness of the silty sands and gravels. These additives reduce the wear on the equipment and extend the distance that the tunnel can be advanced before maintenance of the TBM is required. As a result of the added conditioners, the material being excavated is more uniform in appearance and the conditioners can affect its potential reuses. In order for the material to be approved for beach nourishment, it is likely that a segregation plant would have to be built to separate out the fines that are not suitable for this application.

It is likely from a total project cost perspective that it would be most advantageous to the County to have the contractor remove the material from the site. The Contractor would sell or dispose of the material himself for use as landfill cover (clayey materials) or fill (granular materials).

Given the cost and significance of the project, a Risk Management Workshop was convened with the County in 2010 to proactively identify the range of items that are considered to be a potential risk that could affect the tunnel integrity, cost or schedule. The purpose was to identify items that had the potential 'risk' to affect the project, and to develop an action plan to mitigate each potential risk that was identified. Over fifty potential hazards were identified along with their potential consequences, likelihood of occurrence, potential control measures, and action items and schedule for risk mitigation. The potential cost implications of the 'risks' were considered. Many of the risks will be specifically addressed as the design documents are prepared. Potential issues associated with material excavation and disposal were identified during this process; the approach to risk mitigation for material disposal was to work together with the County to consider material needs, conditions, and disposal requirements along with cost implications at the 60% design level. The potential cost of each disposal option will weigh heavily in the decision making process for this issue, given the need to avoid increasing the total project cost.

2. Storm surge potential and impact prevention

According to the National Hurricane Center Sea, Lake and Overland Surge from Hurricane (SLOSH) model results, a storm surge of approximately 5 feet could result at the Bergen Point WWTP site from a Category 1 hurricane and a storm surge of up to ten feet could result at the barrier island site from a Category 1 hurricane. A Category 4 hurricane would result in storm surges of over twenty feet at both the WWTP and the barrier island sites. Storm surges from hurricanes or tropical storms could affect the progress of tunnel construction.

The SLOSH model results will be provided to bidders as part of the tunnel design documents. There are several alternative approaches that the contractor could implement to address a potential surge. If a storm event is predicted to occur, the contractor's response is likely to vary depending on the stage of tunnel construction and his willingness to assume the risk of losing equipment and/or redoing work if the site is flooded.

In general, if a hurricane is forecast, the contractor will have sufficient time to remove all personnel as well as any exposed equipment/materials from the tunnel prior to the storm event.

Potential Impacts during Working or Receiving Shaft Construction

Vulnerable equipment and materials would be removed from the shaft and/or site. The impact of a storm surge during working shaft or receiving shaft construction could be mitigated by shotcreting the frozen ground on a daily basis to ensure that the shaft maintained its structural integrity if it was flooded. When the storm event was over, any standing water would be pumped out of the working shaft and to the head end of the WWTP, and construction would proceed. Discharge of any standing water in the receiving shaft would be addressed as a special condition in the tidal wetlands permit. Applying shotcrete to the exposed shaft walls is routinely performed on a scheduled basis by the contractor. The schedule they develop for this work is part of the contractor's means and methods and the impact of requiring this work on a daily basis would be expected to be relatively minor.

Impacts during Tunnel Construction

The impact of a storm surge during tunnel construction could be mitigated by placement of a bulkhead door to seal off the TBM and tunnel face from the surge. Other equipment/materials and personnel would be removed from the tunnel. After the storm event had passed, any standing water would be pumped out of the shaft, pumped to the head of the WWTP and construction would proceed.

Alternatively, the contractor could choose to berm or sheet the work area, or he could choose to let the construction site flood and resume work after pumping out the water.

A hurricane would impact the construction schedule; the potential impacts on schedule/cost have been considered during the risk evaluation.

3. Environmental characteristics of the maximum extent of staging areas

Figure 1 depicts the location of the maximum anticipated extent of the construction area on the barrier island.   The figure also depicts the extent of the federally regulated wetlands and the boundary of the state wetlands. The following activities will occur within this part of the easement:

- Construction of the receiving or exit shaft (approximate location shown on the figure)
- Connection of the new tunnel beneath the Bay to the existing pipeline discharging to the ocean
- Material/equipment storage and contractor staging area.

The design team has advanced the preliminary design of the tunnel/outfall connection to provide an updated estimate of the area that will be disturbed, as shown.

A site visit was conducted on July 25, 2012 to confirm the plant materials present in the area that will be disturbed.   Based on the predominance of invasive species evident throughout the easement, it was evident that most of the area to be disturbed during construction activities had previously been disturbed.   Native plant materials were observed just to the east and the west of the existing easement/proposed staging area.

The plant types identified in the upland area are summarized on Table 1.

Table 1 – Plants Identified in Upland Area

Botanical Name	Common Name	Comments
Invasive Species		
Alianthus altissima	Tree of Heaven	Tree
Alliaria petiola	Garlic Mustard	Herbaceous
Artemesia vulgaris	Mugwort	Herbaceous
Celastrus orbiculatus	Oriental Bittersweet	Vine
Eleagnus umbeliata	Autumn Olive	Shrub – Almost the entire length of the proposed staging area along the Parkway was lined with olives
Phragmites australis	Common reed grass	The Phragmites were almost up to the road line
Robinia pseudocacia	Black locust	Tree
Rosa multiflora	Multiflora Rose	Shrub
Native Species		
Myrica pensylvanica	Bayberry	Shrub – very few
Parthenocissus quinquefolia	Virginia Creeper	Vine – native but wrapped around everything
Prunus maritima	Beach Plum	Shrub
Prunus serotina	Wild Black Cherry	Tree – maybe 20 feet in height

Plants identified in the wetland area are listed in Table 2.

Table 2 – Plants Identified in Wetland Area

Botanical Name	Common Name	Comments
Phragmites australis	Common reed grass	The Phragmities was almost up to the road

It appeared that the Phragmites was the dominant species in the wetland area within the proposed staging area. Spartina - Cord Grass was noted outside and to the north of the staging area.

Plant growth was too dense to access the northern/wetland part of the disturbed area from the south/Parkway. Views from the marina to the southeast of the site showed that phragmites are present through much of the easement with a border of spartina along the bayfront. Figures 2 through 5 provide an indication of the distribution of upland type vegetation, phragmites and spartina in the area.

The New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) also visited the site on August 13, 2012 to provide guidance on the site restoration plan that must be developed. A site restoration plan must be developed by a landscape architect registered in New York State, and NYSOPRHP has requested that the plant materials identified in Table 3 be specified in that plan.

Table 3 – Plant Materials to be Identified in Site Restoration Plan

Botanical Name	Common Name
Baccharis halimifolia	Groundsel Tree
Juniperus virginiana	Eastern Red Cedar
Myrica pensylvanica	Northern Bayberry
Prunus serotina	Wild Black Cherry
Rhus species	Sumac
Solidago sempervirens	Seaside Goldenrod

Further consultation with NYSOPRHP and New York State Department of Environmental Conservation (NYSDEC) will be required as the restoration plan is developed.

4. Impacts on the project from and methods for dealing with sea level rise

Sea level rise models project a wide range of potential increases in sea level in the coming decades.

The New York City Panel on Climate Change projected a wide range of sea level increases through the 2090s based on a number of different global climate change models; the projections ranged from 10.4 to 70 inches. The New York State Sea Level Rise Task Force projected sea level rise at Long Island to range from 12 to 55 inches by the 2080s. A recent paper by the Lamont Doherty Earth Observatory entitled "***Risk Increase to Infrastructure Due to Sea Level Rise***" identifies a three foot rise in sea level over the next century.

These projected increases in sea level elevation will have an extremely small impact on the tunnel itself. The effect would be an increase in the hydrostatic load on the tunnel lining. This loading of less than 5 pounds per square inch (psi) for each 10 feet of sea level rise would be uniform around the liner.

Operation of the effluent pump station that conveys treated effluent to the outfall tunnel will be affected by sea level rise. The effluent pump station is currently being renovated and will be capable of discharging treated effluent through the tunnel despite the increased sea level elevation. Effluent is currently discharged by gravity during some conditions of effluent flow and tides. As sea level increases (and as a result of changes to the plant processes) the plant will not be able to discharge by gravity as often and the pump station will be operational more often.

The present design of the effluent pump station considered the effects of sea level rise by establishing a higher elevation and by providing pedestals for equipment to provide further protection against flooding.

References:

Lamont Doherty Earth Observatory of Columbia University. **Risk Increase to Infrastructure Due to Sea Level Rise.** Undated.

New York City Panel on Climate Change. **Climate Risk Information.** Release Version February 2009

New York State Sea Level Rise Task Force. **Report to the Legislature.** December 27, 2010.

5. Potential for tunnel integrity issues (collapse, settling and how it affects joints) and contingencies

During the July CEQ meeting, concern was expressed that the Bergen Point outfall tunnel would encounter a similar situation as the Chunnel. Since the construction of the Chunnel there have been major improvements in tunnel boring machines regarding the ability to monitor the location of the tunnel heading and the applied loads that the tunnel is exerting on the ground for excavation.

A comparison with the Chunnel is difficult to make since that tunnel was in rock whereas at the depth of this tunnel, the TBM will be excavating soil, identified as a "soft ground" tunnel . However, the issues raised are still valid.

Settlement of a rock tunnel is very unusual. In soft ground it is more common. However, once the tunnel itself is in place, it weighs less than the soil that was removed, so the general tendency would be for the tunnel to move upward. The ground above the tunnel acts to hold it in place. The larger concern is to place the tunnel at the design location during construction. With the instrumentation available today, the TBM operator can see in three dimensions exactly where the tunnel is relative to the target location at any time during the excavation. He also has the controls to make adjustments to the course so any deviation can be corrected within a distance that will allow the liner (rings) to be placed within the design tolerances. This timely correction allows for watertight installation of the rings.

The liner segments are formed into a ring within the shield of the back end of the TBM. The outer diameter of the completed liner ring is smaller than the inner diameter of the TBM shield. As the TBM is advanced forward, pushing off of the liner ring, the void between the outside of the liner and the ground (the inner diameter of the TBM shield) is filled with grout. Consequently, the tunnel is supported by either the TBM, or the liner, as construction proceeds.

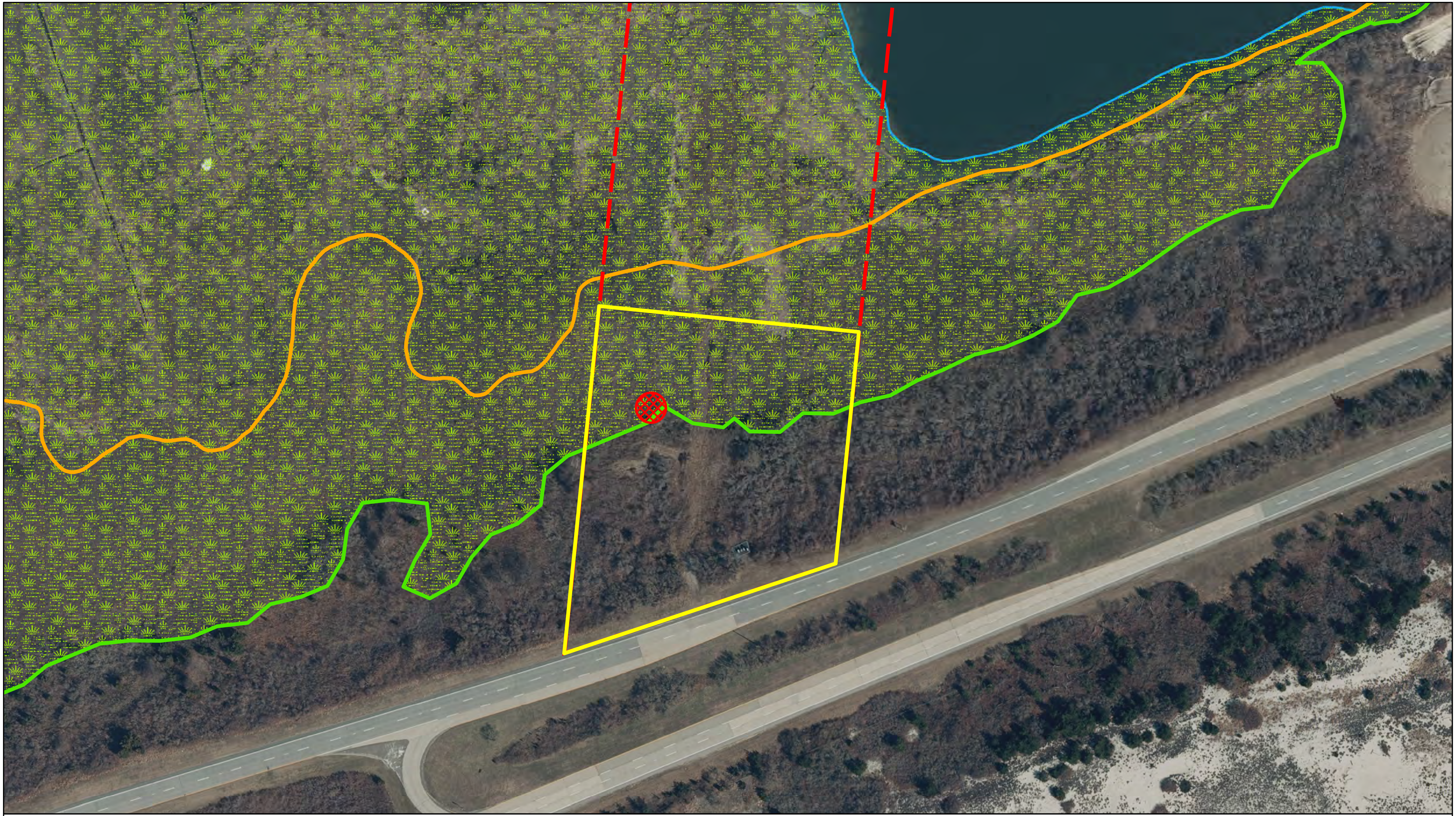
Provided that the tunnel ring segments are manufactured to meet design requirements and these segments are installed within the tolerances identified in the specifications, the assembled rings will withstand the loads that will be imposed on them by the soil and water. Usually the loads imposed on the ring segments to put them in place, i.e. the construction loads, are greater than the long term loading condition, which provides an added safety factor to the ring in addition to what is required for the long term loading. The design documents will define the acceptable tolerances of the liner joints and the permissible leakage rates. The liner system design considers all external pressures and loads that can act on the ring once it is in place. The contractor will consider the method of lifting the ring segment into place and further increase the strength of the liner as necessary. These new loads are also checked by the engineer during the shop drawing review phase of tunnel construction.

For this particular tunnel, the engineering parameter values that would indicate if the ground would be subject to liquefaction due to the vibrations of the machine as it advances through the ground have been carefully reviewed. Soils most susceptible to liquefaction are fine grained non-plastic soils such as silt, silty sand and fine sand with Standard Penetration Test values (SPT N values) that are less than 20 and a depth of less than 50 ft. Where soils that may be susceptible to liquefaction have been encountered within the tunnel horizon, the N values have all been above 20 and the depth is greater than 50 feet. Therefore liquefaction is not considered to be an issue for this tunnel.

A strong earthquake at the exact location of the tunnel causing several feet of displacement is the only force anticipated to have the potential to shear the tunnel. This possibility is considered to be extremely remote. In the less remote case of a potential earthquake with an epicenter located several miles away, the tunnel would move along with the ground.

6. Fate of existing outfall pipe and contingency in the event the new tunnel must be shut down

While SCDPW has not completed their evaluation of the ultimate fate of the existing outfall pipe, current plans are to abandon the outfall in-place so that it could be used as an emergency back-up in the future. SCDPW will continue to re-evaluate this option based on their on-going assessment.



N

Legend

Shaft
State Wetland Boundary
Federal Wetland Boundary
Easement
Staging Area
Wetland
Littoral Zone

Bergen Point WWTP
Outfall Replacement Project

1 inch = 100 feet

0 50 100 200 *Feet*

Approxiamte Location of Staging Area
Suffolk County, Department of Public Works
Figure 1

CDM Smith

Date: 7/25/2012

3
2
1
Reference Point
Ocean Pkwy
Imagery ©2012 DigitalGlobe, GeoEye, New York GIS, Map data ©2012 Google

Figure 3, Location 2

Figure 4 – Location 3

Figure 5 – Location 3

COUNTY OF SUFFOLK

STEVEN BELLONE
SUFFOLK COUNTY EXECUTIVE

DEPARTMENT OF PUBLIC WORKS

GILBERT ANDERSON, P.E.
COMMISSIONER

PHILIP A. BERDOLT
DEPUTY COMMISSIONER

MEMORANDUM

TO: Gloria Russo, Chairperson, CEQ

FROM: John Donovan, P.E., Chief Engineer

SUBJECT: **Sewer District No. 3 – Southwest Bergen Point Wastewater Treatment Plant Outfall Replacement Project**

DATE: July 3, 2012

Enclosed, please find 15 paper copies and one electronic copy of an EAF and supporting materials for the Sewer District No. 3 – Southwest Bergen Point Wastewater Treatment Plant Outfall Replacement project.

The objective of the project is to replace the deteriorating section of the Bergen Point WWTP outfall that extends from the WWTP southwards, approximately 14,200 feet, beneath Great South Bay, to the barrier island. Six alternatives were identified and evaluated based upon cost-effectiveness, construction and environmental impacts, and implementation schedule.

The selected alternative, construction of a replacement tunnel beneath the bottom of Great South Bay, was recommended as it avoids construction within Great South Bay, and any discharge of treated effluent to Great South Bay, which significantly reduces the potential for environmental impact. The selected alternative also can be implemented the most quickly, has the lowest capital cost and the lowest operational cost.

Please note that Phase I of the project, renovation of the Final Effluent Pump Station, was previously designated as a Type II action via Resolution No. 156-2011, attached.

We would appreciate the project being discussed at the July 18, 2012 CEQ meeting.

JD:ni
Attachment
cc: Gil Anderson, P.E. Commissioner
Janice McGovern, P.E., Principal Civil Engineer
Ben Wright, P.E., Principal Civil Engineer
jd7-3-12 sd3 Bergen Point WWTP outfall replacement project memo to GRusso

335 YAPHANK AVENUE ■ YAPHANK, N.Y. 11980 ■ (631) 852-4204 FAX (631) 852-4659

SUFFOLK COUNTY FULL ENVIRONMENTAL ASSESSMENT FORM (EAF)

Instructions: This document is designed to assist in determining whether the action proposed may have a significant effect on the environment. Please complete the entire Data Sheet. Include as much information as possible such as feasibility studies, design reports, etc. Attach additional sheets if necessary. Mark irrelevant questions N.A., not applicable.

A. General Information:

1. Name of Project:

Bergen Point Wastewater Treatment Plant Outfall Replacement

2. Location of Project: (specify Town, Village or Hamlet and include project location map on next page.)

S.C.S.D. No. 3 – Bergen Point Wastewater Treatment Plant

Street Address:

600 Bergen Avenue, West Babylon, Suffolk County, New York 11707

Name of property or waterway:

Project is a replacement tunnel beneath the bottom of Great South Bay

3. Maps of Property and Project: Attach relevant available maps, including a location map (note: use road map, Hagstrom Atlas, U.S.G.S. topo map, tax map or equivalent) and preliminary site plans showing orientation, scale, buildings, roads, landmarks, drainage systems, areas to be altered by project, etc. – Please see attached location map ***(Figure 1)*** and map depicting tunnel layout ***(Figure 2)***.

4. Type of Project: (check one) New __________ Expansion
Neither: Replacement of a Portion of the Existing Outfall

5. Capital Program: (specify) Item #8108__ Date Adopted____*___Amount $197M in 2014-2016 Capital Program and Budget

6. General Description of Project Including its Purpose (attach relevant design reports, plans etc.):

A copy of the **Sewer District 3- Southwest Bergen Point Wastewater Treatment Plant Outfall Replacement Project Engineering Design Report** (May 2011) and a separate copy of the Executive Summary of the Engineering Design Report are attached.

The project will replace the deteriorated section of the existing S.C.S.D. No. 3 – Bergen Point Wastewater Treatment Plant (WWTP) outfall that extends from the WWTP southwards, approximately 14,200 feet beneath Great South Bay to the barrier island, by tunneling. Most of the proposed construction will take place underground, beneath the bottom of Great South Bay, to eliminate impacts to the Bay and the environment as much as possible.

The ten to twelve foot diameter tunnel will be constructed using a Tunnel Boring Machine (TBM). The project includes construction of two access shafts on either end of the tunnel, an access or launch shaft for the TBM on the southwest side of the WWTP property, and an exit/receiving shaft to remove the TBM from the tunnel on the barrier island, just north of

Ocean Parkway within the existing easement. Both the access and the exit/receiving shafts will be approximately 30 feet in diameter. The intent is to utilize groundfreezing to construct the shafts to reduce construction-related impacts to the surrounding areas. The TBM will be lowered down into the access shaft approximately 80 feet below mean sea level and the tunnel will be constructed as the TBM is advanced along the proposed alignment beneath the Bay bottom. A concrete liner will be installed within the tunnel behind the TBM. At the barrier island near the existing sample chamber, the TBM will be removed through the exit/receiving shaft and the new tunnel will be connected to the existing ocean section of the outfall, which will continue to convey treated effluent from the WWTP to ocean discharge. A new bypass connection system with linestops will be used to make the connection.

A staging area of approximately three acres will be established at the WWTP for temporary storage of equipment, supplies and excavated soils. A staging area of between one and three acres will also be required on the barrier island for construction equipment and to make the connection to the existing ocean section of the outfall. A generator will be required to power groundfreezing at both the access and the exit/receiving shafts. Tunneling will generate up to 90,000 cubic yards of excavated sand/silt/clay material that can be re-used or removed for off-site disposal.

After construction is complete, treated effluent will continue to flow from the Bergen Point WWTP to ocean discharge, as has been the case for over 30 years. The staging/access shaft areas will be restored, except for manholes/chambers that may remain for any future maintenance needs. ***Figure 3,*** attached, depicts the layout of the proposed tunnel replacement within the existing 300 foot easement, in plan view and in cross section.

There will be no impact to WWTP operations during construction.

Work within the Final Effluent Pump Station was also described in the **Sewer District 3-Southwest Bergen Point Wastewater Treatment Plant Outfall Replacement Project Engineering Design Report** and is also funded from Capital Program 8108. Construction work on the Final Effluent Pump Station is scheduled to begin in 2013. Replacement of the pumps, electrical controls and mechanical systems within the pump station was previously designated as a Type II action via Resolution No. 156-2011 and is not addressed further by this EAF.

7. Project Status: (check if begun)

		Start	Completion
X	PROPOSAL	May 2003	June 2003
X	STUDY	June 2004	On-going
X	PRELIMINARY PLANNING	Dec. 2008	March 2012
	FINAL PLANS: SPECS		
	SITE ACQUISITION	N/A	
	CONSTRUCTION		
	OTHER		

8. Departments Involved:

NAME AND ADDRESS OF DEPT. PERFORMING DESIGN & CONSTRUCTION	**NAME AND ADDRESS OF INITIATING DEPT. (If different)**
Name: Suffolk County Department of Public Works	Same
Street/P.O.: 335 Yaphank Avenue	
City, State: Yaphank, New York	
Zip: 11980	
Contact Person: Gilbert Anderson, P.E., Commissioner	
Business Phone (631) -852-4010	

B. Project Description

1. Scale of Project: The project will be constructed primarily beneath the bottom of Great South Bay to avoid impacts to the Great South Bay and the environment. Access shafts and staging/storage areas at the SCDPW Bergen Point WWTP site, and north of Ocean Parkway on the Barrier Island within the existing easement will be required during construction.

a. Total contiguous acres now owned at site:	50 +/-
b. Acreage to be acquired:	0
c. Developed acreage now: Developed acreage at completion of project: Developed acreage ultimately:	N/A – No change
d. Acreage of vegetation or cover to be removed:	Approximately one acre of currently vegetated area at the WWTP site, and one to three acres of vegetated area within the existing easement on the barrier island Existing vegetated areas will be re-vegetated when construction is complete
e. Acreage to remain undeveloped:	N/A – No change
f. Building gross floor area now: Building gross floor area proposed:	N/A – No change sq. ft. acres sq. ft. acres
g. Height of tallest structure on site now: Height of tallest structure proposed on site:	N/A – No change

h. Proposed Building use (if any):	N/A
i. Off-street parking spaces now: Off-street parking spaces proposed:	N/A – No change number acres number acres
j. Max. vehicle trips/hr. when operational:	N/A - No change
k. Roads on site now:	N/A – No change length acres
l. New road construction or reconstruction	N/A – No change length acres
m. Will project result in an increase in energy use? If yes, indicate type(s):	No increase in energy use as a result of the new outfall.
n. Will project require storage of liquid fuels and chemicals? If yes, describe substances and amounts to be stored:	During construction only – Diesel fuel will be required for generators powering the ground-freezing systems at the WWTP and on the barrier island; it is estimated that a total of nearly 85,000 gallons of diesel fuel will be required to power the generators throughout the construction period. Additional diesel fuel and gasoline will be required for other construction equipment on-site; this volume has not been developed at this time. It is anticipated that soil conditioners (e.g., bentonite) will be added to the soil materials being removed from the tunnel to reduce abrasion to the Tunnel Boring Machine cutter (sandy materials), to reduce sticking to the cutter (clayey materials) and to enhance settling of the finer tunneled materials.

2. Project Schedule:

a. Is project single or multi-phase?	Multi-Phase
b. If multi-phase, how many phases?	Two – Final effluent pump station work is

	scheduled to begin in 2013.
c. Total construction time (months)	Approximately 36 total for Phase 2, the outfall replacement project. Visible construction operations will primarily occur at the Bergen Point WWTP shaft site where the construction equipment will be lowered into the tunnel, and the soils will be removed. Construction activities will occur at the barrier island during a shorter time period - when the exit/receiving shaft for the Tunnel Boring Machine is being constructed, when the Tunnel Boring Machine is removed from the tunnel at the exit/receiving shaft, and when the new outfall section crossing beneath the Bay is connected to the existing outfall section that crosses beneath the barrier island and discharges to the Ocean.

3. Wastes and Pollutants Generated During Project Construction and Operation:

	Components	Quantity	Mode of Disposal
a. Sanitary Sewage	During construction only – From construction workers	Not yet defined	Construction trailer will be connected to the existing Bergen Point WWTP plant drain or Port-O-Johns
b. Liquid industrial waste	N/A		
c. Toxic chemicals	N/A		
d. Pesticides or herbicides	During construction only – Potential use of insect repellants such as DEET by construction works for personal protection against ticks/mosquitoes	Not defined – workers may apply insect repellants for personal use	N/A
e. Solid wastes	N/A		
f. Clearing or demolition debris	Brush	To be removed as necessary	Compost facility

		from staging and work areas at the Bergen Point WWTP shaft site and at the barrier island exit/receiving shaft site.	or landfill
g. Spoil disposal or sedimentation	Sands, silts, clays and gravel materials from shafts and tunnel	Up to 90,000 cubic yards	Material is expected to be appropriate for beneficial re-use; to be determined by SCDPW and contractor
h. Atmospheric emissions	During construction, from construction equipment and vehicles		N/A
i. Surface water runoff	N/A – no new paved areas		
j. Noise exceeding ambient	Heavy equipment operation, generators for ground freezing	N/A	N/A
k. Odors exceeding 1hr/day	N/A		
l. Other (specify)	N/A		

4. Does Project Involve Any:

Grading Cut/Fill; List amounts.	Excavated tunnel access shafts; total of up to 6,600 cubic yards of material removed, including bulking factor
Dredging; List max.depth, length & width.	N/A
Spoil Area; List amount.	Yes – considering bulking factor, up to 80,000 cubic yards of tunneled material will need to be removed from site
Bulkheading; List length.	N/A

Dewatering; List g.p.m. & period of time.	The intent is to use groundfreezing for shaft construction to minimize dewatering and any associated impacts. Dewatering is anticipated when the replacement outfall is connected to the pump station and the existing ocean section of the outfall. It is estimated that this could require dewatering of between 1,000 to 2,000 gallons per minute (gpm) for up to 4 months.

5. Indicate Sources of Utilities:

Water	Public water is available at the Bergen Point WWTP, and is located nearby the barrier island exit/receiving shaft site. Water trucks may be used in lieu of tapping into the public supply. Cooling water will also be required during tunneling; the source has not been determined.
Electricity	Generators at treatment plant site and on barrier island during construction
Gas	N/A
Other (please specify)	N/A

6. Total Water Usage:

Gallons per Day

If water supply is from wells, indicate pumping capacity in gallons per minute ________.

Based on another on-going tunnel project, approximately 25,000 gallons of water could be required for cooling the Tunnel Boring Machine. Based on conditions at the other similar project, this supply would be required once, the water would be stored on-site and recirculated.

C. Project Area Description/Existing Conditions:

1. Acreage of Physical Characteristics of Project Area:	Presently	After Completion
Meadow, field, scrub growth – up to 3 acres at exit/receiving shaft	< 3	< 3
Wooded	N/A	N/A
Agricultural	N/A	N/A
Freshwater wetland	N/A	N/A
Tidal wetlands (0 at access shaft, up to 3 acres at exit/receiving shaft)	< 3	< 3 – no change

Surface waters – Great South Bay is between work areas; tunneling work will proceed beneath the Bay bottom to avoid impacts to the Bay	N/A	N/A
Cleared, graded or filled land – at Plant site - loose sand & gravel, mowed grass and vegetation	~ 14 acres	~ 14 acres
Paved areas (roads, parking, etc.)	~ 7 acres	~ 7 acres
Buildings (List number and sq. ft.) 15 bldgs, 11 tanks on Plant site	~ 409,156 sq. ft.	~ 409,156 sq. ft
Other (please specify)		
TOTAL for WWTP Site TOTAL for Exit/Receiving Site	~ 50 acres ~ 1 - 3 acres within existing easement	~ 50 acres ~ 1 - 3 acres within existing easement

2. Streams within or contiguous to project area: *(Please list name of stream and/or name of river to which it is tributary, including intermittent streams)*

Santapogue Creek runs along the west side of the County-owned Bergen Point WWTP, and discharges to Great South Bay. Great South Bay is between the access and exit/receiving shafts; outfall construction will occur below the Bay bottom by tunneling to avoid construction within the Bay. Mud Creek is located along the east side of the WWTP.

3. Lakes, Ponds, Wetland areas within or contiguous to project area: *(Please list name(s) and size(s) in acres)*

No lakes, ponds or wetland areas are adjacent to the access shaft on the WWTP site. Estuarine and marine wetland areas are adjacent to the exit/receiving shaft location on the barrier island; estimated to be one to three acres.

4. a. Are there natural drainage channels on the project site? ___ Yes ___x___No No natural drainage channels are within the areas to be disturbed during construction

b. How far is project area from freshwater wetlands, tidal wetlands or surface waters?

The project area is adjacent to Great South Bay at the access shaft/staging area location at the WWTP and is adjacent to tidal wetlands at the exit/receiving shaft location on the barrier island. Great South Bay is between the access and exit/receiving shafts; all construction would occur below the Bay bottom.

5. Is the Project area within the 100 yr. Flood plain? _____x______yes ___________no
Source: Flood Insurance Rate Map #s 36103C0861H, 36103C0862H and 36103C0863H, revised September 25, 2009

6. Depth to the water table: at surface______0-3 ft ___3-8 ft ____8-16 ft____16 ft _x_ 0 to 12 ft

7. Predominant soil type (s) on project site as identified in the Soil Survey of Suffolk County - 1975: *(Include soils map of site.)* ***Please see Figures 4a and 4b***

Predominantly fill/dredged material at access shaft site at WWTP; Tidal marsh at exit/receiving shaft location on barrier island

8. General character of the land: Generally uniform slope **x** on WWTP site Generally uneven and rolling or irregular **x** on barrier island . *(Include topographic map of site.)* ***See attached Figure 5***

9. Approximate percentage of proposed project site with slopes: 0-10% **100%** 10-15%___or greater ____%.

10. Any unique or unusual land forms on the project site? (i.e. cliffs, dunes, kettle holes, eskers, other geological formations):

No unusual land forms present

11. Describe the predominant vegetation types on the site:

Mowed grass, landscaped trees and Phragmites at the WWTP site. Common maritime shrubs, such as Virginia creeper, *Rosa rugosa* and Bayberry on the Bay side of the barrier island exit/receiving shaft location

12. Describe the predominant wildlife on the site:

Common song birds and squirrels at access shaft location on WWTP site. Common song birds, deer, mosquitoes, ticks and shore birds at exit/receiving shaft location on barrier island.

13. Does project site contain any species of plant or animal life that is identified as threatened or endangered? **x** yes___no; if yes, give source and identify each species;

NYSDEC Environmental Resource Mapper Endangered Animals: American Burying Beetle (WWTP & receiving shaft location; date last documented 1893) Threatened Plants: Swamp Sunflower (WWTP & exit/receiving shaft location; date last documented 1898)

14. Is project contiguous to, or does it contain a building or site of historic, pre-historic or paleontological importance?____yes__**x**___no. Explain.

No – the access shaft location is on the Bergen Point WWTP site, the receiving shaft is located in an easement north of and adjacent to Ocean Parkway. The proposed project does not involve any landmark structures owned by Suffolk County. A search of the national and state historic databases indicates that the proposed project also does not involve any historic structures or sites listed in the National Register of Historic Places (http://nrhp.focus.nps.gov/natreghome.do?searchtype=natreghome) or the New York State Register of Historic Places (http://nysparks.com/shpo/online-tools/). The state's on-line historic databases also indicate that the proposed project does not involve any historic sites or structures in Suffolk County or the Town of Babylon (http://nysparks.com/shpo/online-tools/). Appendix A is not applicable.

15. List the specific activities now occurring at project location (i.e. hunting, fishing, hiking etc.)

Activities associated with operation of a municipal WWTP now occur at the access shaft location at the WWTP. The exit/receiving shaft location on barrier island is located north of Ocean Parkway within a vegetated, but previously disturbed easement. A marina and a parking lot are located to the east and northeast of the shaft. Boating and fishing occur in Great South Bay, between the tunnel shaft locations.

16. Is the project site presently used by the community or neighborhood as an open space or recreation area__yes __**x**_no--The access shaft is located at the WWTP. Great South Bay is between the access and exit/receiving shafts; tunnel construction would occur below the Bay bottom. The exit/receiving shaft location on the barrier island is currently open space; but is not used by the neighborhood. Construction activities would occur within the vegetated area between the Ocean Parkway and the marina. The Barrier island site will be revegetated upon project completion.

17. Does the present site offer or include scenic views or vistas known to be important to the community __yes and _**x**_no. The Bergen Point WWTP, where most of the visible construction activity will take place, is not known to be an important scenic vista. Some construction equipment that will be used/stored at the WWTP site may be visible from Great South Bay. Construction will primarily occur beneath the Bay bottom, where it will not be visible to the public. Exit/receiving shaft construction on the Barrier Island will occur north of Ocean Parkway. The presence of construction equipment will be temporarily visible from cars travelling on Ocean Parkway, and from boats passing through the State Boat Channel, however when construction is complete the equipment will be removed and the site will be restored.

18. Zoning:

a. Current specific zoning or use classification of site?	Suffolk County land use maps show the Bergen Point WWTP site as "Waste Handling and Management" and the exit/receiving shaft site as "Recreation and Open Space."
b. Is proposed use consistent with present zoning or use?	Yes. Work will be primarily

	below ground and construction-related impacts will be temporary.
c. If no, indicate desired zoning or use.	

19. What is the dominant land use and zoning classification within a 1/4 mile radius of the project (e.g. single family residential, R-2) and the scale of development (e.g. 2 story)? *(Include existing land use map)* See attached ***Figure 6***

Recreation and Open Space, Commercial, A residence: 12,500 sq. ft. SF homes; B residence: 10, 000 sq. ft. SF homes

20. Is the site served by existing public utilities?_x_yes Power is available at the access shaft location at the WWTP and at the exit/receiving shaft on the barrier island; potable water and wastewater disposal are available at the access shaft location at the WWTP. _X_no water/wastewater disposal are available at the exit/receiving shaft location on barrier island (although public utilities are available at nearby marina and park).

a) If yes, does sufficient capacity exist to allow connection? ___x_____yes________no. However, the outfall will not require connection to utilities.

b) If yes, will improvements be necessary to allow connection?_______yes___x____no

21. Is the site located in an agricultural district certified pursuant to Agriculture and Market Law, article 25-AA, Section 303 and 304?__________yes___x_____no.

22. Is the site located in or substantially contiguous to a Critical Environmental Area designated pursuant to Article 8 of the ECL, and 6 NYCRR 617?________yes___x___no.

23. Has the site ever been used for disposal of solid or hazardous wastes?_______yes___x___no.

D. Impact Summary and Mitigation

1. How many acres of vegetation (trees, shrubs, ground covers) will be removed from site?
__Up to 3 _____acres

2. Will any mature forest or other locally important vegetation be removed by this project?
________yes____x_____no. Explain.

No mature forest will be removed during the project. Marsh grass will be removed from the barrier island during exit/receiving shaft construction; the site will be restored when construction is complete.

3. Are there plans for erosion control and stabilization?__x___yes ___no.

Erosion control is required

4. Are there any plans for revegetation to replace that removed during construction?
__x__yes __no. Explain and attach plans.

Restoration of the barrier island site will be required when construction is complete; the detailed plans will be developed in cooperation with NYSDEC and NYS Parks Department when the final construction plans and specifications are prepared.

5. Will project physically alter any surface water bodies? __yes__x__no. Explain.

Great South Bay is between the access and exit/receiving shafts; the tunnel will be constructed below the Bay bottom to avoid any alteration of/impacts to the Great South Bay.

6. Will project require relocation of any projects, facilities or homes? __yes__x__no. Explain.

7. Number of jobs generated:

During construction?	Preliminary estimate of 40 to 50
After project is completed?	0

8. Number of jobs eliminated by this project ____**0**____.

E. Alternatives - Briefly list alternatives to the proposal considered

As described in the attached **Engineering Design Report**, a total of six alternatives were identified and evaluated: Alternative 1 – Tunnel with Carrier Pipes Alternative 2 – Tunnel – Selected Alternative Alternative 3 – Tunnel via Open Cut Alternative 4 - New Outfall Discharging to Great South Bay Alternative 5 - Lining Existing Failing Section of Outfall with Temporary Discharge to Bay Alternative 6 - Upgrade WWTP, Pump Treated Effluent Back to Recharge the Aquifer Via Injection Wells Alternative 2, the proposed alternative, was selected primarily because it will result in the least environmental impact to the Great South Bay and environs and because it can be implemented the most quickly, to reduce the potential environmental damage associated with the potential failure of the existing portion of the outfall beneath Great South Bay. The No-Action Alternative is not a feasible option because of the potential environmental impact to Great South Bay when the existing outfall fails. Due to the magnitude of the construction cost, Suffolk County retained a second team of experts to review the draft Engineering Design Report, including the approach, the recommended alternative and the cost. The independent review confirmed the proposed alternative, approach and the preliminary cost estimate.

F. Approval and Compliance

1. Will project involve funding or financing by any:

   a. Federal agency (specify) ______; amount________.

   b. State agency (specify)________; amount_______.

   c. Local agency (specify) **x** Suffolk County__; amount estimated: $197,000,000__.

2. Does project require permit or approval from:

	YES	NO	TYPE
a. Army Corps of Engineers	X		See attachment A
b. U.S. Environmental Protection		X	
c. Other Federal agency (specify) **NOAA/USFWS/USCG**	X		See attachment A
d. N.Y.S. Environmental Conservation Department	X		See attachment A
e. Other State agency (specify)	X		See attachment A
f. County Health Department			
g. County Planning Department			
h. County Public Works Department	X		See attachment A
i. Town or Village Board **Babylon Dept. Env Control**	X		See attachment A
j. Town or Village Planning Board			
k. Town or Village Zoning Board			
l. Town or Village Building Department			
m. Town or Village Highway Department			
n. Town or Village Environmental Agency			
o. Local Fire Marshal			
p. Other local agency			

3. Conformance to existing comprehensive or project master plans.

	yes	no	Description
a. State	x	___	Recommended alternative is consistent with the recommendations included in the New York State Coastal Management Program
b. Bi County	___	___	(see below for South Shore Estuary Reserve reference)
c. County	x	___	Recommended alternative is consistent with the recommendations included in the County's draft Comprehensive Water Resources Management Plan, also see below.
d. Town	x	___	Please see below:

Town and County

Long Island South Shore Estuary Reserve Comprehensive Management Plan, Adopted April 25, 2001 -

The proposed project conforms to Chapter 2: Improve and Maintain Water Quality of the plan in that it would assist with maintaining the Great South Bay's water quality by installing a new outfall pipe below the Bay bottom to replace the deteriorated section of the existing Suffolk County Bergen Point WWTP outfall and prevent failure. Suffolk County and the Town of Babylon became part of the SSER Council and adopted this plan on April 12, 2001.

e. Village ___ ___ ___ N/A

PREPARER Mary Anne Taylor Date 7/3/12

TITLE Associate, Camp Dresser & McKee

SIGNATURE* Mary Anne Taylor

I certify that the information herein is accurate.

PROJECT DIRECTOR JOHN C. DONOVAN Date July 3, 2012

TITLE CHIEF ENGINEER SANITATION - SCDPW

SIGNATURE*

I certify that the information herein is accurate

*Signature of both preparer and project director required

Part 2 - RESPONSIBILITY OF LEAD AGENCY
Project Impacts and Their Magnitude

General Information (Read Carefully)

X In completing the form the reviewer should be guided by the question: Have my decisions and determinations been **reasonable?** The reviewer is not expected to be an expert environmental analyst.

X Identifying that an effect will be potentially large (column 2) does not mean that it is also necessarily **significant**. Any large impact must be evaluated in PART 3 to determine significance. By identifying an impact in column 2 simply asks that it be looked at further.

X The **Examples** provided are to assist the reviewer by showing types of impacts and wherever possible the threshold of magnitude that would trigger a response in column 2. The examples are generally applicable throughout the State and for most situations. But, for any specific project or site other examples and/or lower thresholds may be appropriate for a Potential Large Impact rating.

X Each project, on each site, in each locality, will vary. Therefore, the examples have been offered as guidance. They do not constitute an exhaustive list of impacts and thresholds to answer each question.

X The number of examples per question does not indicate the importance of each question.

Instructions (Read carefully)

a. Answer each of the 19 questions in PART 2. Answer **Yes** if there will be **any** impact.
b. **Maybe** answers should be considered as **Yes** answers.
c. If answering Yes to a question then check the appropriate box (column 1 or 2) to indicate the potential size of the impact. If threshold impact equals or exceeds any example provided, check column 2. If impact will occur but threshold is lower than example, check column 1.
d. If reviewer has doubt about size of the impact then consider the impact as potentially large and proceed to PART 3.
e. If a potentially large impact or effect can be mitigated by a change in the project to a less that large magnitude, check the yes box in column 3. A No response indicates that such a reduction is not possible.

IMPACT ON LAND

1. Will the proposed action result in a physical change to the project site? __x__Yes ___No - Temporary change during construction – both access and exit/receiving shaft areas will be restored when construction is complete.

IMPACT ON LAND **Examples** that would apply to Column 1	**1** **Small to Moderate Impact**	**2** **Potential Large Impact**	**3** **Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Any construction on slopes of 15% or greater, (15 foot rise per 100 foot of length), or where the general slopes in the project area exceed 10%.			
Construction of land where the depth to the water table is less than 3 feet.	X		Project has incorporated groundfreezing technology to avoid dewatering when possible
Construction of paved parking area for 1,000 or more vehicles.			
Construction on land where bedrock is exposed or generally within 3 feet of existing ground surface.			
Construction that will continue for more than w year or involve more than one phase or stage.	X		The project is comprised of two

			phases. The first has already been designated as a Type II action. The Phase II recommended alternative has the shortest construction schedule of all six of the alternatives identified and evaluated; construction activities will occur primarily on the WWTP site and beneath the bottom of Great South Bay
Excavation for mining purposes that would remove more than 1,000 tons of natural material (i.e., rock or soil) per year.			
IMPACT ON LAND	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Construction of any new sanitary landfill.			
Construction in a designated floodway.	X		No permanent above-ground facilities, fill or impervious area will be added; the area will continue to serve in a floodway.
Other Impacts (Please describe)			

2. Will there be an effect to any unique or unusual land forms found on the site? (i.e., cliffs, dunes, geological formations, etc.) yes __x__ no.

List Specific land forms:			

IMPACT ON WATER

3. Will proposed action affect any water body designated as protected? (under Articles 15,24,25 of the Environmental Conservation Law, ECL) ___ yes __x__ no.

IMPACT ON WATER (**Examples** that would apply to column 2)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Developable area of site contains a protected water body.			

Dredging more than 100 cubic yards of material from channel of a protected stream.			
Extension of utility distribution facilities through a protected water body.			
Construction in a designated freshwater or tidal wetland.	X		Groundfreezing has been incorporated into the proposed alternative to mitigate impacts
Please List Other Impacts:			Alternative with least impact to the County's water resources has been selected

4. Will proposed action affect any non-protected existing or new body of water? ___ yes _x_ no

A 10% increase or decrease in the surface area of any body of water or more than a 10 acre increase or decrease.			
Construction of a body of water that exceeds 10 acres of surface area.			
Please List Other Impacts:			

5. Will proposed action affect surface or groundwater quality? ___ yes _x_ no

Proposed Action will require a discharge permit.			
Proposed Action requires use of a source of water that does not have approval to serve proposed (project) action.			
Proposed Action requires water supply from wells with greater than 45 gallons per minute pumping capacity.			

IMPACT ON WATER (cont.) (**Examples** that would apply to column 2)	**1** **Small to Moderate Impact**	**2** **Potential Large Impact**	**3** **Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Construction or operation causing any contamination of a public water supply system.			
Proposed Action will adversely affect groundwater.			
Liquid effluent will be conveyed off the site to facilities which presently do not exist or have inadequate capacity.			
Proposed Action requiring a facility that would use water in excess of 20,000 gallons per day.	x		Based on recent experience at another tunnel of similar size, the slurry that will be

			used to tunnel may require in excess of 20,000 gallons of water per day – however that tunnel is in rock, which is believed to require more water than the sand/silt/clay found in this tunnel alignment. Typically, after tunneling is initiated, the slurry is reused to the extent possible.
Proposed Action will likely cause siltation or other discharge into an existing body of water to the extent that there will be an obvious visual contrast to natural conditions.			
Proposed Action will require the storage of petroleum products greater than 1,100 gallons.	x		Storage of diesel fuel for the generators to power the groundfreezing will be required; project design documents will require that fuel storage facilities be designed and constructed in accordance with Suffolk County Sanitary Code Article 12 requirements and all NYS PBS requirements.
Proposed Action will allow residential uses in areas without water and/or sewer services.			
Proposed Action locates commercial and/or industrial uses which may require new or expansion of existing waste treatment and/or storage facilities.			
Please list other impacts:			

6. Will proposed action alter drainage flow, patterns or surface water runoff? ___ yes __x__ no.

Proposed Action would impede flood water flows.			
Proposed Action is likely to cause substantial erosion.			
Proposed Action is incompatible with existing drain patterns.			
Proposed Action will allow development in a designated floodway.			
Please list other impacts:			

IMPACT ON AIR

7. Will proposed action affect air quality? ___ yes _x_ no.

IMPACT ON AIR (**Examples** that would apply to column 2)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Proposed Action will induce 1,000 or more vehicle trips in given hour.			
Proposed Action will result in the incineration of more than 1 ton of refuse per hour.			

IMPACT ON AIR (cont.)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Proposed Action emission rate of all contaminants will exceed 5 lbs. per hour or a heat source producing more than 10 million BTU's per hour.			
Proposed Action will allow an increase in the amount of land committed to industrial use.			
Proposed Action will allow an increase in the density of industrial development in existing industrial areas.			
Please List Other Impacts:			

IMPACT ON PLANTS AND ANIMALS

8. Will Proposed Action affect any threatened or endangered species? ___ yes _x_ no. **All work would be underground using trenchless technology and construction impacts would be temporary. Last recorded NYSDEC siting of T&E was in 1898**.

IMPACT ON PLANTS AND ANIMALS (**Examples** that would apply to Column 2)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Reduction of one or more species listed on the New York or Federal list, using the site, over or near site or found on the site.			
Removal of any portion of a critical or significant wildlife habitat.			
Application of pesticide or herbicide over more than twice a year other than for agricultural purposes.			
Please list other impacts:			

9. Will Proposed Action substantially affect non-threatened or endangered species? ___ Yes _x_ No **All work would be underground using trenchless technology and construction impacts would be temporary.**

Proposed Action would substantially interfere with any resident or migratory fish or wildlife species.			
Proposed Action requires the removal of more than 10 acres of mature			

forest (over 100 years of age) or other locally important vegetation.			

IMPACT ON AGRICULTURAL LAND RESOURCES

10. Will the Proposed Action affect agricultural land resources? ___ Yes _x_ No

IMPACT ON AGRICULTURAL LAND RESOURCES (**Examples** that would apply to Column 2)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
The Proposed Action would sever, cross through, or limit access to a field of agricultural land (includes cropland, hayfields, pasture, vineyard, orchard, etc.			

IMPACT ON AGRICULTURAL LAND RESOURCES (cont.)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Construction activity would excavate or compact the soil profile of agricultural land.			
The Proposed Action would irreversibly convert more than 10 acres of agricultural land or, if located in an Agricultural District, more than one acre of agricultural land.			
The Proposed Action would disrupt agricultural land management systems (e.g., subsurface drain lines, outlet ditches, strip cropping); prevent agricultural land management measures from being installed; or create a need for such measures (e.g., cause a farm field to drain poorly due to increased runoff)			
Prime or unique farmland as defined by USDA-SCS 7 CFR Part 657 and governed by the Farmland Protection Policy Act of 1981 is involved.			
Please list other impacts:			

IMPACT ON AESTHETIC RESOURCES OR COMMUNITY CHARACTER

11. Will proposed action affect aesthetic resources, or the character of the neighborhood or community? ___ Yes _x_ No

The exit/receiving shaft on the barrier island would be visible from Great South Bay during construction. The site would be restored to original condition upon completion of installation of underground tunnel.

IMPACT ON AESTHETIC RESOURCES OR COMMUNITY CHARACTER (**Examples** that would apply to column 2) *(If Necessary Use the Visual EAF Addendum in Section 617.23)*	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Introduction of proposed land uses, projects or project components obviously different or in sharp contrast to current surrounding land use patterns or existing man-made additions to the landscape.			
Introduction of proposed land uses, projects or project components as described in the above example that will be visible to users of aesthetic resources. This will eliminate or significantly reduce the public enjoyment or appreciation of the appearance or aesthetic qualities of a			

resource or community character.			
Introduction of project components that will result in the elimination or significant screening of scenic views known to be important to the area.			
Please list other impacts:			

During construction, construction equipment will be visible from Ocean Parkway (primarily heading eastbound) and from Great South Bay/the State Boat Channel. The site will be restored when construction is complete.

IMPACT ON HISTORIC AND ARCHEOLOGICAL RESOURCES

12. Will Proposed Action impact any site or structure of historic, prehistoric or paleontogical importance? ___ Yes _x_ No

IMPACT ON HISTORIC AND ARCHEOLOGICAL RESOURCES (**Examples** that would apply to column 2)	**1** **Small to Moderate Impact**	**2** **Potential Large Impact**	**3** **Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Proposed Action occurring wholly or partially within or contiguous to any facility or site listed or eligible for listing on the State or National Register of historic places.			
Any impact to an archeological site or fossil bed located within the project site.			
Proposed Action will occur in an area designated as sensitive for archeological sites on the NSY Site Inventory.			
Please list other impacts:			

IMPACT ON OPEN SPACE AND RECREATION

13. Will Proposed Action affect the quantity or quality of existing or future open spaces or recreational opportunities?
__ Yes _x_ No **Great South Bay is between the access and exit/receiving shafts; all construction would occur below the Bay bottom using trenchless technology. The exit/receiving shaft on the barrier island would be visible from Great South Bay during construction. The site would be restored to original condition upon completion of installation of underground tunnel.**

IMPACT ON OPEN SPACE AND RECREATION (**Examples** that would apply to column 2)	**1** **Small to Moderate Impact**	**2** **Potential Large Impact**	**3** **Can Impact Be Mitigated By Project Change (Enter Yes or No)**
The permanent foreclosure of a future recreational opportunity.			
A major reduction of an open space important to the community.			
Please list other impacts:			

IMPACT ON CRITICAL ENVIRONMENTAL AREAS

14. Will Proposed Action impact the exceptional or unique characteristics of a critical environmental area (CEA) established pursuant to subdivision 6 NYCRR 617.14(g)?___Yes__x_No
List the environmental characteristics that caused the designation of the CEA.

IMPACT ON CRITICAL ENVIRONMENTAL AREAS (**Examples** that would apply to column 2)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Proposed Action to locate within the CEA?			
Proposed Action will result in a reduction in the quantity of the resource?			
Proposed Action will result in a reduction in the quality of the resource?			
Proposed Action will impact the use, function or enjoyment of the resource?			
Please list other impacts.			

IMPACT ON TRANSPORTATION

15. Will there be an effect to existing transportation systems? ___ Yes _x_ No

IMPACT ON TRANSPORTATION (**Examples** that would apply to column 2)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Alteration of present patterns of movement of people and/or goods.			
Proposed Action will result in severe traffic problems			
Please list other impacts:			

IMPACT ON ENERGY

16. Will proposed action affect the communities sources of fuel or energy supply? ___ Yes _x_ No

IMPACT ON ENERGY (**Examples** that would apply to column 2)	**1 Small to Moderate Impact**	**2 Potential Large Impact**	**3 Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Proposed Action will cause a greater than 5% increase in any form of energy in municipality.			
Proposed Action will require the creation or extension of an energy transmission or supply system to serve more than 50 single or two family residences.			
Please list other impacts:			

IMPACT ON NOISE
17. Will there be objectionable odors, noise, glare, vibration or electrical disturbance as a result of the Proposed Action?
___ Yes __X__ No

IMPACT ON NOISE (**Examples** that would apply to column 2)	**1** **Small to Moderate Impact**	**2** **Potential Large Impact**	**3** **Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Blasting within 1,500 feet of a hospital, school or other sensitive facility.			
Odors will occur routinely (more than one hour per day).			
Proposed Action will produce operating noise exceeding the local ambient noise levels for noise outside of structures.			
Proposed Action will remove natural barriers that would act as a noise screen.			
Please list other impacts:	Construction equipment will be used, primarily at the WWTP site; they will also be used for a shorter period at the exit/receiving shaft site on the Barrier Island.		

IMPACT ON PUBLIC HEALTH AND (HAZARDS) SAFETY
18. Will Proposed Action affect public health and safety? ___ Yes __x__ No

IMPACT ON PUBLIC HEALTH AND (HAZARDS) SAFETY (**Examples** that would apply to column 2)	**1** **Small to Moderate Impact**	**2** **Potential Large Impact**	**3** **Can Impact Be Mitigated By Project Change (Enter Yes or No)**
Proposed Action will cause a risk of explosion or release of hazardous substances (i.e. oil, pesticides, chemicals, radiation, etc.) in the event of accident or upset conditions, or there will be a chronic low level discharge or emission.			
Proposed Action will result in the burial of "hazardous wastes" (i.e. toxic, poisonous, highly reactive, radioactive, irritating, infectious, etc., including wastes that are solid, semi-solid, liquid or contain gases).			
Storage facilities for one million or more gallons of liquified natural gas or other liquids.			
Please list other impacts:			

IMPACT ON GROWTH AND CHARACTER OF COMMUNITY OR NEIGHBORHOOD

19. Will Proposed Action affect the character of the existing Community? ___ Yes __x__ No

IMPACT ON GROWTH AND CHARACTER OF COMMUNITY OR NEIGHBORHOOD (**Examples** that would apply to column 2)	**1** **Small to Moderate Impact**	**2** **Potential Large Impact**	**3** **Can Impact Be Mitigated By Project Change (Enter Yes or No)**
The population of the city, town or village in which the project is likely to grow by more than 5% of resident human population.			
The municipal budgets for capital expenditures or operating services will increase by more than 5% per year as a result of this project.			
Will involve any permanent facility of a non-agricultural use on more than one acre in an agricultural district or remove more than 10 acres of (prime) agricultural lands from cultivation.			
Proposed Action will replace or eliminate existing facilities, structures or areas of historic importance to the community.			
Development will in induce an influx of a particular age group with special needs.			
Proposed Action will set an important precedent for future projects.			
Proposed Action will relocate 15 or more employees in one or more businesses.			
Please List other impacts:			

PUBLIC INPUT

20. Is there public controversy related to Potential Adverse Environmental Impacts? ___ Yes __x__ No

Either government or citizens of adjacent communities have expressed opposition or rejected the project or have not been contacted.			Project has been discussed with NYSDEC, and both the SSER and the Town of Babylon were contacted. The general consensus was the the project should proceed as quickly as possible to reduce the risk that the existing deteriorated section of the outfall will fail.
Objections to the project from within the community.			

If Any Action in Part 2 Is Identified as a Potential Large Impact or If You Cannot Determine the Magnitude of Impact, Proceed to Part 3

Determination of Significance

Portions of EAF completed for this project: **x** Part 1 x Part 2 ___ Part 3

Upon review of the information recorded on this EAF (Parts 1, 2 and 3) and considering both the magnitude and importance of each impact, it is reasonably determined that:

A. The project will result in no major impacts and, therefore, is one which may not cause significant damage to the environment. **Prepare a negative declaration:**

B. **For unlisted actions only.** Although the project could have a significant effect on the environment, there will not be a significant effect in this case because the mitigation measures described in Part # have been included as part of the proposed project. **Prepare a CONDITIONAL negative declaration:**

C. The project will result in one or more major adverse impacts that cannot be reduced and may cause significant damage to the environment. **Prepare a positive declaration , proceed with EIS:**

Signature of Preparer (if different from responsible officer) Date

Signature of Responsible Officer in Lead Agency Print or Type Name of Responsible Officer in Lead Agency

Name of Lead Agency Date

Part 3 - Responsibility of Lead Agency

Evaluation of the Importance of Impacts

Information

Part 3 is prepared if one or more impact or effect is considered to be potentially large.

The amount of writing necessary to answer Part 3 may be determined by answering the question: In **briefly** completing the instructions below, have I placed in this record sufficient information to indicate the reasonableness of my decisions?

Instructions

Complete the following for each impact or effect identified in Column 2 of Part 2:

1. Briefly describe the impact.
2. Describe (if applicable) how the impact might be mitigated or reduced to a less than large impact by project change.
3. Based on the information available, decide if it is reasonable to conclude that this impact is **important** to the municipality (city, town or village) in which the project is located.

To answer the question of importance, consider:

- The probability of the impact or effect occurring
- The duration of the impact or effect
- Its irreversibility, including permanently lost resources of value
- Whether the impact or effect can be controlled
- The regional consequence of the impact or effect
- Its potential divergence from local needs and goals
- Whether known objectives to the project apply to this impact or effect

Determination of Significance

An action is considered to be significant if:

One (or more) impact(s) is determined to **be** (both) **large** and its (their) consequence, based on the review above, is **important.**

Part 3 Statements

(Continue on Attachments, as needed)

Intro. Res. No. 1199-2011
Introduced by the Presiding Officer

Laid on Table 3/8/2011

RESOLUTION NO. 156 -2011, MAKING A SEQRA DETERMINATION IN CONNECTION WITH THE PROPOSED SEWER DISTRICT NO. 3 – SOUTHWEST – FINAL EFFLUENT PUMP STATION (CP 8108), TOWN OF BABYLON

WHEREAS, the Suffolk County Council on Environmental Quality (CEQ) has reviewed a project designated as the "Proposed Sewer District No. 3 – Southwest – Final Effluent Pump Station (CP 8108), Town of Babylon", pursuant to Section 6 of Local Law No. 22-1985 which project involves the replacement of pumping systems, electrical controls, and mechanical systems within the Bergen Point Wastewater Treatment Facility Final Effluent Pump Station; and

WHEREAS, at its February 16, 2011 meeting, the CEQ reviewed the information submitted by the Suffolk County Department of Public Works in connection with this project; and

WHEREAS, the CEQ recommended that the above activity be considered a Type II action, pursuant to the provisions of Title 6 NYCRR, Part 617.5(c)(1)(2) and (25) and Chapter 279 of the Suffolk County Code; and

WHEREAS, the CEQ has advised the County Legislature and the County Executive by memo dated February 22, 2011 of said recommendations; and

WHEREAS, Section 279-5(H) of the SUFFOLK COUNTY CODE requires the Presiding Officer to introduce legislation for an appropriate SEQRA determination; and

WHEREAS, the Suffolk County Legislature has reviewed the EAF and the CEQ recommendations; now, therefore be it

1st **RESOLVED**, that this Legislature hereby determines that the Proposed Sewer District No. 3 – Southwest – Final Effluent Pump Station (CP 8108), Town of Babylon constitutes a Type II action, pursuant to the provisions of Title 6 NYCRR, Part 617.5(c)(1)(2) and (25) and Chapter 279 of the Suffolk County Code, since it involves the purchase of equipment for the maintenance, repair, replacement, rehabilitation and/or reconstruction of a structure or facility in kind, on the same site; and be it further

2nd **RESOLVED**, that a copy of this Resolution shall be filed with the Suffolk County Clerk, the initiating unit of said project, and with the CEQ; and be it further

3rd **RESOLVED**, that in accordance with Section C1-4(1)(d) of the SUFFOLK COUNTY CHARTER and Section 279-5(C)(4) of the SUFFOLK COUNTY CODE, the CEQ is hereby directed to prepare and circulate a SEQRA notice of determination of non-significance in accordance with this Resolution.

DATED: MAR 2 2 2011

APPROVED BY:

____
County Executive of Suffolk County

Date: APR 0 4 2011

SUFFOLK COUNTY
County Legislature
RIVERHEAD, NY

This is to Certify That I, TIM LAUBE, Clerk of the County Legislature of the County of Suffolk, have compared the foregoing copy of resolution with the original resolution now on file in this office, and which was duly adopted by the County Legislature of said County on March 22,2011 and that the same is a true and correct transcript of said resolution and of the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of the County Legislature of the County of Suffolk.

Tim Laube

Clerk of the Legislature

Intro. Res. 1194 **Res. No.** 156 **March 22, 2011**

Motion:
Romaine, Schneiderman, Browning, Muratore,
Eddington, Montano, Cilmi, Lindsay, Viloria-Fisher, Barraga,
Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, ~~Cooper~~

Co-Sponsors:
Romaine, Schneiderman, Browning, Muratore,
Eddington, Montano, Cilmi, Lindsay, Viloria-Fisher, Barraga,
Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Cooper

Second:
Romaine, Schneiderman, Browning, Muratore,
Eddington, Montano, Cilmi, Lindsay, Viloria-Fisher, Barraga,
Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Cooper

LD	Legislator	Yes	No	Abs	NP	R
1	Edward P. ROMAINE				/	
2	Jay H. SCHNEIDERMAN	|				
3	Kate M. BROWNING	|				
4	Thomas MURATORE	|				
[redacted]						
7	Jack EDDINGTON	|				
9	Ricardo MONTANO	|				
10	Thomas CILMI	|				
11	Thomas F. BARRAGA	|				
12	John M. KENNEDY, JR.	|				
13	Lynne C. NOWICK	|				
14	Wayne R. HORSLEY	|				
15	DuWayne GREGORY	|				
16	Steven H. STERN	|				
17	Lou D'AMARO	|				
18	Jon COOPER				/	
5	Vivian VILORIA-FISHER, D.P.O.	|				
8	William J. LINDSAY, P.O.	↓				
	Totals	15	—		2	—

MOTION

X Approve
____Table:________________
____Send To Committee
____Table Subject To Call
____Lay On The Table
____Discharge
____Take Out of Order
____Reconsider
____Waive Rule ____
____Override Veto
____Close
____Recess

APPROVED X FAILED____
No Motion___ No Second___

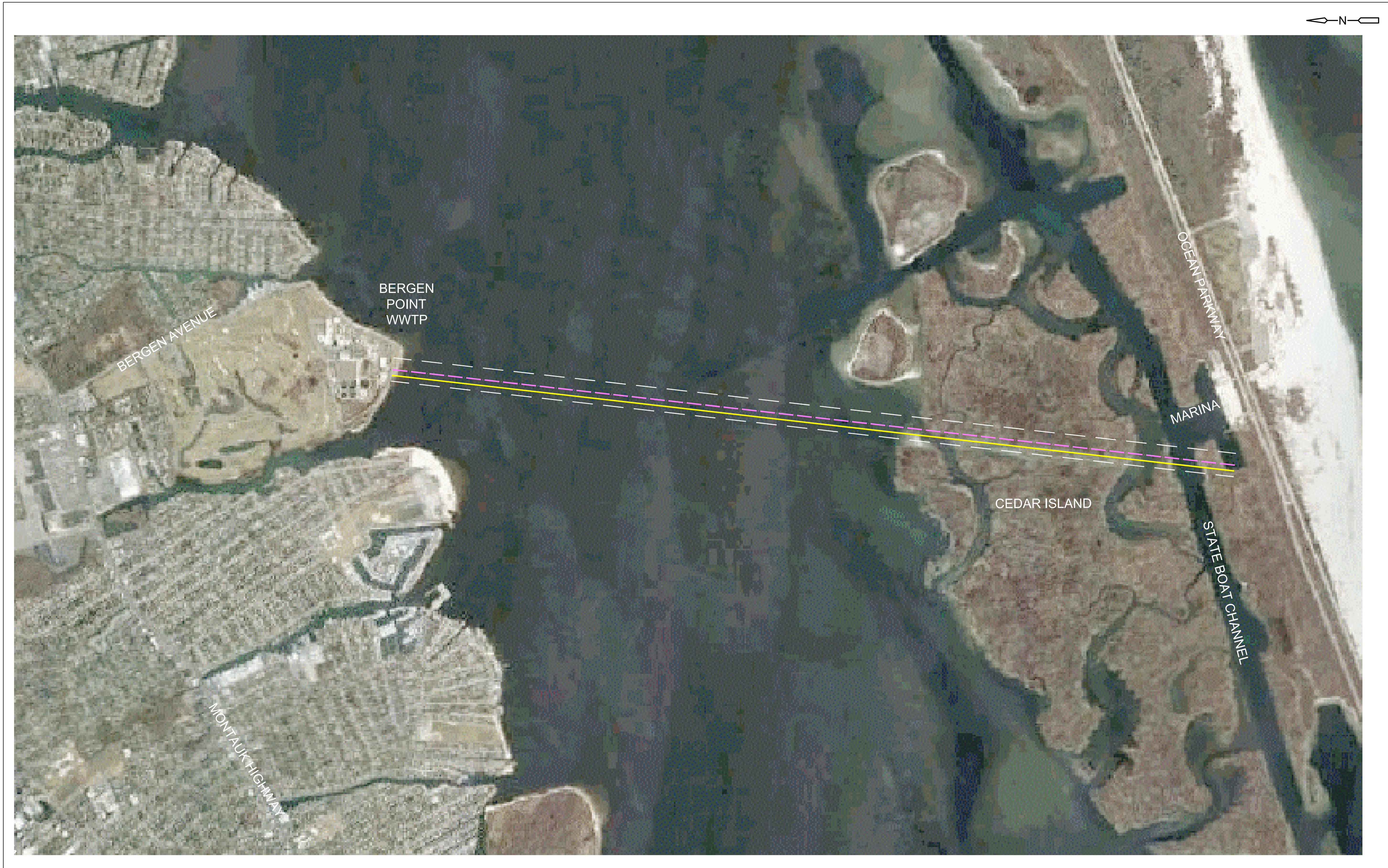
RESOLUTION DECLARED

X ADOPTED
____NOT ADOPTED

Roll Call____Voice Vote X

Tim Laube

Tim Laube, Clerk of the Legislature

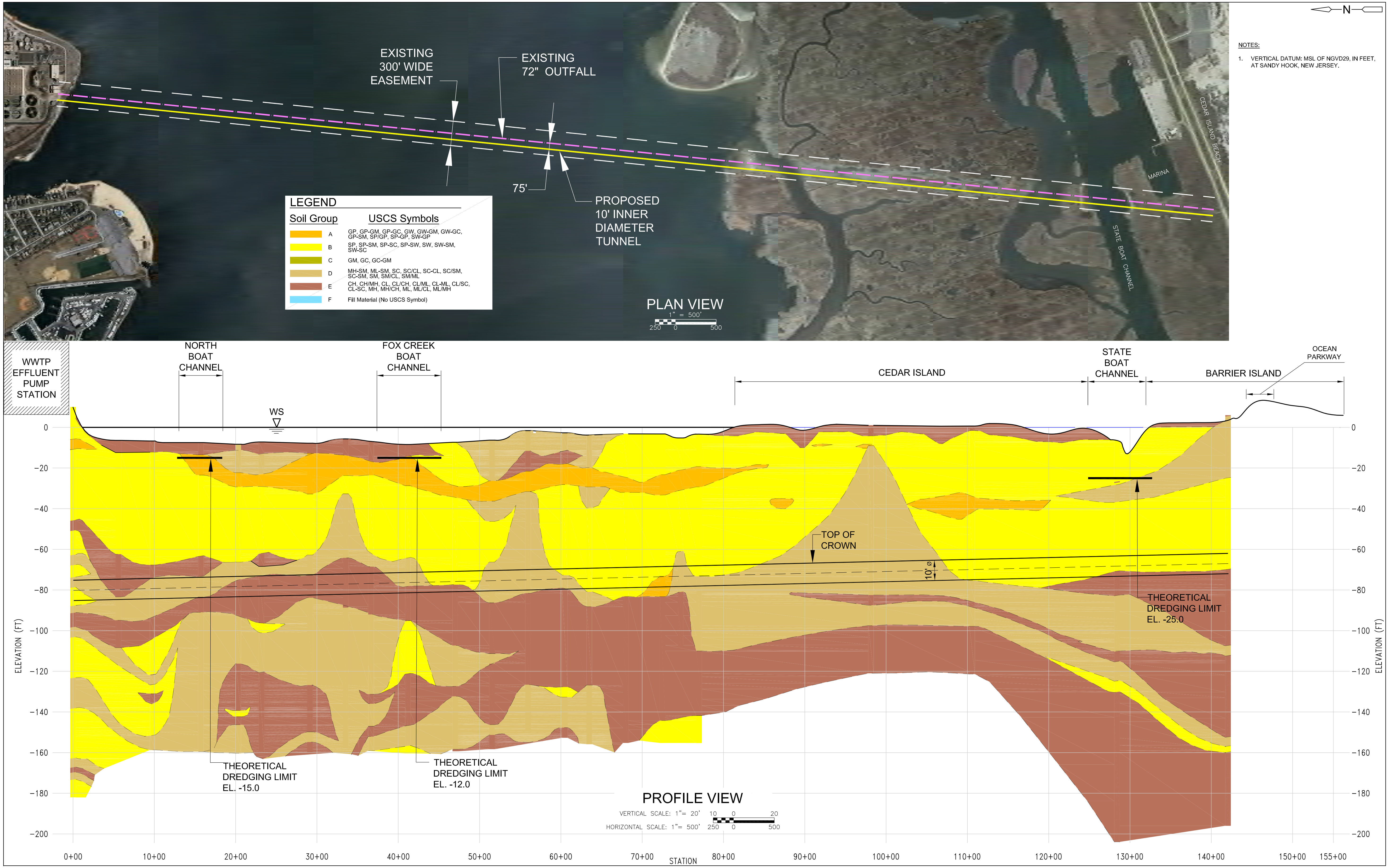


CDM
consulting • engineering • construction • operations

Figure 1
Location Map
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project

Figure 2
Approximate Locations of Working Shafts and Staging Areas
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project

CDM
consulting • engineering • construction • operations



\\Wbysvr01\Cad3\5175\39512\EAF\ FIG 3 06/12/12 10:33 gencorellirj

Figure 3
Horizontal and Vertical Alignment of 10' Tunnel
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project

CDM
consulting • engineering • construction • operations

Soil Map—Suffolk County, New York
(Bergen Point WWTP)
Outfall Replacement - Access Shaft

Map Scale: 1:4,450 if printed on A size (8.5" x 11") sheet.

N

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1,200

USDA Natural Resources Conservation Service

Web Soil Survey
National Cooperative Soil Survey

Figure 4a

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Special Point Features

Blowout
Borrow Pit
Clay Spot
Closed Depression
Gravel Pit
Gravelly Spot
Landfill
Lava Flow
Marsh or swamp
Mine or Quarry
Miscellaneous Water
Perennial Water
Rock Outcrop
Saline Spot
Sandy Spot
Severely Eroded Spot
Sinkhole
Slide or Slip
Sodic Spot
Spoil Area
Stony Spot
Very Stony Spot
Wet Spot
Other

Special Line Features

Gully
Short Steep Slope
Other

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

MAP INFORMATION

Map Scale: 1:4,450 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Suffolk County, New York
Survey Area Data: Version 10, Dec 20, 2011

Date(s) aerial images were photographed: 7/31/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Suffolk County, New York (NY103)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Fd	Fill land, dredged material	35.7	81.8%
Fs	Fill land, sandy	0.8	1.8%
Tm	Tidal marsh	7.1	16.3%
W	Water	0.0	0.0%
Totals for Area of Interest		**43.6**	**100.0%**

Soil Map—Suffolk County, New York
(Cedar Island)
Bergen Point WWTP
Outfall Replacement
Receiving Shaft

Figure 4b

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:2,260 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 18N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Suffolk County, New York
Survey Area Data: Version 10, Dec 20, 2011

Date(s) aerial images were photographed: 7/31/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Suffolk County, New York (NY103)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Du	Dune land	1.3	5.7%
Tm	Tidal marsh	21.9	94.3%
Totals for Area of Interest		**23.2**	**100.0%**

\\Wbysvr01\cad3\5175\39512\EAF\ FIG 5 06/18/12 11:08 gencorellirj

CDM
consulting • engineering • construction • operations

Figure 5
Topography of Exit Shaft Staging Area
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project

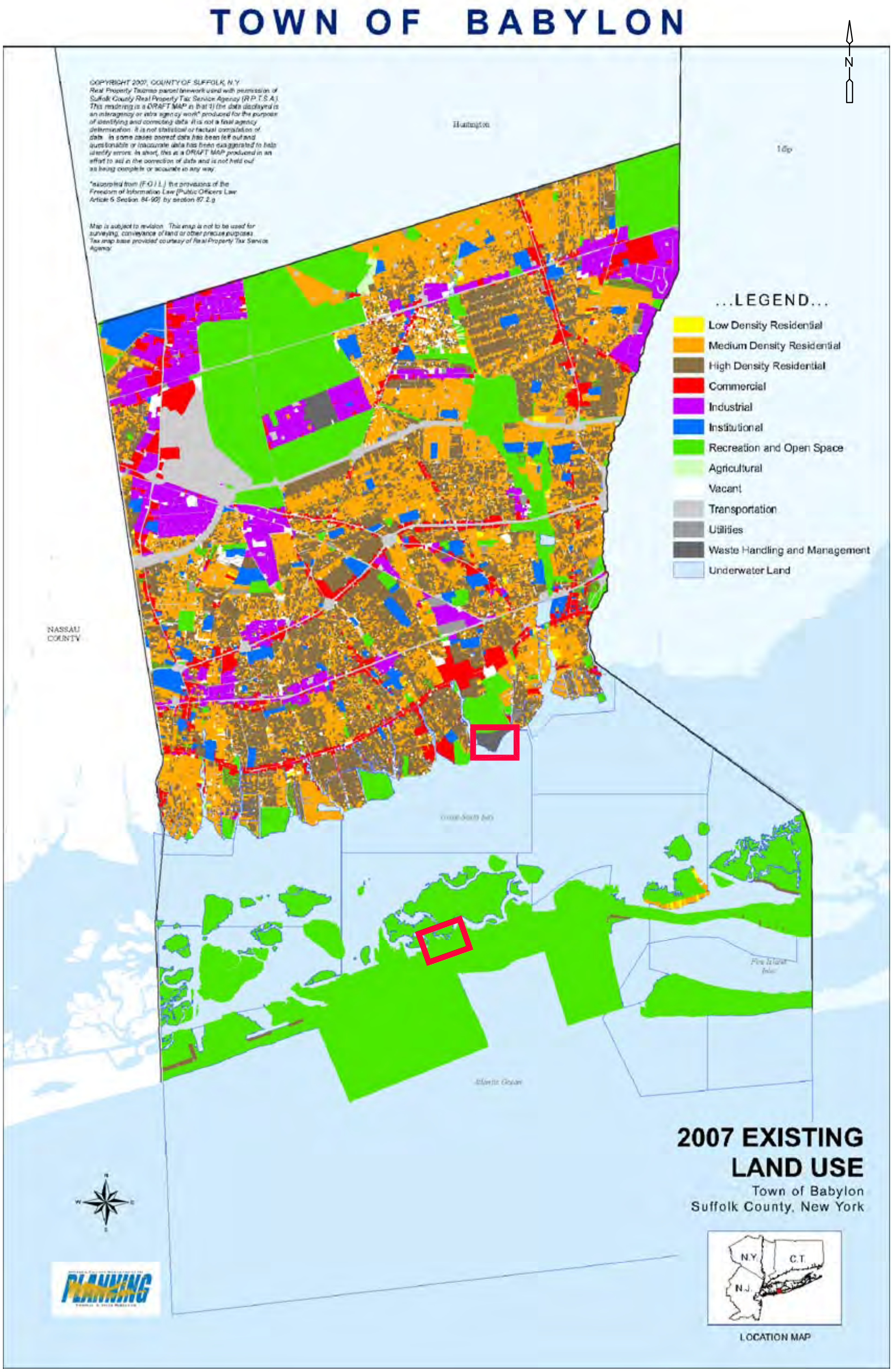


Figure 6
Land Use
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project

CDM
consulting • engineering • construction • operations

\\Wbysvr01\Cad3\5175\39512\EAF\ FIG 6 07/02/12 11:51 gencorellirj

Attachment A

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. Nationwide Permit 7 covers the construction/repair of an outfall while NWP 12 covers the installation of utility lines. Pre-construction notification is required to obtain coverage under these existing permits.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)

Attachment A

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
STATE				
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters. NYSDEC has issued/agreed to standard conditions associated with many of the NWP issued by ACOE.	Roger Evans, Regional Permit Administrator 631-444-0361
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
Air Registration	NYS Department of Environmental Conservation	Environmental Conservation Law Article 19 New York Code of Rules and Regulations Title 6, Part 200-203	Contractor maybe required to obtain permit for onsite generators required for ground freezing event on barrier island.	Roger Evans, Regional Permit Administrator 631-444-0361
Approval	NYS Parks – LI State	N.A.	Regulates access of parkland, including use	Scott Fish 631-669-1000

Attachment A

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
	Park Region		of commercial vehicles.	Michelle Somma Land Management and Regulatory Affairs Coordinator 631-321-3580
Divisible Load Permit Highway Work Permit for Utility Work	NYSDOT – Region 10	NYCRR Title 17, Part 126 – NYS Vehicle & Traffic Law Section 385 NY Highway Law Article 52	NYSDOT regulates the use of NYS roadways. Permit required by vehicles that exceed the road weight. Permit required to work within a NYS ROW &/or install MPTs	Gene Smith, Regional HWP Contact 631-952-6028
LOCAL				
Consultation	SCDPW		Approval of Plans and Specifications	John Donovan, Chief Engineer 631-852-4204
Review and comment	SCDHS			Office of Ecology 631-852-5811
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

CDM

Suffolk County
Department of Public Works

Sewer District 3 – Southwest
Bergen Point Wastewater Treatment Plant
Outfall Replacement Project

Engineering Design Report

May 2011

Contents

Section 1 Introduction

1.1 Background 1-1
1.1.1 Structural Integrity Analysis 1-2
1.1.2 Wire and Mortar Condition Assessment 1-2
1.1.3 Cathodic Protection System Testing 1-3
1.1.4 Recommendations 1-3
1.2 Outfall Replacement Alternatives 1-4
1.3 Report Organization 1-4

Section 2 Design Considerations

2.1 Number and Size of Pipes 2-1
2.1.1 Flow Velocities 2-2
2.1.2 Head Loss 2-3
2.1.3 Power Requirement 2-4
2.1.4 Recommendation 2-4
2.2 Pipe Material Alternatives 2-4
2.2.1 Welded Steel Pipe 2-6
2.2.1.1 Size Availability 2-6
2.2.1.2 Pressure Classes 2-7
2.2.1.3 Joining Method 2-7
2.2.1.4 Restraint Requirements 2-8
2.2.1.5 Corrosion Protection 2-9
2.2.1.6 Constructability 2-11
2.2.2 Ductile Iron Pipe 2-15
2.2.2.1 Size Availability 2-15
2.2.2.2 Pressure Classes 2-16
2.2.2.3 Joining Method 2-16
2.2.2.4 Restraint Requirements 2-16
2.2.2.5 Corrosion Protection 2-17
2.2.2.6 Constructability 2-18
2.2.3 High Density Polyethylene Pipe 2-19
2.2.3.1 Size Availability 2-19
2.2.3.2 Pressure Classes 2-20
2.2.3.3 Joining Method 2-20
2.2.3.4 Restraint Requirements 2-21
2.2.3.5 Corrosion Protection 2-21
2.2.3.6 Constructability 2-21
2.2.4 Fiberglass Reinforced Pipe 2-22
2.2.4.1 Size Availability 2-23
2.2.4.2 Pressure Classes 2-23
2.2.4.3 Joining Method 2-23

2.2.4.4 Restraint Requirements 2-24
2.2.4.5 Corrosion Protection 2-24
2.2.4.6 Constructability 2-24
2.2.5 Concrete Pressure Pipe 2-25
2.2.5.1 Size Availability 2-26
2.2.5.2 Pressure Classes 2-27
2.2.5.3 Joining Method 2-27
2.2.5.4 Restraint Requirements 2-27
2.2.5.5 Corrosion Protection 2-28
2.2.5.6 Constructability 2-28
2.3 Advantages and Disadvantages of Alternative Pipe Materials 2-29
2.4 Summary and Recommendations 2-32
2.4.1 Tunnel Installation – Alternative 1 2-32
2.4.2 Subaqueous Installation – Alternatives 3 and 4 2-32
2.4.3 Buried Installation – Alternative 6 2-32
2.5 Effluent Pump Station 2-32
2.5.1 Description of Existing Pump Station System 2-32
2.5.2 Rehabilitated Pump Station 2-32
2.5.3 Proposed Construction Sequencing 2-33

Section 3 – Alternatives Analysis

3.1 Alternative 1 – Construct Replacement Outfall by Tunneling with Carrier Pipes 3-1
3.1.1 Description of Alternative 3-5
3.1.1.1 Tunnel Construction 3-5
3.1.1.2 Shaft Construction 3-8
3.1.1.3 Pipe Material and Installation 3-12
3.1.1.4 Connection to the Existing Outfall 3-13
3.1.1.5 Disposal of Excavated Materials 3-13
3.1.2 Impacts 3-15
3.1.2.1 Short Term Construction Related Impacts 3-15
3.1.2.2 Long Term Impacts 3-15
3.1.3 Permit Requirements 3-16
3.1.4 Schedule 3-16
3.1.5 Costs 3-21
3.1.6 Summary of Advantages and Disadvantages 3-22
3.2 Alternative 2 – Construct Replacement Outfall by Tunneling, No Carrier Pipes 3-23
3.2.1 Description of Alternative 3-24
3.2.1.1 Tunnel and Shaft Construction 3-24
3.2.1.2 Connection to Existing Outfall 3-24
3.2.1.3 Disposal of Excavated Materials 3-24

3.2.2 Impacts....3-24
3.2.2.1 Short Term Construction Related Impacts....3-26
3.2.2.2 Long Term Impacts....3-26
3.2.3 Permit Requirements....3-26
3.2.4 Schedule....3-26
3.2.5 Costs....3-31
3.2.6 Summary of Advantages and Disadvantages....3-32
3.3 Alternative 3 – Construct Replacement Outfall by Open Cut Method....3-33
3.3.1 Description of Alternative....3-35
3.3.1.1 Size and Number of Pipes....3-35
3.3.1.2 Replacement Outfall Alignment....3-35
3.3.1.3 Subaqueous Crossings by Open Cut....3-35
3.3.1.4 Open Cut Excavation – Shored Excavation Material....3-42
3.3.1.5 Land Side Crossings....3-47
3.3.1.6 Constraints....3-47
3.3.2 Impacts....3-50
3.3.2.1 Short Term Construction Related Impacts....3-50
3.3.2.2 Long Term Impacts....3-51
3.3.3 Permits....3-51
3.3.4 Schedule....3-51
3.3.5 Costs....3-55
3.3.6 Summary of Advantages and Disadvantages....3-57
3.4 Alternative 4 – Construct New Outfall Discharging to Great South Bay....3-57
3.4.1 Description of Alternative....3-57
3.4.1.1 Baseline Environmental Studies....3-59
3.4.1.2 Upgrade of Bergen Point WWTP....3-60
3.4.1.3 Conveyance of Treated Effluent to Discharge....3-61
3.4.2 Impacts....3-62
3.4.2.1 Short Term Construction Related Impacts....3-62
3.4.2.2 Long Term Impacts....3-62
3.4.3 Permits....3-63
3.4.4 Schedule....3-63
3.4.5 Costs....3-63
3.4.6 Summary of Advantages and Disadvantages....3-68
3.5 Alternative 5 – Lining Existing Pipe with Temporary Outfall to the Bay....3-68
3.5.1 Description of Alternative....3-68
3.5.1.1 Slip-Lining Methods and Materials....3-69
3.5.1.2 Temporary Discharge/Disposal of Treated Effluent....3-71
3.5.2 Impacts....3-75
3.5.2.1 Short Term Construction Related Impacts....3-75
3.5.2.2 Long Term Impacts....3-75
3.5.3 Permits....3-75
3.5.4 Schedule....3-75

3.5.5 Costs 3-80
3.5.6 Summary of Advantages and Disadvantages 3-80
3.6 Alternative 6 – Replace the Outfall with Upland Recharge 3-81
3.6.1 Description of Alternatives 3-81
3.6.1.1 Bergen Point WWTP Upgrade 3-82
3.6.1.2 Upgraded Pump Station(s) 3-90
3.6.1.3 Piping/Distribution System 3-90
3.6.1.4 Network of Recharge Basins/Injection Wells 3-90
3.6.1.5 Instrumentation and SCADA System 3-101
3.6.1.6 Long Term Maintenance and Monitoring Requirements 3-101
3.6.2 Environmental Impacts and Constraints 3-102
3.6.2.1 Short Term Construction Related Impacts 3-102
3.6.2.2 Long Term Impacts 3-102
3.6.3 Permits 3-103
3.6.4 Schedule 3-103
3.6.5 Costs 3-103
3.6.6 Summary of Advantages and Disadvantages 3-108
3.7 Results and Conclusions 3-108

Section 4 – Subsurface/Sub-marine Conditions in Project Area

4.1 Geological Setting 4-1
4.2 Regional Geology 4-1
4.2.1 Bedrock 4-1
4.2.2 Lloyd Aquifer 4-1
4.2.3 Raritan Clay 4-3
4.2.4 Magothy Aquifer 4-3
4.2.5 Monmouth Greensand 4-3
4.2.6 Gardiners Clay/"20-Foot Clay" 4-3
4.2.7 Upper Glacial Aquifer 4-3
4.3 Subsurface Investigation Program 4-3
4.3.1 Geotechnical Investigation 4-3
4.3.2 Geotechnical Laboratory Testing Program 4-5
4.3.3 Geotechnical Frozen Soil Laboratory Testing Program 4-5
4.4 Geotechnical Conditions 4-5
4.4.1 Subsurface Soil Conditions – Tunneling Options 4-6
4.4.1.1 Engineering Properties 4-8
4.4.2 Subsurface Soil Conditions – Open Cut and Dredging Options 4-9
4.4.2.1 Engineering Properties 4-10

Section 5 – Conceptual Design of Preferred Alternative

5.1 Description of Preferred Alternative 5-1
5.1.1 Rehabilitation of Effluent Pump Station 5-1

5.1.1.1 Constraints 5-4
5.1.1.2 Phased Approach 5-5
5.1.1.3 Operating Conditions 5-6
5.1.1.4 Pump Station Layout 5-7
5.1.1.5 Yard Piping Layout 5-9
5.1.16 Sequence of Construction...5-9
5.1.2 Outfall Tunnel...5-10
5.1.2.1 Tunnel and Shaft Construction 5-10
5.1.2.2 Connection to Existing Outfall 5-13
5.1.2.3 Disposal of Excavated Materials 5-15
5.2 Permit Requirements..5-15
5.3 Project Schedule...5-15
5.4 Project Costs 5-15

Appendices

Appendix A – Hydraulic Analysis of Outfall Alternatives
Appendix B – Shaft Construction Alternatives
Appendix C – Alternative 6 Back-up

Appendix D - Geotechnical Data Report (Volume 2 of 2)

Figures

2-1	Shored Excavation Pipeline Installation	2-14
2-2	New Outfall Connection	2-34
2-3	Revised Effluent Pump Station Piping	2-35
3-1a	Horizontal and Vertical Alignment of 10′ Tunnel, Draining North	3-2
3-1b	Horizontal and Vertical Alignment of Proposed 12′ Tunnel, Draining South	3-3
3-1c	Horizontal and Vertical Alignment of 12′ Tunnel, Draining North	3-4
3-2	Face of Earth Pressure Balance TBM	3-5
3-3	Screw Auger Depositing Tunnel Muck at Back of Heading onto Conveyor Belt	3-6
3-4	EBP-TBM Instrumentation Monitoring of Machine Loads and Location	3-6
3-5	Major Components of Earth Pressure Balance Machine	3-7
3-6	Stacked Precast Concrete Segments	3-7
3-7	Assembled Ring in the Tunnel with Lighting, Yellow Ventilation, Utility Pipes and Railroad Tracks in the Tunnel during Construction	3-7
3-8	Stuffing the Tunnel with Carrier Pipes	3-8
3-9	Single 72-inch Outfall, Tunnel Detail	3-9
3-10	Dual 54-inch Outfall, Tunnel Detail	3-10
3-11	Approximate Locations of Working Shafts and Staging Areas	3-11
3-12	New Outfall Connection at Barrier Island	3-14
3-13	Preliminary Schedule for Alternative 1, Construct Replacement Outfall by Tunneling	3-20
3-14	Alternative 2 – Horizontal and Vertical Alignment of 10′ Tunnel	3-25
3-15	Preliminary Schedule for Alternative 2, Construct Replacement Outfall By Tunneling	3-30
3-16	Alternative 3, Replacement Outfall by Open Cut	3-34
3-17	Dredged Tunnel Dimensions Dual 54-inch Pipes	3-36
3-18	Conventional Hydraulic Dredge	3-39
3-19	Conventional Hydraulic Dredge	3-39
3-20	Typical Shored Excavation Plan and Cross-Section	3-43
3-21	Proposed Shored Excavation Sequence	3-45
3-22	Landside Trench Dimensions	3-48
3-23	Preliminary Schedule for Alternative 5, Construct Replacement Outfall by Open Cut	3-55
3-24	Alternative 4 – Replacement Outfall Discharging to Great South Bay	3-58
3-25	Preliminary Schedule for Alternative 4 Construct New Outfall Discharging to Great South Bay	3-67
3-26	Alternative 5 – Lining Existing Outfall Pipe and Temporary Outfall	3-73
3-27	Temporary Discharge to Great South Bay	3-74
3-28	Preliminary Schedule for Alternative 5 – Lining Existing Outfall	

With Temporary Discharge to Great South Bay....3-79
3-29 Alternative 5 Bergen Point WWTP Outfall Replacement Project....3-91
3-30 Areas Where Depth to the Water Table is >30 feet Below Ground Surface....3-93
3-31 Finite Element Grid for Suffolk County Regional Groundwater Model....3-94
3-32 Revised Finite Element Grid for Recharge Simulations....3-95
3-33 Simulated Water Table Mounding from Recharging 1 MGD into a Recharge Basin....3-98
3-34 Simulated Water Table Mounding from Recharging 1 MDG into an Injection Well....3-99
3-35 Simulated Water Table Mounding from Recharging 90 MGD....3-100
3-36 Preliminary Schedule for Alternative 6 – Replace Outfall with Upland Recharge....3-107

4-1 North-South Cross Section through Suffolk County....4-2
4-2 Boring Location Plan....4-4

5-1 Final Effluent Pump Station Rehabilitation....5-3
5-2 Revised Effluent Pump Station Piping....5-8
5-3 Recommended Alternative – Horizontal and Vertical Alignment of 10′ Tunnel....5-11
5-4 Stacked Precast Concrete Segments (left) and The Assembled Ring During Construction with Lighting, Yellow Ventilation, Utility Pipes and Railroad Tracks in the Tunnel (right)....5-13
5-5 New Outfall Connection at Barrier Island....5-14
5-6 Preliminary Schedule for Recommended Alternatives, Construct Replacement Outfall by Tunneling....5-19

Tables

2-1 Bergen Point WWTP Outfall Hydraulic Analysis of Pipe Sizes 2-3
2-2 Bergen Point WWTP Outfall Alternatives – Conceptual Pumping Arrangements...2-3
2-3 Summary of Alternative Pipe Materials...2-30

3-1 Potential Permits and Approvals for Alternative 1, Construct Replacement Outfall by Tunneling..3-17
3-2 Preliminary Capital Cost Estimate for Alternative 1 – Tunnel with Carrier Pipes...3-22
3-3 Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling..3-27
3-4 Preliminary Cost Estimate for Alternative 2 - Tunnel......................................3-32
3-5 Potential Permits and Approvals for Alternative 3 – Construction of Replacement Outfall by Open Cut..3-52
3-6 Alternative 3 - Preliminary Open Cut Cost Estimate 3-56
3-7 Potential Permits and Approvals for Alternative 4 – New Outfall Discharging to Great South Bay 3-64
3-8 Alternative 4 - Preliminary Cost Estimate for New Outfall to Bay 3-68
3-9 Potential Permits and Approvals for Alternative 5 – Lining Existing Outfall with Temporary Discharge to the Bay 3-76
3-10 Alternative 5 – Preliminary Cost Estimate for Slip Lining 3-80
3-11 Drinking Water Standards for Water Quality Parameters (USEPA, NYSDOH, NYSDEC, 2006)..3-83
3-12 Potential Parcels for Recharge Analysis 3-97
3-13 Potential Permits and Approvals for Upland Recharge of Treatment Effluent...3-104
3-14 Conceptual Cost Estimate for Alternative 6 – Upland Recharge...................3-103
3-15 Comparison of Bergen Point WWTP Outfall Replacement Alternatives 3-109

4-1 Summary of Observation Well Water Level Data 4-7

5-1 Effluent Pump Station Flows 5-2
5-2 Effluent Pump Station - Design Criteria by Phase...5-7
5-3 Potential Permits and Approvals for the Recommended Alternative, Construct Replacement Outfall by Tunneling...5-16
5-4 Preliminary Cost Estimate for the Recommended Tunnel Alternative 5-15

Section 1 Introduction

The Suffolk County Department of Public Works (SCDPW) owns and operates Sewer District No. 3, Southwest - Bergen Point Wastewater Treatment Plant (WWTP) located in Babylon, NY. The WWTP operates under a New York State Pollution Discharge Elimination System (SPDES) permit and has a current permitted treatment capacity of 30.5 million gallons per day (MGD). Effluent flow from the WWTP is discharged through a 72 inch outfall to the Atlantic Ocean. Acoustical monitoring has indicated that a portion of the existing outfall is in a failing condition and the SCDPW has engaged CDM to perform an evaluation of alternatives to replace that portion of the outfall.

1.1 Background

Treated effluent from the Bergen Point WWTP is discharged through a 32,000 foot long outfall that was constructed in 1977 and consists of 72- inch diameter pre-stressed concrete cylinder pipe (PCCP) and concrete coated steel pipe. The PCCP section of the outfall, which starts at the WWTP effluent pump station and extends beneath the floor of the Great South Bay to the barrier island, (14,200 feet of Price Brothers Pipe) and then out beyond the surf zone into the ocean (1,100 feet of Interpace Pipe), is a total of 15,300 feet long. The concrete coated steel pipe portion of the outfall extends out into the Atlantic Ocean for 17,200 feet, including the 3,500-foot long diffuser section of pipe varying in diameter from 72 to 36 inches.

Since its construction, the outfall pipe and its cathodic protection system have encountered a number of problems. In the late 1980's, storms damaged all the anodes, wiring and test stations on the ocean cathodic protection system. In addition, the cover over the ocean portion of the outfall near the beach was eroded from its original 20 foot thickness down to two feet. In 1992, SCDPW protected a 700-foot section of the ocean portion of the outfall by driving steel sheeting around it and placing a concrete cover over it. The impressed current system was also replaced and energized at that time to protect portions of the outfall pipe as originally designed, as well as to protect the outside of the steel sheeting. At the same time, sacrificial anodes were placed between the sheet piles to protect both their inside surface and the concrete coated steel pipe in that reach. After construction was complete, the impressed current system was tested and found to be operating as intended; subsequent testing confirmed that it continued to function satisfactorily.

More recently, the SCDPW became aware of PCCP pipe failures occurring throughout the world. These pipe failures were related to the breaking of the prestressed wires in the pipe. It has been documented that PCCP manufactured from 1972 to 1980 with Class IV wire has a higher rate of failure than other PCCP installed around the country. The failures are attributed to the use of the very high tensile strength, low ductility Class IV wire, poor quality control during fabrication, pipe coating damage, and/or effects of corrosive environments. The Bergen Point WWTP outfall has both

Class III and Class IV wire. If the outfall pipe were to fail, treated effluent would be discharged directly into the Great South Bay.

In 2003, the SCDPW implemented a three month monitoring program to assess the condition of the PCCP portion of the WWTP outfall using an inline hydrophone system that recorded and located wire breaks in the PCCP as they occurred. The system documented the amount of deterioration that occurred while the hydrophones were installed, but was not designed to ascertain the amount of failure that had occurred prior to the initiation of monitoring.

As part of the monitoring program, two arrays of hydrophones were installed. The first was installed from the WWTP out into Great South Bay for approximately 5,000 feet (Price Brothers Pipe) and the second was installed on the barrier island for approximately 1,100 feet (Interpace Pipe). During the 3-month monitoring period, the first array recorded 646 wire breaks within the monitoring zone and 71 downstream breaks. The second array recorded 4 wire breaks within the array zone, 46 upstream breaks and 5 downstream breaks. This was a significant number of breaks in a short period of time and does not include any breakage in the approximately 9,200 feet of unmonitored PCCP. The breaks identified in the first monitoring zone (Price Brothers Pipe) were fairly evenly distributed along the pipe lengths, i.e., the breaks were not concentrated at any one location. The second array recorded very few breaks within the monitoring zone (Interpace Pipe) but more upstream within the Price Brothers Pipe or Bay section of the outfall. Pure Technologies, which implemented the monitoring program, reported that this was the worst pipeline for breaks that they had ever monitored.

The SCDPW subsequently implemented a phased program to further evaluate the condition of the outfall as summarized in the following subsections.

1.1.1 Structural Integrity Analysis

An analysis of the structural integrity of the PCCP pipe beneath Great South Bay was conducted to determine whether the pipe could withstand the typical internal operating pressure of approximately 25 pounds per square inch (psi) during pumping operations (during normal gravity flow operation, the internal pressure of the pipe is approximately 4 to 5 psi) and whether the pipe would collapse under dewatered conditions.

The analysis, conducted by Openaka Corporation, concluded that if all the wires were broken, the pipe could operate at the operating pressure of 25 psi, but that the concrete core of the external coating of the pipe could crack if the steel cylinder was corroded. The evaluation further concluded that the pipe could potentially collapse with an external water pressure of 11 feet (which exists along the length of the outfall in the Bay) if all of the wires were broken and the core cracked. Available technologies require dewatering of the outfall to determine if the steel cylinder has been corroded; because dewatering the outfall could lead to premature failure or collapse, SCDPW has not pursued this further. Therefore, it is not known at this time if there is any corrosion of the steel cylinder.

1.1.2 Wire and Mortar Condition Assessment

To determine the condition of the exterior mortar on the PCCP pipe, an analysis of the mortar was conducted. This included excavating the PCCP pipe on the barrier island, taking samples of the mortar from the piping and analyzing the samples in a laboratory for chloride levels. The high acid-soluble chloride levels measured in samples of the mortar collected at the barrier island indicated that the corrosion protection provided by the high alkalinity of the Portland cement mortar had been compromised. Metallurgical testing determined that the prestressed wire had moderate sensitivity to hydrogen embrittlement failure. However, visual and sounding inspections of the pipe did not find any indications of corrosion, and petrographic examination of the mortar coatings indicated they were of good quality.

The evaluation concluded that the pipe on the barrier island was in relatively good condition, but recommended that the impressed current cathodic protection system be checked to ensure that it was working properly and providing the correct level of protection. Elevated impressed current levels from the cathodic protection system could accelerate hydrogen embrittlement of the wire leading to breaks and potential pipe failure.

1.1.3 Cathodic Protection System Testing

To determine the condition and effectiveness of the existing cathodic protection system, Openaka Corporation and CORRPRO Companies Inc. performed a field evaluation and testing program. The results of this program indicated that the Impressed Current Cathodic Protection system is operational but that components need to be replaced and that it should be shut down due to discontinuities to prevent potential joint corrosion, cause cylinder corrosion or self interference corrosion if metallic portions of the cathode are not electronically continuous. In addition, based upon the CORRPRO Companies Inc. field testing and analysis of the field data in 2006, the existing anodes in the Bay are nearing the end of their design life. It was estimated that the anticipated design life of the Bay anodes was from 31 to in excess of 50 years. At the time of the testing the majority of the Bay portion of the pipeline was being effectively protected, however, there were two areas, between 19+00 and 22+00 and between 30+00 and 32+00, where marginal protection is being provided. As the pipe is approximately 35 years old at this time, areas of the pipeline may not have any corrosion protection. The areas where discontinuities were identified, which indicated that the cathodic protection system was not functioning successfully; coincided to some degree, to areas where wire breaks had been reported.

1.1.4 Recommendations

Due to the results of the evaluations described above, additional independent experts were also retained by CDM to review the results of the pipe testing. All agreed that the breaks in the prestressed wire have led or will lead to cracking of the exterior concrete, which will allow water to reach the steel cylinder and cause it to corrode, eventually leading to the potential failure of the PCCP pipe. It is unknown exactly where the pipeline is in this process, but all concurred that based on the number of wire breaks, the pipeline is in a deteriorated state, is subject to failure at some unknown time in the future and that the design of a replacement outfall should be initiated for the 14,200 foot PCPP Bay portion of the outfall.

The maximum pressure rating of the pipe cylinder with no reinforcing wire has been calculated by Openaka Corporation to be 52 psi. However, the allowable maximum pressure rating is reduced as wires break and the concrete cracks. It was not possible to calculate the exact pressure rating of the pipe, due to the unknown condition of the concrete. However, all agreed that it was in the best interest of SCDPW to invest in the design of a replacement outfall, rather than spending resources on additional investigation of the existing condition of the outfall. In the meantime, it was recommended that the operating pressure of the pipeline be minimized by the SCDPW to the extent possible. Under pumping conditions, the outfall pipe typically operates in the 23 to 27 psi range, but pressures can exceed 30 psi when pumping flows in the range of 90 MGD.

It should be noted that the SCDPW presently conducts semi-annual dye testing of the outfall under low pressure conditions (non-pumping) which continue to indicate that the pipe is not leaking, since no dye has been detected within Great South Bay or along the beaches.

1.2 Outfall Replacement Alternatives

Five alternatives to replace the existing Bergen Point WWTP outfall have been identified for further evaluation:

Alternative 1 – Replace Outfall with Carrier Pipes Installed within a Tunnel

Alternative 2 – Replace Outfall with Tunnel

Alternative 3 – Construct Replacement Outfall by Open Cut

Alternative 4 – Construct New Outfall Discharging to Great South Bay

Alternative 5 – Line Existing Outfall Pipe (with Temporary Outfall Discharge to Great South Bay)

Alternative 6 – Replace Existing Outfall with Upland Recharge

The potential outfall replacement alternatives were discussed with New York State Department of Environmental Conservation (NYSDEC) in 2008 and in 2009, to identify the regulatory requirements associated with each that would need to be considered. NYSDEC described that their approach to project implementation is:

- To avoid environmental impacts,
- To minimize environmental impacts, and finally
- To mitigate any unavoidable impacts.

NYSDEC identified implementation of the tunnel as the most successful alternative with respect to avoiding impacts to the Bay. NYSDEC also identified some of the issues that would need to be addressed if the County chose to pursue the open cut option, including shellfish impacts, finfish impacts, commercial & recreational fishing impacts, endangered species impacts and submerged aquatic vegetation (SAV) impacts. In addition, the maximum window during which work would be allowed would be from September 30th through January 15 th --- the potential for winter closures to accommodate waterfowl would also exist and have to be evaluated. Furthermore, NYSDEC policy It was acknowledged that this would result in closure of those shellfishing areas that are currently opened during the winter months. Impacts on schedule would include the multiple mobilizations and demobilizations required because the work could not be implemented during the warm weather months. In addition to the modeling that would be required to support the impact analysis, a minimum of three years baseline monitoring would be required. The preliminary discussions indicated that NYSDEC would also require sheeting of the entire tunnel length to reduce impacts of turbidity on the Bay environment. Similar environmental concerns would be associated with the temporary outfall to the Bay while the outfall was being lined and NYSDEC indicated that they would not permit replacement of the outfall with a shorter outfall to the Bay. A number of issues associated with implementation of upland recharge were also identified, including upgrade of the Bergen Point WWTP.

1.3 Report Organization

Section 2 of this report summarizes the evaluation of the new outfall pipe size, pipe material and corrosion protection requirements. Section 3 of this document describes the six alternatives considered to replace the existing outfall, including environmental impacts resulting from both short-term construction-related conditions and long term outfall operation, permitting requirements, preliminary costs and schedules. Section 4 summarizes the results of the geotechnical investigations completed during the winter/spring of 2009. Section 5 presents the conceptual design of the recommended alternative, along with a preliminary project schedule, estimated project costs, and a listing of potential permits.

Section 2
Design Considerations

Six alternatives were identified to replace the deteriorated 14,200 linear feet of PCCP Bay portion of the Bergen Point WWTP outfall. The alternatives listed below have been selected for detailed evaluation:

- **Alternative 1** – Replace Outfall with Carrier Pipes Installed within a Tunnel
- **Alternative 2** – Replace Outfall with Tunnel
- **Alternative 3** – Construct Replacement Outfall by Open Cut
- **Alternative 4** – Construct New Outfall Discharging to Great South Bay
- **Alternative 5** – Line Existing Outfall Pipe (with Temporary Outfall Discharge to Great South Bay)
- **Alternative 6** – Replace Existing Outfall with Upland Recharge

Prior to developing each of the alternatives, the number and size of replacement effluent pipes, pipe material options and cathodic protection requirements were assessed. These evaluations are presented in the following pages.

The outfall pump station will also be upgraded due to the age of the equipment and to respond to changes in hydraulics resulting from the process modifications being implemented as part of the on-going WWTP upgrade and expansion and the outfall replacement. This section also summarizes the sequencing approach that was developed to transition from the existing outfall/pump station to the new outfall without discharging to Great South Bay (Bay).

More detailed descriptions of each alternative, including method of construction, construction-related and operational impacts, permit requirements, preliminary implementation schedules and estimated capital costs are provided in Section 3.

2.1 Number and Size of Pipes

The existing 72- inch outfall was originally sized to convey a projected peak flow of 180 million gallons per day (MGD) when the Bergen Point WWTP was built out to its maximum capacity.

As part of this analysis, various pipe sizes and numbers of pipes were evaluated to address redundancy, head loss and pipe velocities. An average of 25.6 MGD of treated wastewater is currently discharged through the existing 72-inch diameter PCCP outfall from the Bergen Point WWTP. Diurnal flows may be as low as 18 MGD in the early morning hours, and maximum flows of up to approximately 110 MGD are conveyed during peak wet weather events. Although SCDPW is currently in the design phase of an expansion of the WWTP from an average daily flow of 30.5 MGD to 40.5 MGD, with an expected maximum pumping capacity of 110 MGD, the hydraulic analysis considered flows up to 180 MGD since that is the future build out capacity of the WWTP. Velocity, head loss and power requirements were evaluated for several different potential pipe sizes at a variety of flow rates for alternatives 1, 2 and 3. Alternatives 1, 2 and 3 were selected for analysis because they represent similar head conditions to the existing system, while the other three alternatives will have significantly different head conditions. Should one of the other alternatives be selected, the same hydraulic analysis would have to be completed for the specific pipe layout selected. However, the pipe size analysis results will be applied to the other three alternatives, since the analysis takes into account velocities and flow capacities within the various pipe sizes. The evaluation assumed that the new replacement outfall pipes would have a C value of 140 for new pipe. The evaluation is included as Appendix A to this document, and is summarized here. A more detailed evaluation, including a surge analysis, will be completed during detailed design after the pipe material and size have been selected.

The following pipe sizes were evaluated:

- Single 72-inch pipeline
- Dual 54-inch pipeline (single or dual pipe operation)
- Dual 48-inch pipeline (single or dual pipe operation)

A summary of the results of the evaluation is presented in **Table 2-1**. As the upgraded plant will have a future pumping capacity of 110 MGD, a summary of preliminary pumping sizing required for flows up to 110 MGD is presented in **Table 2-2**. The table includes conceptual level estimates of pump horsepower requirements for three selected flows based on the results presented in **Table 2-1**, and identifies the number of operating pumps that would be required to meet each flow condition with the associated horsepower.

2.1.1 Flow Velocities

The desired operating range of velocities for a force main carrying wastewater is generally considered to be 2 to 10 feet per second (fps). A minimum velocity of 2 fps is typically desired for flushing of any sediment that may settle out of the effluent during low flows. A maximum of 10 fps is typically recommended to avoid potential deterioration of the pipe lining. Velocities at flow rates ranging from 30 MGD to 180 MGD are presented on Table 2-1 for each pipe alternative. The analysis indicates that the single 72-inch pipeline and dual 54-inch pipeline with both pipes operating are viable alternatives. The dual 48-inch pipeline velocities with both pipes operating are higher than for the other pipe sizes and future flows of up to 180 would exceed 10 fps within the pipes. Both the dual 54-inch and dual 48-inch pipeline alternatives are flow- limited under single pipe operation. However, the dual 54-inch pipeline operating with a single pipe provides a higher flow capacity than the dual 48-inch pipeline operating with a single pipe.

Table 2-1
Bergen Point WWTP Outfall - Hydraulic Analysis of Pipe Sizes

	Single 72-inch Pipeline			Dual 54-inch Pipeline (Dual Pipe Operation)			Dual 54-inch Pipeline (Single Pipe Operation)			Dual 48-inch Pipeline (Dual Pipe Operation)			Dual 48-inch Pipeline (Single Pipe Operation)		
Q (mgd)	Total Headloss (ft)	Max Operating Pressure [2] (psi)	Velocity 72" line (fps)	Total Headloss (ft)	Max Operating Pressure [2] (psi)	Velocity 54" line (fps)	Total Headloss (ft)	Max Operating Pressure [2] (psi)	Velocity 54" line (fps)	Total Headloss (ft)	Max Operating Pressure [2] (psi)	Velocity 48" line (fps)	Total Headloss (ft)	Max Operating Pressure [2] (psi)	Velocity 48" line (fps)
30	2.3	31	1.6	2.6	31	1.5	7.4	33	2.9	3.9	32	1.8	12.4	35	3.7
40	5.7	33	2.2	6.2	33	1.9	14.5	36	3.9	8.6	34	2.5	23.0	40	4.9
60	15.1	37	3.3	16.2	37	2.9	33.8	44	5.8	21.3	39	3.7	52.0	51	7.4
80	27.8	42	4.4	29.7	43	3.9	59.8	55	7.8	38.2	46	4.9	90.9	67	9.8
90	35.2	45	4.9	37.6	46	4.4	75.2	61	8.8	48.3	50	5.5	113.9	76	11.1
110	52.5	53	6.0	56.0	55	5.3	110.6	76	10.7	71.5	61	6.8	166.9	98	13.5
120	62.2	57	6.6	66.3	58	5.8	130.6	83	11.7	84.6	65	7.4	196.8	110	14.8
140	83.8	66	7.7	89.4	67	6.8	175.1	101	13.6	113.7	77	8.6	263.4	136	17.2
160	108.4	76	8.8	115.6	78	7.8	225.6	121	15.6	146.7	91	9.8	338.9	166	19.7
180	135.7	87	9.8	144.8	90	8.8	281.9	144	17.5	183.6	106	11.1	423.0	200	22.2

1. Analysis conducted for highest static head condition based on min water Elevation +8.0 at plant effluent and Mean High High Tide Elevation of +5.4.
2. Pressure at point of lowest elevation in proposed lines, at approximate pipe centerline elevation -67.0.

Table 2-2
Bergen Point WWTP Outfall Alternatives - Conceptual Pumping Arrangements

	Single 72-inch Pipeline					Dual 54-inch Pipeline (Dual Pipe Operation)					Dual 48-inch Pipeline (Dual Pipe Operation)				
Q (mgd)	Q/ Operating Pump (mgd)	Hp/ Operating Pump (Hp)	Total Water Hp Required [1] (Hp)	Total Pump Hp Required [2] (Hp)	No. Operating Pumps	Q/ Operating Pump (mgd)	Hp/ Operating Pump (Hp)	Total Water Hp Required [1] (Hp)	Total Pump Hp Required [2] (Hp)	No. Operating Pumps	Q/ Operating Pump (mgd)	Hp/ Operating Pump (Hp)	Total Water Hp Required [1] (Hp)	Total Pump Hp Required [2] (Hp)	No. Operating Pumps
30.5	30	500	12	19	1	30	500	13	21	1	30	500	21	32	1
40.5	40	500	40	63	1	40	500	44	68	1	40	500	60	94	1
110.0	28	500	1013	1583	4	28	500	1081	1689	4	22	500	1380	2157	5
30.5	30	600	12	19	1	30	600	13	21	1	30	600	21	32	1
40.5	40	600	40	63	1	40	600	44	68	1	40	600	60	94	1
110.0	37	600	1013	1583	3	37	600	1081	1689	3	28	600	1380	2157	4
30.5	30	700	12	19	1	30	700	13	21	1	30	700	21	32	1
40.5	40	700	40	63	1	40	700	44	68	1	40	700	60	94	1
110.0	37	700	1013	1583	3	37	700	1081	1689	3	28	700	1380	2157	4

1. Based on hydraulic analysis summarized in Table 2-1.
2. Based on 1.25 safety factor applied to water horsepower.

2.1.2 Head Loss

For the range of flow conditions considered, the total head loss is the lowest for the single 72-inch pipeline alternative. The system head loss for the single 72-inch pipeline was used as the baseline for comparison to the head losses for the dual 54-inch pipeline and dual 48-inch pipeline alternatives for flows of 30.5 mgd, 40.5 mgd and 110 mgd, which represent the current average daily design flow, future average daily design flow and future peak design flow conditions respectively.

As shown on **Table 2-1**, slightly higher head losses were obtained for the dual (two pipes operating) 54-inch alternative as compared to the single 72-inch alternative. Head losses for the dual (two pipes operating) 48-inch pipe alternative were nearly double those for the single 72-inch pipe. The practical implication of the increased head loss is a proportionate increase in the operating power required for effluent pumping. It should be noted that this analysis does not include effluent pump station losses. The effluent pumps and discharge piping will also be replaced as part of the project. The effluent pump station losses will be similar for all alternatives and are thus not included at this time.

2.1.3 Power Requirement

The power required for effluent pumping is directly proportional to the total head loss experienced in the piping system. The percent increases in power requirement will therefore be proportional to the increases in head loss for each alternative. The upgraded effluent pump station is assumed to have four pumps with three operational and one standby.

As indicated in **Table 2-2**, the single 72-inch pipeline is the most efficient of the three alternatives with respect to power requirement and is defined as the base condition of the three alternatives. The power requirements were calculated in terms of water horsepower.

2.1.4 Recommendation

For redundancy purposes, it has been assumed that the dual 54-inch pipeline alternative will be implemented for each of the alternatives. The dual 54-inch pipeline can discharge the widest range of flows at acceptable velocities, and has lower head losses/pumping requirements than the dual 48-inch option.

2.2 Pipe Material Alternatives

The alternatives evaluated in this report require installation of new pipelines for conveyance of the Bergen Point WWTP effluent. Six different pipe materials were evaluated for the new carrier pipe(s), including:

- Welded Steel Pipe
- Ductile Iron Pipe (DIP)
- High Density Polyethylene Pipe (HDPE)
- Fiberglass Reinforced Pipe (FRP)
- Concrete Pressure Pipe (CPP, including pre-stressed concrete cylinder pipe, PCCP, and bar wrapped concrete cylinder pipe, BWCCP)
- Polyvinyl Chloride Pressure Pipe (PVC)

The ability to use PVC as the material for the replacement outfall carrier pipes was briefly investigated. Several searches regarding PVC pipe including an internet search for references to large diameter PVC pipe in pressure service were conducted. No references could be found for PVC pipe for pressure service in the range of 54 inches or greater. Manufacturers and suppliers of PVC pressure pipe, Harvel Inc., JM Eagle, ISCO and IPEX, were also contacted by phone. IPEX responded that they make a PVC pipe up to 48 inch diameter while the other companies manufacture or sell PVC pipe only up to 24 inches in diameter. An internal company-wide search for experience with large diameter PVC pipe for pressure service identified a single 36- inch pressure pipe installation, as well as concerns and inherent risks that would be associated with special manufacture of large diameter PVC pipe.

The following is a summary of the findings culled from the various searches described above:

- The largest standardized size of PVC pipe for pressure service is 48 inches in diameter (found in AWWA C905) as manufactured by IPEX. They will not make larger PVC pipe.

- Manufacturers of PVC pipe generally carry up to 24 inches in diameter as standard product. Larger pipe sizes are generally custom items.

Based on these findings, PVC pressure pipe up to 48 inches can be obtained with a pressure rating of 100 psi. This pipe is not large enough, does not have the required pressure rating and was not considered further as a viable option for carrier pipe material in the replacement Bergen Point WWTP outfall.

The selection of a specific pipe material and joining system must be compatible with the means and methods of installation and must meet the functional requirements of the pipeline over its design life. Considerations for selection include the serviceability of each of the potential pipe materials, pipe-specific field assembly, installation and joint assembly requirements, external coatings, internal lining options, local availability, and the cost of construction based on the site conditions. The suitability of each of these materials for different applications is described below.

The pipe line installations fall into the following three categories:

- Tunnel installation (Alternative 1)
- Subaqueous installation (Alternatives 3 and 4)
- Buried installation (Alternative 6)

(No carrier pipes are included as part of Alternative 2. Materials for Alternative 5 are discussed independently in Section 3.)

The following analysis was conducted to identify the most suitable pipe material for each of the above categories. Each of the materials considered was evaluated based on the following characteristics:

- Size availability

- Pressure classes
- Joining method
- Restraint requirements
- Corrosion protection
- Constructability
- Cost

In general, ductile iron, steel and pre-stressed concrete are the most commonly used materials for large diameter water or wastewater pipes. However, HDPE and FRP are also becoming more commonly used in certain applications. Each type of pipe has its own unique requirements for field assembly, trenching, and installation, as well as differing requirements for joint restraint and corrosion protection as described in more detail below.

2.2.1 Welded Steel Pipe

Steel pipe has been used successfully in water system infrastructure projects for over 150 years. Early pipe systems were manufactured from riveted steel sheet. Currently, standard practice is to use shop welded steel plates or fabricated spiral seam pipes. The American Water Works Association (AWWA) under AWWA C200 – Steel Pipe, has established standards for manufacturing, design, and construction of steel pipe water transmission systems. Steel pipe is well suited for trenchless construction including pipe jacking, pipe ramming, microtunneling, slip lining and horizontal directional drilling.

2.2.1.1 Size Availability

Standard Diameters

Steel pipe is available in standard nominal sizes from 6 inches to 144 inches but can be manufactured in practically any diameter size based on project requirements. Steel pipe diameters can be selected to serve the hydraulic or installation requirements of a system and adjusted at points within the system as needed to match standard fitting and valve sizes if different from the nominal system pipe size. Steel pipe is available in the nominal 54-inch and 72-inch diameters that are being considered for the replacement outfall. Fittings for steel pipe are fabricated to fit the nominal pipe size.

Standard Lengths and Fittings

Steel pipe is normally produced in standard 40-foot and 50-foot lengths but can be made to any required shorter length. On request, the steel pipe can readily be provided in 20-foot and 25-foot lengths, by cutting the standard lengths in half at the factory.

Fittings are generally fabricated from cut and mitered pieces of steel pipe, which are welded together to form the desired bend. Bends are not limited to standard angles as with ductile iron, but can be formed to any desired angle. Fittings are typically joined to straight pipe in the field by welding.

Virtually any type of steel fitting including bends, tees, wyes, and reducers can be fabricated to meet the needs of the project. Standard dimensions for fittings are published in AWWA C208 "Dimensions for Fabricated Steel Water Pipe Fittings". Because fittings are not as resistant to internal pressure as straight sections of pipe, they are often strengthened by means of crotch plates, wrappers and collars.

2.2.1.2 Pressure Classes

Steel pipe is available in standard working pressure classes from 150 psi to 300 psi. Although steel pipe is manufactured with standard wall thicknesses corresponding to each pressure class, manufacturers can furnish pipe in virtually any wall thickness based on the project's needs. The wall thickness used in a steel pipe system is based on a number of parameters, which include:

- Internal pressure due to maximum system pressure and surge pressure;
- External pressure due to earth loading, atmospheric or hydrostatic pressure, and vehicle and impact pressure;
- Handling;
- Pipe bedding system, and
- Material yield strength.

2.2.1.3 Joining Method

Steel pipes are reasonably flexible and can be joined by field welding, bell-and-spigot rubber gasket joints, mechanical couplings, split sleeve mechanical couplings, or flanges.

Various types of field welds are used in steel pipes including butt strap joints and lap-welded slip joints. Butt strap joints join two pieces of plain-end pipe together. They are typically used for wall thickness in excess of ¾-inches, for working pressures in excess of 400 psi, and in installations where a thermal expansion/contraction situation may be encountered. As this is not the case for the outfall replacement, butt-strap joints will not be necessary.

Welding of joints provides a completely restrained joint pipe system and is water-tight. Lap welding also allows for small angular deflections in the pipe joints prior to welding. Air testing of joints can be performed either on the interior or exterior of the pipe, although typically it is performed on the exterior of the pipe to avoid risking the integrity of the interior of the pipe. This type of joint would be applicable for either a dredged or tunnel type of crossing. Lap welding can be done either on the interior or exterior of the pipe, or on both, if required.

Gasketed joint systems are available for large-diameter steel pipes up to 84-inches in diameter. Field joint systems include rolled groove rubber gasketed joint, Carnegie-shape rubber gasket joint, and fabricated rubber gasket joint. Gasketed bell and spigot joints are the least expensive method of joining steel pipe systems although additional costs are incurred in providing joint restraint. Gasketed bell and spigot joint systems are easily assembled in the field and also allow for relatively large angular deflection of the joints. Bell and spigot gasketed joints require pipe restraint at valves, bends, tees, reducers and other fittings. Joint restraint can be provided by concrete thrust blocks or, in some cases, by welding the joints at the pipe sections to be restrained. Given the diameter of the proposed pipeline and the project conditions, thrust blocks are not recommended and welding of joints would be required to provide any necessary restraint.

Rolled groove rubber gasket joint pipe is available in sizes up to 72 inches in diameter. The gasket joint consists of a bell and spigot formed directly into the ends of the cylinder. The spigot end includes a formed groove that retains the rubber gasket. When the spigot is inserted into the bell, the rubber gasket compresses against the steel surface to form a watertight seal. Water tightness of the joint relies only on the compressive force of the gasket and not on water pressure within the pipe. Rolled groove joints cannot be provided for steel pipe with wall thickness greater than 0.375-inches because the material is too heavy to form the groove. Steel pipe suitable for construction of a replacement outfall would have wall thickness ranging from 0.225 inches for 54-inch pipe to 0.323 inches for 72-inch pipe, and these rolled groove joints could be considered.

For larger diameter pipe, Carnegie bell and spigot joints can also be provided. A bell-and-spigot Carnegie joint consists of a steel joint ring welded to the cylinder to form a self-centering point sealed by a compressed rubber gasket. Carnegie joints are feasible for underwater assembly; however, they are not restrained and would require the use of thrust blocks or other method. Given this requirement and the fact that Carnegie joints are generally not economical for large-diameter pipe, this type of joint system will not be considered for the outfall.

Mechanical couplings are used for connection of plain-end pipe. These couplings provide joint flexibility and can be mechanically restrained with the use of tie-rods that thread through gussets or lugs attached to the pipe. A dielectric coating, such as a liquid-applied epoxy or a fusion-bonded epoxy, is recommended when the coupling is buried. Split sleeve mechanical couplings are similar to mechanical couplings and consist of three basic components, which include a one- or two-piece housing, gaskets and nuts and bolts.

Flanged joints are used at connections to valves or areas where disassembly of the joint may be required for service or access. Although it may be feasible to provide flanged joints for a dredged or tunnel type of crossing, this would be labor intensive given the proposed pipe diameter and is therefore not recommended. Additionally, testing of the individual joints would not be feasible.

2.2.1.4 Restraint Requirements

Thrust restraint is required at all bends, tees, reducers, and other fittings to balance forces developed by changes in flow direction or velocity, including transient flow phenomena. Steel pipe fittings can be restrained by welding of pipe joints, concrete thrust blocks, or joint harnesses. If the method of pipe joining is welding at all joints, the pipeline will be restrained throughout its length. Welding of joints would be a suitable method of joint restraint for tunnel installation. For buried pipe installation, a non-rigid joint that allows for slight deflections and movement of the pipe with differential settlement would be more suitable. For buried installation, a combination of O-ring gasketed joints and lap-welded joints may be considered for providing thrust restraint.

2.2.1.5 Corrosion Protection

General

For steel pipes, which have a much thinner wall thickness than DIP or concrete pipes, consideration of corrosion protection is important. Steel itself provides a lower degree of corrosion protection than DIP or PCCP. The rate of steel corrosion is directly related to the corrosivity of the surrounding soil. Steel pipe typically corrodes by pitting, which can result in rapid pipe wall penetrations.

An anode, a cathode, an electrolyte and a metallic path are required for corrosion to occur. In installations where steel pipe is immersed in a corrosive soil, some sections of the pipe will be anodic, other sections will be cathodic and the pipe itself will provide the metallic path. The time to corrosion penetration of a steel pipe wall is determined by the corrosivity of the surrounding electrolyte and the pipe wall thickness. The lower the resistivity of the electrolyte, the higher the potential for corrosion will be. Water present in the soil will typically be the electrolyte. Sea water and brackish water have very low resistivity, and consequently present a very high potential for corrosion. Supplemental corrosion protection, therefore, is essential for a welded steel pipeline in subaqueous crossings. Alternatively, increasing the thickness of the pipe wall beyond the required structural thickness to provide supplementary thickness for sacrificial purposes or "corrosion allowance" could be considered.

Corrosion protection for a subaqueous steel pipe system would typically include a high quality dielectric exterior coating (such as polyurethane), cathodic protection to protect the piping from accelerated corrosion and an interior liner. For tunnel installation and subaqueous installation, interior lining and an exterior coating with an impressed current system will likely be required.

For a buried steel pipe system, an exterior coating system and interior liner would likely be sufficient to provide corrosion protection.

Coatings and Linings

An exterior coating system would protect the steel pipe from a corrosive soil environment and may also help protect the pipe from damage, depending on the coating selected. Coatings are typically shop-applied to the extent possible. However, field application of the coating may be required at the joint. If the installation method involves underwater joining of pipe sections, field application of coating to completed joints may not be feasible.

Tape coating systems consist of a primer adhesive applied to a clean blasted steel surface, followed by an inner dielectric tape (typically 20-mil thick) for corrosion protection, and two outer tape layers (typically 30-mil thick each) for mechanical protection. Tape systems are applied as overlapping tape in the factory prior to application of the exterior tapes. The interior dielectric tape layer is holiday tested with a minimum of 6,000 volts. Polyurethane exterior coatings are also available for steel pipe. The application process is similar to the process for polyurethane liners. Following near-white blasting of the pipe exterior, multiple layers of coating are applied under rigidly controlled conditions. Polyurethane coating provides excellent corrosion protection and abrasion resistance. Damage to polyurethane coating sustained in transportation or pipe installation cannot be identified as easily as damaged tape. Damaged polyurethane can be repaired in the field, although it is more difficult to achieve the proper conditions for its application in the field.

As discussed below, several types of interior (lining) corrosion control systems are available for steel pipe. Lining of the pipeline provides for efficient hydraulic capacity and prevents deterioration of the pipeline over time from the effects of flowing water. Protection against deterioration of the pipe from the inside can be achieved by installing cement mortar lining, polyurethane lining, or an epoxy lining. One of the advantages of steel pipe over ductile iron is the ability of steel pipe to receive a bonded coating and lining. This reduces the amount of current required with an impressed current cathodic protection system.

Cathodic Protection

Cathodic protection for the welded steel pipeline could include impressed current anode groundbeds and/or rectifiers. The cathodic protection would protect the entire length of the sub-aqueous crossing. The steel piping would be protected from corrosion at coating holidays and in areas where the external coating experienced a reasonable amount of damage during installation.

Cathodic protection would prevent corrosion caused by soil and stray current at the coating flaws on steel pipe. Properly maintained, the cathodic protection system will prevent external corrosion failures. Supplementary pipe wall for sacrificial purposes or "corrosion allowance" would not be necessary for steel pipe if the pipe wall met structural requirements and cathodic protection was applied. Impressed current anodes can be effective when installed remotely from the pipeline. It should be noted that an impressed current cathodic protection system may be feasible for a steel pipeline, but not for a ductile iron pipeline which has similar corrosion potential. The key difference is that steel pipe would be provided with a dielectric coating, which greatly reduces the magnitude of current required for cathodic protection. The major ductile iron pipe manufacturers no longer provide or recommend these types of coatings, nor will they warranty pipe with coatings provided by others. Therefore, a much higher current would be required for effective cathodic protection of a ductile iron pipeline.

It should be noted that for Alternative 1, cathodic protection may become less of an issue since the pipes would be installed inside of a primary liner consisting of gasketed concrete segments; thus the material in contact with the pipes would be some type of controlled grout or similar material.

2.2.1.6 Constructability

Tunnel Installation (Alternative 1)

To construct the outfall using a tunneling method of installation requires construction of an access or "working shaft" to launch the tunnel boring machine (TBM). The launching shaft would likely be constructed on the Bergen Point WWTP site since this would provide a better access point to tunnel from and be able to bring in equipment, remove the tunnel excavate (muck), and convey the all equipment, materials, steel pipe and personnel down to the tunnel. A receiving shaft would also be required at the termination point of the pipeline to remove the TBM and make necessary connections. This shaft is typically much smaller and requires much less access, etc.

Steel pipe can be provided in 20-foot or 25-foot lengths. These lengths would be compatible with the tunnel's anticipated working shaft diameter of approximately 30 to 35 feet (see Section 3). Alternatively, the working shaft can be constructed with a "notch" to accommodate 40-foot length pipe segments. Once installed in the tunnel, the annular space between the steel pipe(s) and the carrier pipe would be grouted and provide for protection of the pipes. The steel pipe does not necessarily need to be coated or tape wrapped for tunnel installation. Good practice, however, may dictate the use of an exterior coating for added protection of the steel pipe. Details would be developed during design.

Interior lap-welded joints are suitable for the tunnel alternative and will allow pipe sections to be joined without the need for exterior access to the joints. This allows a smaller tunnel diameter and a marginal reduction in construction cost. The steel pipe joints would be welded along the interior seam of the overlapping bell and spigot joint. Based upon past experience it is assumed that a double weld (interior and exterior) is not required for this project. The estimated time required to perform a weld is approximately 6 hours per joint for a 54-inch diameter pipe. The welding procedure will require additional ventilation. Although just one of the many factors determining tunnel diameter (e.g., ventilation, lighting, and drain piping systems, etc.), the thinner wall thickness and ability to weld joints on the inside allows for a smaller diameter tunnel than other pipe materials that require access to the exterior of the pipe to join pipe sections, and consequently a larger tunnel diameter.

Five hundred eighty 25-foot sections of steel pipe would be required for the approximate 14,500 foot tunneled replacement outfall. Assuming 579 welded joints, 3,474 man-hours would be required for welding the joints. Assuming at least two joints are welded at a time, one on each of the dual pipes, and allowing time for inserting the pipes sections into the tunnel, two welds could be completed each 8-hour shift per day. Assuming that work is performed during two 8-hour shifts, each day, it would take a minimum of 290 working days to complete the welding of the joints. Discussions with steel suppliers have indicated that multiple joints of a single pipe can be welded at the same time. However, this is a means and methods of the contractor performing the work and requires that appropriate health and safety measures are in place. For planning purposes, it is assumed that two joints will be welded per shift per day. Time for inspecting and testing the joints will increase the number of working days for pipe installation.

If the alternative 40-foot length pipe sections were utilized, 363 pipe sections would be required; with 362 joints on each of the two carrier pipelines. Assuming the same rate of productivity as described above (e.g., two welds per pipeline per 16 hour working day), the installation schedule would be reduced to approximately 181 days.

Subaqueous Installation (Alternative 3 and 4)

A number of technologies exist for sub-aqueous construction of pipe lines. Before proceeding with an in-depth evaluation of alternatives, a range of technologies was reviewed. An initial screening process was performed to eliminate alternatives that do not warrant detailed evaluation for this project. To be considered for further evaluation, each technology was considered for its ability to meet the following general criteria:

- A proven track record for crossings of comparable length and diameter
- Suitability to the anticipated subsurface geologic conditions

Dredged Trench - For the dredged trench or open cut alternative, it is important to evaluate methods used for the installation of the pipeline, the dredging work, excavated material management and the shoreline transitions. Installation of pipelines in a dredged trench is generally accomplished using one of the following methods:

- Bottom Pull Method – The pipeline would be placed by pulling pipe from land (or a docked barge) along the bottom of a prepared trench. After placement, the pipeline would be backfilled and protected against possible shipping/boating hazards and other design conditions.
- Float and Sink Method – The pipeline would be constructed by prefabricating long sections of the pipeline on land, filling the segment with air or providing other means of buoyancy, floating over the prepared trench and sinking it in place. After placement the segments of the pipeline would be joined and the pipeline would be backfilled.
- S-Lay Barge – The pipeline would be constructed by joining segments of the pipeline on a barge and lowering the pipe to the trench bed at a typical horizontal inclination of 30 degrees by means of a mechanical structure known as a "stinger".
- Segmental Construction - This method of installation consists of joining short sections on a barge or a single piece of pipe and lowering the sections down using a crane. The sections of pipe are positioned in the trench, joined and tested.

These methods and the applicability to this project are further discussed in Section 3. There are basically two types of dredges, mechanical and hydraulic. There are also adaptations for special dredging situations or deposits of dredged material. Dredges available in the New York area are the Bucket Hopper, Mechanical Backhoe, Clamshell, Power Shovel, and the cutter suction pipe. Material that is unsuitable for ocean disposal or reuse is often dredged with an environmental or closed bucket.

Dredged material management will be vital for the proposed dredged crossing since large quantities will need to be excavated. Ideally, dredged material could be re-used, for example for beach nourishment at or near the project site or disposed of either in the ocean or upland. Dredging and disposal are regulated by a number of federal, state and local agencies. In general accordance with permitting agencies, further studies must be performed to develop a dredged material management plan. Chemical characterization of the in-situ sediments is an important factor in developing a concept for a dredging project. Test results have a direct impact on dredging method and means, disposal method and means, and costs.

The shoreline transition on both sides of the Great South Bay involves crossing very shallow and sensitive environmental areas, especially across Cedar Island. According to NYSDEC, work would be restricted to the window from September 30th to January 15th for work within the Bay itself, and from September 30th to April 1st on the island. NYSDEC also identified the need to assess imposition of other work restrictions based upon the potential presence of over-wintering birds. A supported excavation using sheet piling on the Cedar Island side would be likely. In addition, the draft of the barges and equipment size will be limited due to the shallow depth of the Bay as shown on navigation maps.

Shored Excavation – The installation of a pipeline through a waterway with a shored excavation can be accomplished by using cofferdam structures. The cofferdams would be rectangular in shape with horizontal braces across, and built in stages, moving along the proposed pipeline alignment. When construction in the dry is required, an underwater concrete slab has to be installed. Since the construction stages are temporary and of short duration, a retrieval of cofferdam sheets should be possible. Soils inside the cofferdam are excavated and the sections of the pipeline are installed either by the Segmental Construction method or Float and Sink method discussed above. A general layout of the shored excavation method is presented in **Figure 2-1.**

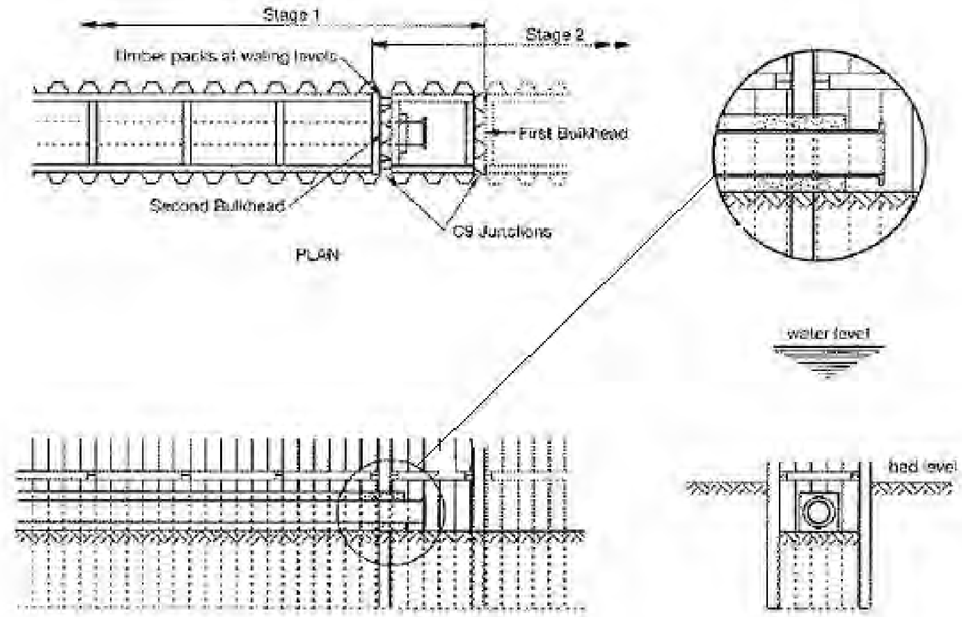


Figure 2-1 - Shored Excavation Pipeline Installation

<u>Applicability -</u> As a primary method, the shored excavation is a viable technique for this project. It has been used to cross similar waterways, in comparable water depths and required excavation depths. It could be used as the primary method to construct the pipeline across Cedar Island and then one of the other open cut methods could be used across the Bay. It may also be used for the entire crossing.

A variety of pipeline materials has been used in dredged trench applications. Pipe materials typically used for dredged trench sub-aqueous crossings are steel, ductile iron, PCCP and high density polyethylene (HDPE).

Long lengths of pipe would be advantageous for the sub-aqueous crossing, particularly for minimizing pipe connections for the open cut alternative. For open cut construction, steel pipe joints are made either on land or on a barge. It is assumed that a single interior lap weld joint will be used. Underwater welding is impractical and extremely expensive and a mechanically restrained joint would be preferred. However, the commercially available, mechanically restrained joints for steel pipe are not well suited to underwater assembly.

The type of trench backfill system used for installation of a steel pipe system is one of the most important design considerations. Because a steel pipe is a flexible piping system, substantial support for the pipe is required from the trench envelope. Steel pipe requires sufficient bedding to support the pipe and the backfill. A layer of screened gravel, typically between 6 to 12 inches in depth, may be required along the bottom of the trench for subaqueous installation. In addition, material placed around the pipe needs to provide suitable support. Typically a graded sand backfill is needed to the crown of the pipe. Material of this type is specifically graded to be able to "rained down" through the water and is somewhat self compacting.

Buried Installation (Alternative 6)

The use of steel pipe is more prevalent in rural or agricultural areas for buried installations, because there are minimal existing utilities and laying 40 to 50 foot lengths of pipe in straight runs substantially reduces overall installation costs. Conversely, steel pipe is not as commonly used in densely populated areas because the need for many bends and fittings to avoid existing utilities makes it impractical to install 40 to 50 foot lengths of pipe.

The pipe routing required to implement Alternative 6 (upland recharge) will require numerous bends and fittings of various pipe sizes. Fabrication of all of the required fittings for a steel pipe system would likely account for a substantial portion of the total system cost.

Open cut construction is the most common method for installing steel pipe for underground infrastructure. Trenchless technology will be used for installation of the piping to cross under utilities and highways such as the Long Island Railroad (LIRR), Sunrise Highway and Southern State Parkway crossings.

2.2.2 Ductile Iron Pipe

Ductile iron pipe (DIP) is a relative of cast iron pipe that has been used in American water systems for over 150 years. Numerous cities have functioning cast iron water mains that are over 100-years old. DIP and fittings were first manufactured in 1948 and have been used successfully in water and wastewater systems since that time. DIP is manufactured by the addition of magnesium to low sulfur molten iron. DIP has high tensile strength and high impact resistance and is manufactured in accordance with the American Water Works Association "Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids" (AWWA C151).

2.2.2.1 Size Availability

Standard Diameters

Ductile iron pipe is available in nominal sizes from 3 inches to 64 inches. At this time, DIP is not manufactured in the United States in diameters greater than 64 inches. Therefore, ductile iron pipe would be applicable only for use with the dual 54-inch pipe alternative.

Standard Lengths and Fittings

Ductile iron pipe is normally produced in nominal 18-foot and 20-foot lengths. The pipe sizes considered for this project are available in 20-foot nominal lengths. These pipe lengths are compatible with any of the three installation methods considered here.

A wide variety of standard ductile iron fittings in the full range of nominal pipe sizes is available for use with ductile iron pipe. The fittings are available with the same range of joints available for ductile iron pipe.

2.2.2.2 Pressure Classes

Ductile iron pipe is available in five pressure classes, from 150 psi to 350 psi in 50 psi increments, each of which corresponds to a specific wall thickness for each diameter. Additional thickness classes are available if thicker wall pipe is required due to loading or other structural considerations. In the 54-inch nominal diameter size, ductile iron pipe is available in the full range of pressure classes.

2.2.2.3 Joining Method

A variety of joint types can be used for ductile iron pipe. Ductile iron joint types include push-on joint, mechanical joint, restrained joint, flanged joint and ball-and-socket joint. Of these, the push-on joint is the most widely used.

The push-on joint is a bell and spigot type joint with a rubber gasket located in a groove inside the socket at the bell end of the pipe. Push-on joints have been tested up to 1,000 psi. The push-on joint is simple to assemble and can be used in wet trench conditions and underwater applications. Push-on joints are available for the full range of ductile iron pipe sizes. Push on joints would be suitable for tunnel or buried installation.

Mechanical joints are used with plain end pipe, are available only up to 24-inch nominal pipe size and are not suitable for subaqueous installation.

Restrained joints are a special type of push-on or mechanical joint designed to provide longitudinal restraint. Restrained joints are available for the full range of nominal ductile iron pipe sizes. For 3-inch through 24-inch nominal pipe sizes, restrained joints are rated up to 350 psi working pressure. For 30-inch through 64-inch nominal pipe sizes, restrained joints are rated up to 250 psi working pressure.

Flanged joints are rigid joints used primarily in above ground installations. Flanged joints are available for the full range of nominal ductile iron pipe sizes and are rated for 250 psi working pressure. However, flanged piping is suitable for interior use and not buried use and will not be used on this project except within the effluent pump station.

Ball-and-socket joints are designed to provide maximum deflection (12° to 15° in the larger nominal pipe sizes) and restraint against joint separation. These joints are often recommended for use in subaqueous installations, in locations with large changes in alignment and grade, or where settlement will occur due to poor soil conditions. Ball-and-socket joints, however, are substantially more costly than other available joint types.

2.2.2.4 Restraint Requirements

For the pressure applications required for the outfall pipe, ductile iron pipe will require joint restraint. As noted above, restrained push-on joints would be the most suitable methods of providing restraint for a ductile iron pipe system. For tunnel installation, restraint requirements might be minimized by grouting of the annular space around the pipes. In that case, either push-on joints or restrained joints could be suitable. Ball-and-socket joints for subaqueous installation also provide adequate joint restraint as do restrained push-on joints. Restrained push-on joints are also used for buried pipe installation.

2.2.2.5 Corrosion Protection

General

The rate of corrosion of ductile iron pipe is directly related to the corrosivity of the soil and is similar to the corrosion rate of steel. Variations in soil resistivity in the area immediately adjacent to an alignment will generate corrosion activity on ductile iron pipe. Stray current will also accelerate corrosion on ductile iron. Unlike steel, which tends to corrode primarily by pitting, ductile iron graphitizes in various patterns, ranging from wide areas to smaller, pit shaped penetrations. Graphitic corrosion is a process where the metal constituents of the ductile or cast iron leave the pipe, leaving only the remaining carbon. While graphitized ductile iron often appears to be sound pipe, the carbon has only a small fraction of the strength of the original ductile iron. Failures result from only minor changes in soil conditions (freeze/thaw) or internal or external pressure.

Depending on the soil conditions, the corrosion control requirements for ductile iron pipe in a land side buried installation will not be substantial. In corrosive environments, such as in brackish/saline waters, additional corrosion protection, in the form of a cathodic protection system, will be required. For a subaqueous ductile iron pipeline installed beneath Great South Bay, supplemental corrosion protection will be essential. For landside buried installation where the pipe will be below the water table, cathodic protection may also be required.

Coating and Lining

Ductile iron pipe comes with a shop-applied standard asphaltic coating that provides minimal corrosion protection. The standard shop coating is typically sufficient for installations in non-aggressive soils or non-corrosive environments such as are typical on Long Island. For upland landside buried installation of ductile iron pipe, therefore, no additional corrosion protection is anticipated. The interior of the pipe can be lined with cement mortar lining. Cement mortar lining is most frequently used because of the ease of application and durability as compared to other linings.

Cathodic Protection

An impressed current system would be the most suitable for a subaqueous installation. Cathodic protection could also be recommended for the tunnel installation due to the possibility of ambient water seepage into interstitial spaces between the tunnel grout fill and the pipe exterior.

The literature, recent tunnel designs, and experience indicate that leakage through the concrete tunnel liner segments could be expected to range from about 10 to 40 gallons per minute (gpm) for the entire tunnel length, depending upon the liner system that is designed. The liner system design and the ability of any ambient water to infiltrate the grout to reach the pipe exterior would be further evaluated during detailed design.

The first requirement for cathodic protection for ductile iron pipe would be joint bonding to provide electrical continuity along the length of the pipe. Joint bonding is typically accomplished by cad welding. Cad welding is an exothermic process for making welded connections for electrical bonds. The process uses a mixture of copper oxide and aluminum in a graphite mold. The mixture is ignited and the exothermic reaction produces molten copper which provides a highly conductive permanent bond. Cad welding is an accepted method for connecting cathodic protection leads to steel or ductile iron pipe.

Since cad welding cannot be performed underwater, a subaqueous ductile iron pipeline would require jumper strips to provide electrical continuity. Jumper strips are metallic strips welded onto the pipe that allow the joint bond to be made via a mechanical connection in the field. The strips would be welded onto the pipe at the factory and the joint bond would be made during installation.

Cathodic protection for ductile iron pipe would work best with a factory application of a high quality dielectric coating (such as polyurethane) along with pipe joint bonding. However, externally coated ductile iron pipe is no longer available. Without a bonded external coating, the cathodic protection requirements for bare (non-coated) large diameter ductile iron pipe in a subaqueous installation will be substantially higher than for a steel pipe with bonded coating. Impressed current cathodic protection with current outputs of that magnitude could create significant stray current impacts on other pipelines in the area. From a corrosion control standpoint, the requirements for a subaqueous DIP installation will be substantially higher and more costly than for a steel pipe system.

2.2.2.6 Constructability

Tunnel Installation (Alternative 1)

Ductile iron standard 20-foot pipe lengths are compatible with the tunnel's working shaft dimensions. Ductile iron restrained push-on joints would be suitable for installation as carrier pipe in a tunnel. A restrained push-on joint is almost rigid with only a ½ degree deflection possible. This would not, however, be an issue in a tunnel installation. The best option for a ductile iron pipe restrained push-on joint uses a locking ring at the pipe joint that requires access to the outside of the joint to tighten the ring. Unlike steel pipe with lap joints, ductile iron pipe would require enough room in the tunnel to access the pipe exterior. However, the access to the locking ring is only required at a single point along the pipe circumference. Based on this and preliminary tunnel dimensions as presented in Section 3, it is expected that there will be sufficient room to assemble ductile iron pipe with restrained push-on joints in the tunnel.

Filling of the tunnel annular space with grout after the carrier pipe was installed would proceed in the same manner as with steel pipe.

Subaqueous Installation (Alternative 3and 4)

Ductile iron pipe with restrained push-on joints would be suitable for installation by open cut. Push-on joints with lock ring for restraint would be the best option for subaqueous installation.

Four general methods of construction for steel pipe in a subaqueous crossing were presented above. Of these, only the drag and pull method is not applicable to ductile iron pipe unless the joints were specifically designed to take the substantial tensile forces on the joints that would occur. The three remaining options are:

- Float and Sink Method – The pipelines would be constructed by prefabricating the pipeline or long sections of the pipeline, filling with air or providing other means of buoyancy, floating over the prepared trench and sinking it in place. After placement the pipeline would be backfilled.

- S-Lay Barge – The pipeline would be constructed by supporting the pipeline by means of a mechanical structure known as a "stinger", and lowering the pipe to the trench bed at a typical horizontal inclination of 30 degrees.

- Segmental Construction - This method of installation consists of joining short sections on a barge or a single piece of pipe and lowering down the sections using a crane. The sections of pipe are positioned in the trench, joined and tested.

Buried Installation (Alternative 6)

Ductile iron pipe would be suitable for the buried installation. The majority of the buried installation would be open cut construction, with some segments requiring installation by trenchless technology. Restrained push-on joints would be suitable in this case.

2.2.3 High Density Polyethylene Pipe

High Density Polyethylene (HDPE) pipe is a high strength polymer conduit that depends on the surrounding soils to support internal and external loading and to maintain its oval shape.

HDPE pipe is outside diameter controlled, meaning that the internal diameter is reduced when the pipe wall thickness is increased. The thickness of the pipe wall increases substantially as internal and external loading requirements are increased. This can result in an actual internal diameter that is significantly smaller than the nominal diameter. Although the frictional resistance of HDPE is less than that of ductile iron or steel, the smaller internal diameter will result in higher flow velocities and head losses. Another factor which must be accounted for with HDPE is its high degree of thermal expansion. Although HDPE is not commonly used for large water or wastewater lines, it has various advantages over other materials. One of the most significant advantages is that it is not susceptible to corrosion and does not need a protective coating or cathodic protection. Additionally, it is very flexible for ease of installation where it is pulled into a carrier conduit.

2.2.3.1 Size Availability

Standard Diameters

Solid wall HDPE pipe is outer diameter controlled and manufactured only up to a nominal outside diameter of 63-inches. Therefore, it cannot be considered for the single 72-inch diameter replacement outfall option. The largest available pipe size of solid wall HDPE, nominal 63-inch diameter, has an internal working diameter of 56.85 inches, which is suitable for use with the dual 54-inch pipe option.

Standard Lengths and Fittings

HDPE pipe is normally produced in standard nominal 20-foot and 50-foot lengths. HDPE pipe can be cut in the field to any required length. The shorter standard lengths would be suitable for use in tunnel installation and for buried installation.

Two types of HDPE fittings are available for use with HDPE pipe, molded and fabricated. Molded fittings are made by injection molding and are fully pressure rated. Fabricated fittings are made from mitered sections of pipe and have a reduced pressure rating due to the change in diameter at the miter cuts. All standard fittings are available, including elbows, wyes, reducers and tees, as well as flange adapters and transition fittings for connecting to other pipe materials. Occasionally, ductile iron fittings are used with HDPE pipe where it may be necessary to disassemble a joint to provide access for maintenance or inspection. Flange adapters or mechanical joint adapters are used to connect HDPE pipe to ductile iron fittings or pipe.

2.2.3.2 Pressure Classes

Pressure ratings for HDPE pipe are determined by the pipe's dimensional ratio (DR) classification and the resin type used. The highest available rating for 63-inch solid wall HDPE pipe corresponds to DR21 pipe. The two resin types available for commercially available HDPE pipe are PE 3408 and PE 4710. PE 3408 is the most commonly available and in DR21 pipe provides a working pressure rating of 80 psi with allowance for 100 psi surge pressure. Resin PE 4710 is a newer material that is not as readily available as PE 3408 and requires longer lead times for production and delivery. In DR21 pipe, PE 4710 provides a working pressure rating of 100 psi, with allowance for 100 psi surge pressure. The working pressure ratings for 63-inch, DR21 HDPE pipe made with both resins are within the normal operating pressure of the outfall for the expected maximum pumping capacity of the Bergen Point WWTP (e.g., 110 MGD); however, the surge pressure that could occur in the outfall at the maximum design flow for the existing outfall, 180 MGD, is beyond that of the HDPE pipe. It is anticipated that similar conditions will occur in the landside alternative (Alternative 6).

2.2.3.3 Joining Method

There are only two joining methods available for joining segments of HDPE pipe of the size considered for this project, heat fusion welding and flanged joints.

Heat fusion welding requires use of two pieces of equipment, a facing machine and a fusion welding machine. The facing machine is used to make the ends of pipe sections square prior to heating for fusion welding. Once the pipe ends are squared, the ends are heated to melting and held together at a prescribed pressure until the material cools. The resultant joint is made of the fused ends of the two segments of pipe. Joints in HDPE pipe made by heat fusion are as strong as the material itself. Typical footprint dimensions for a fusion welding machine of the type required for the pipe size considered for the outfall are 15 feet long by 9 feet wide. A fusion welded joint cannot be made underwater. HDPE pipe with fusion welded joints would not be compatible with an installation method requiring underwater joining of pipe sections (i.e., Alternatives 3 and 4).

Flanged joints for HDPE pipe require the use of flange adaptors and steel or ductile iron back up rings. Flange adaptors are butt welded to plain end pipe to provide a flange joint to another section of pipe, fittings or valves.

2.2.3.4 Restraint Requirements

Fusion welded joints for HDPE have the same pressure rating as the pipe itself. Solid wall HDPE pipe with fusion welded joints is restrained through its whole length and requires no additional restraint method.

The use of flanged joints would also provide restraint for HDPE pipe. An HDPE system using flanged joints is considered to be fully restrained.

2.2.3.5 Corrosion Protection

HDPE is a non-metallic, non-reactive material that does not experience soil- induced corrosion. Depending on the installation conditions, however, on occasion, ductile iron fittings are used in conjunction with HDPE pipe. If used in a subaqueous installation, metallic fittings installed with an HDPE pipeline would require galvanic cathodic protection. The galvanic cathodic protection for metallic components would consist of zinc anodes that are connected directly to the metallic components, to minimize external corrosion and prevent premature failure.

2.2.3.6 Constructability

Tunnel Installation (Alternative 1)

Of the various materials being considered for this project, HDPE pipe has one of the largest outside diameters for the nominal inner diameter and required pressure rating. This means it may require a slightly larger tunnel diameter than the other material options. Based on the maximum Bergen Point pumping capacity of 110 MGD, HDPE would be a viable alternative; however, based on the future maximum peak flow of 180 MGD, the surge pressure rating of HDPE pipe for the diameter required is not sufficient, and would result in elimination of HDPE from further consideration.

Subaqueous Installation (Alternatives 3 and 4)

For a peak flow rate of 110 MGD, HDPE would be an appropriate carrier pipe material for Alternatives 3 and 4. However, the surge pressure rating of HDPE pipe in the diameter required for the subaqueous installation is not adequate for the future maximum peak flow of 180 MGD. Based on the future maximum peak flow of the Bergen Point WWTP, HDPE is not an appropriate material for the outfall carrier pipes for Alternatives 3 and 4.

Buried Installation (Alternative 6)

For the current peak flow of 110 MGD, HDPE would be an appropriate pipe material for Alternative 6. However, the surge pressure rating of HDPE pipe is not adequate for the future maximum peak flow of 180 MGD. Based on the future maximum peak flow of the Bergen Point WWTP, HDPE will not be considered an appropriate material for Alternative 6.

2.2.4 Fiberglass Reinforced Pipe

There are two general types of fiberglass reinforced pipe manufactured for water and wastewater transmission, Reinforced Polymer Mortar Pipe (RPMP) and Reinforced Thermosetting Resin Pipe (RTRP). Reinforced Polymer Mortar Pipe incorporates a sand aggregate mixed in with the polymer resin in its structural layers, making it generally more durable and more amenable to use in the alternatives considered for outfall replacement.

RPMP is produced via one of two generic processes, centrifugal casting or filament winding. The manufacturing methods differ, but either can meet most design criteria. RPMP is corrosion resistant both inside and out. The pipe's glass fibers and polymer mortar create a non-conductive material that is immune to electrochemical reactions caused by acids, bases, and salts. RPMP has a high stiffness, making it durable and low in maintenance.

Centrifugally cast fiberglass reinforced polymer mortar (CCFRPM) pipe contains glass fiber reinforcements similar to reinforced concrete pipe. Stiffness classes, ranging from 18 to 72 SN, are selected based on project application and design criteria.

CCFRPM pipe is constructed with seven layers, including an outer layer of sand and resin followed by a heavily reinforced chopped glass and resin layer, a transition layer, a core layer made of polymer mortar, a transition layer, a heavily reinforced layer made of chopped glass and resin, and finally a liner of high elongation resin. These layers form a strong, durable and long lasting pipe material. The centrifugal casting process allows for a sophisticated pipe wall structure built from the outside to the inside, within an external rotating mold. The resin is specially formulated so that it does not polymerize during the filling process. Rather, the material remains pliable until rotated at high speeds to force out the air and begin polymerization of the resin. The rotation and removal of air is one of the advantages CCFRPM pipe has over its fiberglass competitors.

Filament wound reinforced polymer mortar pipe is similar in material to the centrifugally cast polymer mortar pipe and is constructed with four layers. The interior of the pipe includes an inner corrosion resistant layer of a resin system based on the corrosion control requirements of the particular application, an inner and an outer structural layer consisting of helically wound fiberglass roving or chopped strand mat saturated with resin, and a core layer of polymer mortar consisting of a mix of sand, mortar and resin. This pipe is manufactured using a continuous mandrel process, which allows the use of continuous glass fiber reinforcements on the circumference of the pipe. The filament winding process impregnates glass-reinforced strands with a matrix of resin, and then applies wetted fibers to a mandrel under controlled tension in a predetermined pattern. Repeated passes establish a layered construction achieving the design wall thickness. This type of pipe does not have a substantial history in large diameter installations, particularly in tunnel installations and is generally used for chemical or fire service piping.

2.2.4.1 Size Availability

Standard Diameters

Fiberglass pipe (CCFRPM) is available in nominal diameters ranging from 18 inches to 110 inches. Fiber wound RPMP is available in nominal diameters ranging from 24 inches to 90 inches.

Standard Lengths and Fittings

Both CCFRPM and fiber wound RPMP pipe are produced in standard nominal 20-foot lengths. Due to the production process for CCFRPM pipe, the actual length of nominal 20-foot sections will normally vary between 19'-6" and 20 feet. A fixed 19' 6" length can be provided on request to ensure consistent layout lengths. Shorter lengths can be provided if desired for tunnel applications.

2.2.4.2 Pressure Classes

CCFRPM pipe is available in six pressure classes, from 25 psi to 250 psi. In the 54-inch nominal diameter size considered for the outfall replacement, CCFRPM pipe is produced in pressure classes up to 200 psi working pressure. Fiber wound RPMP is available in five pressure classes, from 50 psi to 250 psi in 50 psi increments.

2.2.4.3 Joining Method

Three joint types are available for use with CCFRPM pipe in pressure service. These include standard filament wound composite (FWC) coupling joint, flush FWC coupling joint, and pressure relining joint. Stainless steel mechanical couplings are available for use with closure pieces, for tie-ins. FWC couplings and flange adapters can be used for connection to other pipe materials if required.

CCFRPM pipe has a certain degree of flexibility, but the joint system must be considered carefully. CCFRPM pipe generally joins pipe sections with FWC coupling joints for direct bury and aboveground installations of pressure pipes. FWC coupling joints are structural filament-wound sleeves over-wrapped and mechanically locked to an internal membrane. The sealing design includes both lip and compression elements so that the joint is suitable for both non-pressure service and pressure service up to 250 psi. The coupling is factory assembled to one end of each pipe for ease of use in the field.

For jacking and tunnel installations of pressure pipes, flush FWC couplings are typically used. Flush FWC couplings consist of a reduced diameter that is approximately the same diameter as the outer diameter of the pipe. When assembled, the joint is essentially flush with the pipe outer surface. The maximum deflection for both the FWC and flush FWC couplings is ¾ degrees or 3 inches for a 20-ft length of pipe.

For a subaqueous installation, it may be necessary to use joints with mechanical anchoring in each pipe. These joints are typically not standard, and it may be necessary to design and manufacture them specifically for this project. Alternatively, pipe sections may be constructed on land using laminated joints with the pipe sections joined underwater using mechanical joints. However, field lamination of joints requires strict quality control to ensure that the joint is constructed properly.

Four types of standard large diameter joints are available for the fiber wound RPMP pipe. All four joints are bell and spigot type. Single gasket joints are bell and spigot joints with a single rubber o-ring. Key-lock restraint joints are bell and spigot with an o-ring seal and double notches in the pipe bell and pipe spigot to introduce nylon key rings for joint restraint. The double gasket testable joint is a bell and spigot joint with two o-ring seals notched into the pipe spigot and a seal pressure check port between the o-rings. The final standard joint type is the slipline/jacking joint in which the bell and spigot are flush on the outside and a jacking ring contact point of the bell and spigot.

Flanged and butt and wrap joints as well as variations on the above joints, such as a restrained, testable joint with double o-ring and single key-lock are also available as non-standard options.

2.2.4.4 Restraint Requirements

Thrust blocks are the only method of providing true pipe restraint for CCFRPM pipe. Concrete encasement of each joint would be necessary to provide restraint of pipe joints. Fiber wound RPMP can be restrained using the standard key-lock restrained joints.

2.2.4.5 Corrosion Protection

Both fiber wound RPMP and CCFRPM pipe are generally one-hundred percent corrosion resistant and therefore typically require no corrosion protection other than what is already provided in the manufacturing process. Occasionally, as with HDPE, depending on the installation conditions, ductile iron fittings may be used with fiber wound RPMP or CCFRPM pipe to allow change of direction in a limited space or to provide restraint for a particular joint. A landside installation of either pipe with ductile iron fittings in the soil types typical in Long Island would not require corrosion protection for the fittings. If ductile iron fittings are used with fiber wound RPMP or CCFRPM pipe in subaqueous installation, corrosion protection would be needed for the ductile iron fittings. The recommended method for corrosion protection for the fittings would be galvanic protection with anodes attached to each fitting.

2.2.4.6 Constructability

Tunnel Installation (Alternative 1)

Generally, both types of fiberglass reinforced polymer mortar pipe can be installed by tunneling methods either inside a carrier pipe or as a stand-alone tunnel on account of their corrosion resistance and durability. The main drawback for CCFRPM pipe is the lack of joint restraint that is required for pressure service. In a tunnel installation where the annular space is to be filled with grout, conservatively the system would not rely on the grout fill to provide any kind of restraint. Additionally, to conform to the space constraints of the tunnel shafts, ductile iron bends would need to be used with CCFRPM pipe. The pipe walls and outer diameter of both fiber wound RPMP and CCFRPM pipe are also greater than those of ductile iron or steel, which might require an increase in the tunnel diameter in order to insert pipe sections without difficulty.

Subaqueous Installation (Alternative 3 and 4)

Limited open-cut methods would be suitable for use with fiberglass reinforced pipe. Assembly of fiber wound RPMP nor CCFRPM pipe on a barge for subaqueous installation is not feasible. The joints on fiberglass reinforced polymer mortar pipes are sealed by pressure and friction only, and would not hold together if sections were joined prior to installation. Assembly of either pipe on land for installation in a subaqueous trench is also limited. Each joint for either type of pipe would have to be made underwater by divers.

Another concern with using fiberglass reinforced polymer mortar pipe in an open-cut sub-aqueous crossing is the pipe's sensitivity to bedding. Due to the stiffness of fiberglass reinforced polymer mortar pipe, a firm, uniform bed is required. Depending upon the manufacturer, ballast may also be required.

Buried Installation (Alternative 6)

The use of fiberglass reinforced polymer mortar pipe in buried installations is more typical than for the tunnel and open cut outfall replacement alternatives. For CCFRPM, FWC couplings would be used. However, the requirement to restrain the joints for pressure service would again be a limitation to use of the material. For fiber wound RPMP, the standard key-lock restrained joint would be a suitable option for buried installation.

2.2.5 Concrete Pressure Pipe

Concrete pressure pipe includes several types of pipe including prestressed concrete cylinder pipe (PCCP), reinforced concrete cylinder pipe, reinforced concrete non-cylinder pipe and concrete bar wrapped cylinder pipe. The various types of concrete pipe are categorized by whether they contain a full length cylinder, and whether they are reinforced with either prestressed high strength wire, smooth bar or deformed bar. The two types considered for this analysis are PCCP and concrete bar wrapped cylinder pipe.

All concrete pressure pipe is of composite design utilizing both concrete and steel as primary structural elements. In general, both PCCP and concrete bar wrapped steel cylinder pipe are composite products consisting of a welded steel cylinder and a concrete core. The manufacturing process of both types of pipe begins with fabrication of the steel cylinder by spirally rolling and welding coiled sheet. The thickness of the cylinder varies depending on the design thrust conditions or, if necessary, longitudinal bars may be added to take the thrust. Fabricated joint rings are welded to the ends of the cylinders.

For fabrication of PCCP, concrete is cast around the cylinder by either centrifugal or vertical casting to create the core. After the core cures, high tensile wire is helically wrapped around the core. The wire diameter, tension and spacing are determined by the manufacturer to provide the required internal and external load capacities of the completed pipe. At the time of prestressing, cement slurry is applied between the wire and core. This slurry is rich in cement content and highly alkaline, and provides corrosion protection for the prestressing wires. After the wire is placed, the exterior of the pipe is sprayed with cement mortar to provide a minimum coating thickness of ¾-inch over the wire.

PCCP is manufactured in accordance with AWWA C301 "Standard for Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids," and designed in accordance with AWWA C304, "Standard for Design of Prestressed Concrete Cylinder Pipe."

For fabrication of bar wrapped concrete pressure pipe, a concrete or mortar lining is applied to the interior of the cylinder. Reinforcing bar is then spirally wrapped around the cylinder and an external coating of portland cement is applied.

Bar wrapped concrete cylinder pipe is manufactured in accordance with AWWA C303 "Prestressed Concrete Pressure Pipe, Steel Cylinder Type", and designed in accordance with AWWA C304, "Concrete Pressure Pipe, Bar Wrapped, Steel Cylinder Type."

Standard PCCP is manufactured based on the standards established by AWWA. The design engineer provides pipe system design operating conditions which are utilized by the manufacturer in the batch manufacture of PCCP for the project. Hydrostatic proof of design tests and pipe section production tests are conducted by an approved independent testing laboratory at the factory to ensure that the production pipe delivered to the job site will meet the design conditions specified by the engineer.

2.2.5.1 Size Availability

Standard Diameters

There are two types of PCCP – lined cylinder pipe (LCP) and embedded cylinder pipe (ECP). Lined cylinder pipe has an internal concrete or mortar lining and an external coating of portland cement mortar. The prestressed steel wire is wrapped directly onto the steel cylinder. In embedded cylinder pipe, the steel cylinder is embedded in a concrete core, the prestressed steel wire is wrapped around the concrete core and a coating of portland cement mortar is applied to the exterior.

Lined prestressed concrete cylinder pipe is generally available in sizes up to 48 inches in diameter.

Embedded prestressed concrete cylinder pipe is manufactured in sizes from 48-inches to 144-inches in diameter. Bar-wrapped concrete cylinder pipe is manufactured in the U.S. in sizes from 10 inches to 72 inches, but availability varies by location. Locally, bar-wrapped concrete pressure pipe may be available up to 60-inch diameter size.

Large diameter PCCP is manufactured in New Jersey and in South Carolina and Texas.

Standard Lengths and Fittings

Both embedded and lined PCCP are manufactured in standard section lengths of 20 feet. Non-standard lengths of 40 feet have been used on similar projects for sub-aqueous installation, providing the advantage of reducing in half the number of underwater joints. Non-standard lengths, however, are of a much lesser availability and may be difficult to procure.

Fittings are constructed by cutting and welding steel plate or sheet into a cylinder of the desired configuration. Adapters can also be fabricated to connect PCCP to valves and ductile iron or steel pipelines. Beveled pipe can also be provided to allow for a greater deflection at joints to meet alignment requirements. The fittings themselves are not actually a prestressed design, but rather rely on the strength of the structural steel plate to carry design loads. As with steel pipe, bends can be made to any required angle. Standard straight pipe is normally furnished in lengths approximately 20 feet long but can be provided in 40-ft lengths. PCCP, whether restrained or push-on joint, cannot be field cut to create a shorter length. However, short pipes between 2-feet and 18-feet can be manufactured and are used to meet critical points of intersection, valves, or other connections that cannot be accomplished by other means.

Bar-Wrapped Concrete Cylinder Pipe is normally available in standard 20-foot to 40-foot laying lengths.

2.2.5.2 Pressure Classes

Prestressed Concrete Embedded Cylinder Pipe is designed for working pressures up to 350 psi. Bar-Wrapped Concrete Cylinder Pipe is designed for working pressures up to 400 psi.

2.2.5.3 Joining Method

Joints are of the rubber-gasketed bell and spigot design, and are constructed by welding steel joint rings to the end of the cylinder. The bell and spigot joint is normally used in the various concrete pressure pipe types described here and consists of a steel bell ring and a steel spigot ring which compress a rubber O-ring gasket when assembled. Field mortaring and grouting are required after joint assembly to protect the steel. Joints are protected by use of a plastic cloth diaper placed around each exterior joint recess and fastened in place with either wire or steel strapping stitched into the diaper edges. The diaper is then filled with a flowable grout. Use of this type of joint requires the Contractor to hydrostatically test the pipeline after installation. Another type of rubber-gasketed joint is a double gasket air testable joint which allows for water-tightness testing of individual joints immediately upon installation of the joint. The joint can be tested either on the inside or outside of the pipe. This type of joint eliminates the need to conduct a test on the completed line, therefore eliminating the need for bulkheads and the difficult and time consuming task of filling large diameter water mains with water for a hydrostatic test. A double gasket air testable joint would be recommended for either a dredged or tunnel type of crossing.

2.2.5.4 Restraint Requirements

The PCCP system (lined or embedded) is able to withstand high internal pipe pressure and large external loads. Under most conditions, this system also provides for a high level of corrosion resistance. PCCP normally requires less stringent pipe bedding and backfilling than steel pipe. PCCP is a rigid pipe system and does not depend on the passive resistance of the soil for support of vertical loads, but still requires joint restraint at bends, tees, bulkheads, and other fittings.

Restraint of joints at fittings such as bends and tees can be achieved by the use of thrust blocks or "tied" joints. As discussed prior, concrete thrust blocks are not recommended for large diameter pipelines. "Tied" joints for PCCP are of the gasketed bell and spigot design, but are either welded or harnessed. Welded joints can be welded either from the inside with a continuous fillet weld or on the outside of the pipe, often welding only the upper 270 degrees. Harnessed joints provide a mechanical means of transmitting thrust across the joint. Alternate manufactures have different types of harnessed joints. For the 72-inch pipe, harnessed joints would be specified in lieu of the welded type restrained joints.

Harness clamp joints are strained by a two-part harness clamp. The bottom half of the harness clamp is positioned under the joint prior to placing the next pipe length. After the pipe is installed, the top half of the clamp is positioned over the joint and secured to the bottom half by tightening the bolts on each side. Grout is then poured into a grout band over the joint before the line is pressurized. The grout distributes any thrust loads around the joint as well as provides corrosion protection for the joint.

2.2.5.5 Corrosion Protection

Special lining and coating systems are available for PCCP. The lining system in PCCP consists of the inner face of the concrete core of the pipe. The concrete provides a smooth surface for hydraulic flow. Coal tar epoxy systems can be applied to PCCP for additional interior protection, although are typically not used.

In buried installations, PCCP is protected from aggressive soils by the exterior mortar coating applied over the concrete core of the pipe. Should it be determined that additional corrosion protection is warranted, coal tar epoxy or polyethylene tubes can be utilized for external corrosion protection.

In a subaqueous installation or a tunnel installation with assumed water intrusion, a cathodic protection system would be required. Joint bonding to provide electrical continuity between pipe sections would be necessary for a cathodic protection system to be effective. As previously described for ductile iron pipe, joint bonding for electrical continuity is typically accomplished by cad welding to form the bond. For a subaqueous application, however, or an installation with restricted space where cad welding cannot be performed, joint bonding for the pipeline would require jumper strips to provide electrical continuity. Jumper strips, as described in the ductile iron pipe section, are metallic strips welded onto the pipe that allow the joint bond to be made via a mechanical connection in the field. The strips would be welded onto the concrete pipe at the factory and the joint bond would be made during installation.

2.2.5.6 Constructability

PCCP is a rigid pipe system and typically has less stringent bedding requirements than DIP or steel. However, the type of trench backfill system used for installation of PCCP has an important effect on its external load-carrying capacity. There are five types of typical bedding conditions for PCCP as described by AWWA C304 and AWWA M9 as R1, R2, R3, R4, and R5. The higher the external loading on the pipe system, the more stringent the bedding material needs to be.

Tunnel Installation (Alternative 1)

Generally, either type of concrete pressure pipe, bar-wrapped or PCCP, would present the greatest challenge of all the pipe materials considered in this analysis in a tunnel installation, due to the pipe dimensions and the weight of the material. PCCP has the largest outside diameter and weight of all the pipe materials included in this analysis. The 72-inch and 54-inch nominal diameter PCCP have, respectively, a maximum outside diameter of 84.5 inches and a weight of 1,657 pounds per linear foot, and an outside diameter of 64 inches and a weight of 1,008 pounds per linear foot. Bar-wrapped concrete cylinder pipe of 72-inch and 54-inch nominal diameter are slightly better with a maximum outside diameter of 77 inches and a weight of 735 pounds per linear foot, and an outside diameter of 59 inches and a weight of 519 pounds per linear foot respectively.

Additionally, the requirement to apply a diaper and grout to the exterior recess of the joint around the entire circumference and installation of joint bonds for continuity of cathodic protection require substantial space for access to the pipe exterior and would require a substantially larger tunnel, adding approximately four to six feet to the required tunnel diameter.

Subaqueous Installation (Alternative 3 and 4)

PCCP is versatile and can be installed by using either a dredged trench method (float and sink or lay barge) or a tunneling method. The double gasket air testable joints provide the flexibility of testing joints on the outside or inside of the pipe. Joints can also be tested on land before installation if sections of pipe are joined before being sunk.

Buried Installation (Alternative 6)

Both PCCP and bar-wrapped concrete pressure pipe are well suited for buried installations. The pipes are designed to withstand substantial overhead and lateral earth loads. The push-on type bell and spigot joints of both allow for a simple assembly of pipe lengths in an open cut installation. The joints with flexible o-ring allow sufficient flexibility to maintain water tightness under normal conditions of soil movement. Restrained or harness joints would be specified for pipeline bends or deflections. These pipe types, however, are limited to open cut installation. Any segments of installation requiring pipe jacking or other trenchless technology would require another pipe material for that segment and use of adapter fittings for transition to the other material. Adapter fittings for connection of bar-wrapped or PCCP to either ductile iron or steel are available. One major disadvantage of using either of the concrete pressure types is the weight of the pipe material. For PCCP, for example, the pipe's per linear foot weight of 1,008 lb per linear foot for 54-inch diameter and 1,657 lb per linear foot for 72-inch diameter is approximately 3 times as heavy as the next heaviest materials which are ductile iron and fiberglass reinforced polymer mortar pipe.

2.3 Advantages and Disadvantages of Alternative Pipe Materials

The advantages and disadvantages of replacing the existing outfall with dual 54-inch diameter pipes with each of the five materials are summarized below in **Table 2-3**.

Table 2-3 Summary of Alternative Pipe Materials

Comparative Items		Pipe Material				
		Steel	*Ductile Iron*	*HDPE*	*FRP*	*Concrete Pressure Pipe*
Size Availability	Diameter	• Nominal Size: 6″ to 144″ • Any diameter as required	• Nominal Size: 3″ to 64″ • No greater than 64″	• Nominal Size: up to 63″	• Nominal Size: 18″ to 110″	• Nominal Size (Lined PCCP): up to 48″ • Nominal Size(Embedded PCCP): 48″ to 144″ • Nominal Size (Bar-wrapped): 10″ to 72″
	Standard Lengths	• Typically 40′ or 50′ standard • Can be provided 20′ or 25′ • May be cut in field	• Typically 18′ to 20′ • May be cut in field	• Typically 50′ and 20′ • May be cut in field	• Typically 20′ lengths • 20′ lengths vary between 19′ 6″ and 20′ • May be cut in field	• Typically 20′ standard lengths • Non-standard 40′ lengths available
	Fittings	• Steel fittings available including bends, tees, wyes, reducers, not limited to standard angles	• Variety of fittings available in full range of nominal pipe sizes	• Two types: molded (fully pressure rated) and fabricated (reduced pressure rating due to diameter changes) • Ductile iron fittings recommended	• Standard fittings available • In pressure applications, fittings may require encasement to resist thrust • Ductile iron fittings recommended	• Standard fittings available • Adapters available for connecting to ductile iron or steel pipe • Beveled pipe for greater deflection at joints is available
	Wall Thickness	• 0.225″ to 0.323″ • Can be furnished in any thickness	• 0.51″ to 0.54″	• 3.00″	• 1.17″ to 1.49″	• 4″ to 6.5″
Pressure Rating	Working	• 150 – 300 psi standard • Can be higher as required	• 150 – 350 psi standard	• 80 - 100 psi (dependent on resin and dimensional ratio)	• 150 – 200 psi	• Embedded PCCP: up to 350 psi • Lined PCCP: up to 400 psi
	Surge	• 100 psi	• Working psi + 100 psi surge	• 100 psi + 100 psi surge	• 210 – 280 psi	• Working + 100 psi surge
Joining Method	Method	• Welded Joints: Butt strap joints, lap welded slip joints • Can be welded on interior or exterior of pipe, or both • Gasketed Joints: Bell and Spigot – either rolled groove or Carnegie shape rubber gasket	• Push-on joint (most common), mechanical joint, restrained joint, flanged joint, and ball and socket joint. • Push-on joints are bell and spigot w/ rubber gasket; may be used in wet trench or sub-aqueous	• Heat fusion welded: requires facing and fusion welding machine where ends are squared and melted together • Flanged: requires flange adaptors and steel or ductile iron back up rings	• Flush FWC(most common for tunneling) and FWC coupling joint, or pressure relining joint • SS mechanical couplings available for closure pieces and tie-ins. Use FWC and flange adapters for other materials	• Bell and Spigot joints typical • Double gasketted air testable joints also available • Field mortaring and grouting required
	Testing	• Air testing of individual joints from inside or outside pipe	• Hydrostatic testing required	• Hydrostatic testing of entire pipeline required	• Hydrostatic testing of entire pipeline required	• Hydrostatic testing typical • Air testing with use of air testable joints
Restraint Requirements		• Not required if lap welded joint • Required if push on joint	• Required, flanged and restrained push-on joints most suitable • Ball-and-socket considered fully restrained	• Fusion welded and flanged are considered restrained • May require restraint on transitions	• Thrust blocks and concrete encasement around joints	• Required at bends and other fittings • Restrained with welded or harnessed joints • Thrust blocks may be used
Corrosion Protection	Cathodic Protection System	• Has poor corrosion resistance • Impressed current, active system best for subaqueous or tunnel	• Has poor corrosion resistance • No practical corrosion control method for subaqueous • Joint bonding required with cathodic protection	• Corrosion resistant • Metallic fittings, if used, require galvanic protection	• Corrosion resistant • Metallic fittings, if used, require galvanic protection	• Steel cylinders and steel reinforcement require cathodic protection system • Joint bonding required
	Interior Lining	• Required, cement-mortar lining, coal-tar, polyurethane or epoxy lining also available	• Typically cement-mortar	• n/a	• n/a	• Cementitious lining
	Exterior Coating	• May not be required for tunnel, but advisable • Required for subaqueous or buried • Fusion bonded epoxy or polyurethane coating available	• Standard shop-applied coating only (asphaltic coating)	• n/a	• n/a	• Cement mortar coating
Constructability	Tunnel	• Lengths – 20′ – 25′, compatible with shaft dimensions • Grouted annular space for additional support and cathodic protection • Interior lap-welded joints, requires additional ventilation • 579 joints required for 25′ lengths of pipe	• Lengths – 20′ • Restrained bell and spigot joints most suitable – allow only ½ degree of deflection	• Requires larger tunnel diameter • Pressure rating adequate for 90 MGD, not for 180 MGD • No room for fusion welding machine in shaft or tunnel • Can't be inserted if fused outside of tunnel • Heat of hydration from grout may cause deformation	• Installed either inside carrier pipe or as stand-alone tunnel due to corrosion resistance and durability • Max degree of deflection ¾ to 3″ for 20′ lengths of FWC and flush FWC coupling	• Lengths – 20′ • Requires larger tunnel for access to grout joint exteriors • Heaviest pipe material per foot ranging from 519 lb/ft to 1657 lb/ft • Requires cathodic protection system and bonded joints • Restrained joints required at bends and fittings

	Sub-aqueous	• Longer lengths preferred • Pipe joints furnished on barge or on land • Impractical to weld, mechanically restrained joints preferred	• Boltless with rubber gasket provides pressure tight seal and retainer for joint restraint with a 12.5 – 15 degree of deflection • Most feasible installation by lowering pipe from barge and assembling underwater by divers or operating launch chute from barge extending to the bottom of the trench	• Fusion welding may be done on barge where pipe can be laid as joined, or • Fusion welding of long sections that may be floated out to trench (difficult due to bay depth) • Must be weighed down and sunk by ballast collars • Joined by divers	• Assembly on barge is not feasible • Joints are assembled by pressure and friction, which would not hold in place if sections were joined prior to installation • Joints would have to be made underwater by divers • Stringent bedding requirements	• May use 40′ non-standard lengths • Joints would need to be made underwater • Can use air testable joints • Restrained or harnessed joints required at bends and fittings • Requires cathodic protection system and bonded joints
	Buried	• Not typical in urban areas • Open cut installation may require directional drilling • Stringent bedding requirements	• Restrained push-on joints are suitable • Corrosion protection – standard ductile iron exterior with polyethylene encasement • Less stringent bedding requirements	• Most practical • Fusion welding – most typical • Flanges or restrained mechanical couplings to connect valves and appurtenances • Most stringent bedding requirements	• Open cut installation • FWC couplings suitable, however restraining requirements for pressure service would be a limitation to use of pipe.	• Open cut installation required • Restrained or harnessed joints required at bends and fittings • Generally simple assembly with bell and spigot joints • Not suitable for any segments requiring trenchless technology
Structural Integrity		• Good, typically not subject to sudden failure	• High impact resistance and tensile strength	• Flexible, high degree of expansion	• High stiffness, durable, low-maintenance	• Rigid pipe system with flexibility at joints • Durable, low maintenance
2009 Material Cost (per linear foot of 54-inch diameter pipe)		• $320/linear foot • $3,500 per 54″90°bends	• $340 – $426/lf for push-on joints • $1700/lf for ball & socket joints • $18,890 per 54″ DI 90°bends	• $263/linear foot • $18,890 per 54″ DI 90°bends	• $372/linear foot • $18,890 per 54″ DI 90°bends	• $249 - $420/linear foot • 45°Bends: $3,700 to $6,200 ea • 90°Bends: $6,000 to $10,800 ea • Restrained joints: $600 to $900 ea

2.4 Summary and Recommendations

2.4.1 Tunnel Installation - Alternative 1

Steel pipe with lap welded joints is the most suitable material for use in a tunnel installation. It is the most common pipe material used for tunnel installation and provides the most flexibility with respect to pipe size and pressure rating, as it can be designed for both specific diameters and pressure ratings based on system requirements. Steel pipe has more reliable corrosion protection options than either ductile iron or CCFRPM pipe.

2.4.2 Subaqueous Installation - Alternatives 3 and 4

For the subaqueous portion of the open cut method alternative, the most suitable pipe materials would be steel, ductile iron, HDPE or CCFRPM. However, due to restraint requirements, either HDPE or ductile iron pipe would be preferable, and it is presumed that ductile iron or HDPE pipe would be used for Alternatives 3 or 4.

2.4.3 Buried Installation - Alternative 6

The most suitable material for the majority of the buried installation is ductile iron.

2.5 Effluent Pump Station

2.5.1 Description of Existing Pump Station System

Secondary effluent from final clarifier numbers 1 through 6 is conveyed by gravity through Junction Chamber Numbers 1 and 2 via 60/84/96- inch conduits and into Junction Chamber Number 3 via a 108- inch conduit. Flow then enters the effluent pump station's wet well conduit along the north side of the building prior to flowing through the two 12′- 0″x 8′- 9″ pump suction conduits located along the east and west side of the effluent pumping equipment. The east conduit feeds both the pump suction piping as well as the existing Final Effluent Pump Level Control Chamber. The western conduit is a bypass around the pump station and can feed the Final Effluent Pump Level Control Chamber. Typically, gravity flow from the pump station is maintained up to 30 plus MGD depending on tidal conditions.

The existing pumping system is comprised of three pumping units, each rated at a flow capacity of 45 MGD with piping connections for a fourth pump to be installed. Typically, two pumping units are in operation with the third pumping unit acting as a standby; thus providing a total pumped flow capacity of 90 MGD. Pump suction for all pumping units is through the east wet well. Pump flow capacity can be varied as each pumping unit is

furnished with a magnetic drive where the speed of the pumping units is controlled as a function of wet well level in the automatic mode. However, the County typically operates the pumps in the manual mode.

2.5.2 Rehabilitated Pump Station

New York State Department of Environmental Conservation (NYSDEC) has expressed strong opposition to any discharge of treated secondary effluent to the Bay, even on a temporary basis, due to the potential environmental impacts and because the Bay has recently been designated as a no discharge zone by the United States Environmental Protection Agency

(EPA). Therefore, a sequence to connect to the existing outfall without a Bay discharge has been developed, as described below. Construction of the effluent pump station improvements will be implemented prior to the construction of any of the outfall alternatives presented in Section 3.

Secondary effluent from the final clarifiers will continue to flow by gravity to the effluent pump station as previously described. However, gravity flow to the ocean outfall is expected to be reduced as a function of the head loss associated with the proposed ultraviolet disinfection system. The proposed ultraviolet disinfection system will be located in between the final clarifiers and the effluent pump station and its construction is expected to begin in 2011.

To convey final effluent to discharge, a new outfall under the Bay will be constructed, as shown on **Figure 2-2**. The proposed upgraded pump station facility would include four new pumping units, each rated at a flow capacity of approximately 45 MGD. Three pumping units would be in operation with the fourth pumping unit acting as a standby; thus providing a total pumped flow capacity of approximately 135 MGD. Pump suction for all new pumping units would continue to be from the east pump suction conduit and pump flow capacity can be varied as each pump would be furnished with a variable frequency drive where the speed of the pumping units would be controlled as a function of the pump station wet well.

In order to maintain the effluent pump station in operation during construction, a phased approach to upgrading the existing effluent pump station must be implemented. This will require two pumps to remain in operation while the existing third pump is removed from service. Two new effluent pumps and piping will be installed at a time with connection to the existing outfall and future connection for the new outfall. After placing the new pumps, the two remaining pumps would be removed from service, demolished and replaced, and the new pumping units and piping installed and connected to the new discharge piping. The new facilities are shown by **Figure 2-3**.

2.5.3 Proposed Construction Sequencing

The proposed construction sequencing for constructing the proposed new pumping equipment, Effluent Pump Level Control Chamber and site piping, are shown on **Figures 2-2** and **2-3.** In the proposed sequence of construction, the effluent pump station work will be completed prior to the construction of the new outfall. The proposed sequence is as follows:

Effluent Pump Station

- Close the isolation valve on the suction pipe to pump no. 2 and close existing 48- inch cone check valve on the force main connecting both north and south pumping units. Remove pump no. 2 and associated suction and discharge piping up to the existing 48- inch cone check valve. Install new pump nos. 1 and 2 and piping including branch run and isolation valve for future tie in into pump nos. 3 and 4 discharge piping. Connect new discharge piping to the existing outfall piping wye connection outside the pump station. This will require the installation of an isolation valve on the outfall.

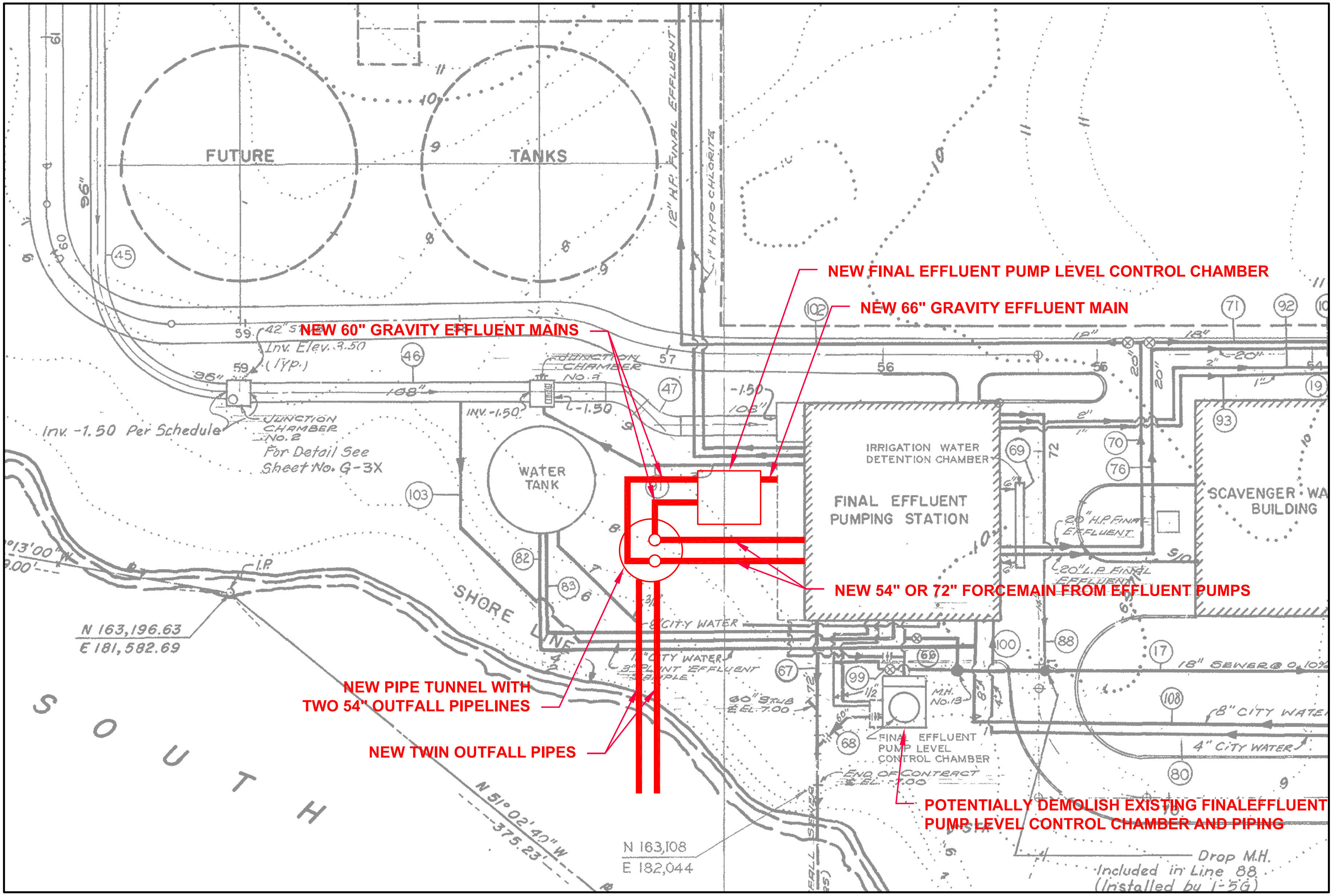


Figure No. 2-2
New Outfall Connection
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

U:\5175\39512\ FIG2-3 01/19/10 11:19 garveydj

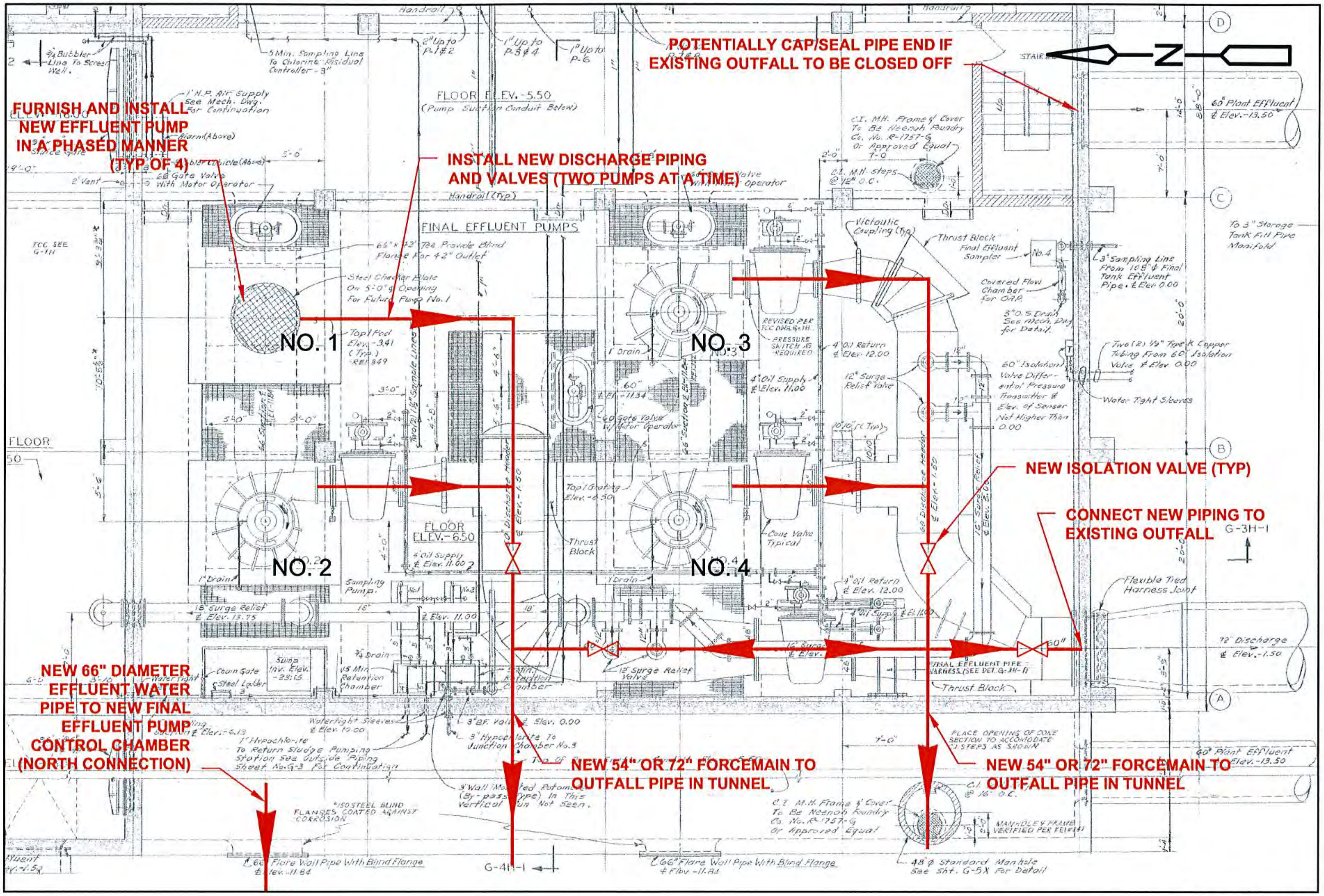


Figure No. 2-3
Revised Effluent Pump Station Piping
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

- Test and turn over for operation new pump nos. 1 and 2.
- Close the isolation valve on the suction pipe to pump nos. 3 and 4. Remove existing pump nos. 3 and 4 and associated suction and discharge piping up to the south wall of pump station. Install new suction and discharge piping.
- Test and turn over for operation new pump nos. 3 and 4.
- The operation of the effluent pump station will continue to be off of the existing level control chamber.

New Outfall

To continue to provide the County with the ability to flow by gravity, a new level control chamber must be provided. This work would be completed as the outfall tunnel is being completed. A new 66-inch gravity effluent main will be connected to the existing west suction conduit at the northern 66-inch flare pipe connection. The suction conduit will be isolated by closing the existing 96 by 96- inch sluice gate on its upstream end and the 60-inch gate valve on the downstream piping. Upon dewatering of the channel, the 66-inch blind flange will be removed and 66 inch piping and valving installed. The level control chamber will be constructed in conjunction with this pipe and valve installation and connected to the existing outfall.

Section 3
Alternatives Analysis

A variety of alternatives to replace the existing Bergen Point WWTP outfall are presented below. The purpose of this section of the Preliminary Engineering Design Report is to identify the outfall replacement alternative that:

- Can be implemented most cost-effectively;
- Will have the least adverse impact to the environment, considering both short-term construction and long-term operational effects;
- Can be implemented within five to seven years.

Six alternative approaches to convey the treated effluent from the Bergen Point WWTP to discharge have been identified for further consideration. Each of these alternatives is briefly described in the following pages. A summary of each alternative, including method of construction, construction-related and operational impacts, permit requirements and preliminary estimates of implementation schedule and capital and operating costs is provided.

3.1 Alternative 1 – Construct Replacement Outfall by Tunneling, with Carrier Pipes

Alternative 1 would replace the section of the existing outfall that extends from the Bergen Point WWTP south beneath Great South Bay to the barrier island by tunneling. On the barrier island, the new outfall would be connected to the existing ocean outfall to convey treated effluent to discharge. Most of the construction associated with this alternative would occur underground to avoid impacts to the Great South Bay and surrounding environment. The tunnel alternative would include an access shaft on each end of the outfall tunnel. The north shaft, which would serve as the launch or working shaft for the tunnel, would be located on Suffolk County property at the southwest side of the Bergen Point WWTP. The south, or exit shaft, would be located at Gilgo State Park on the barrier island just north of Ocean Parkway.

Figures 3-1a, 3-1b and 3-1c present schematic plans and profiles for three tunnel options being considered – ten foot inner diameter tunnel sloped north toward the plant, twelve foot inner diameter tunnel sloped south toward the barrier island and twelve foot inner diameter sloped north toward the plant. The overall length of the tunnel would be approximately 14,200 linear feet (lf). The results of the geotechnical program implemented during the winter of 2009, and described in Section 4 of this document, concluded that tunneling using a Tunnel Boring Machine (TBM) is the most feasible tunneling approach to replace the existing outfall. The tunnel would be driven from north to south, in either a slight upwards gradient or slight downwards gradient. The depth would vary from 45 to 75 feet depending on the gradient selected.

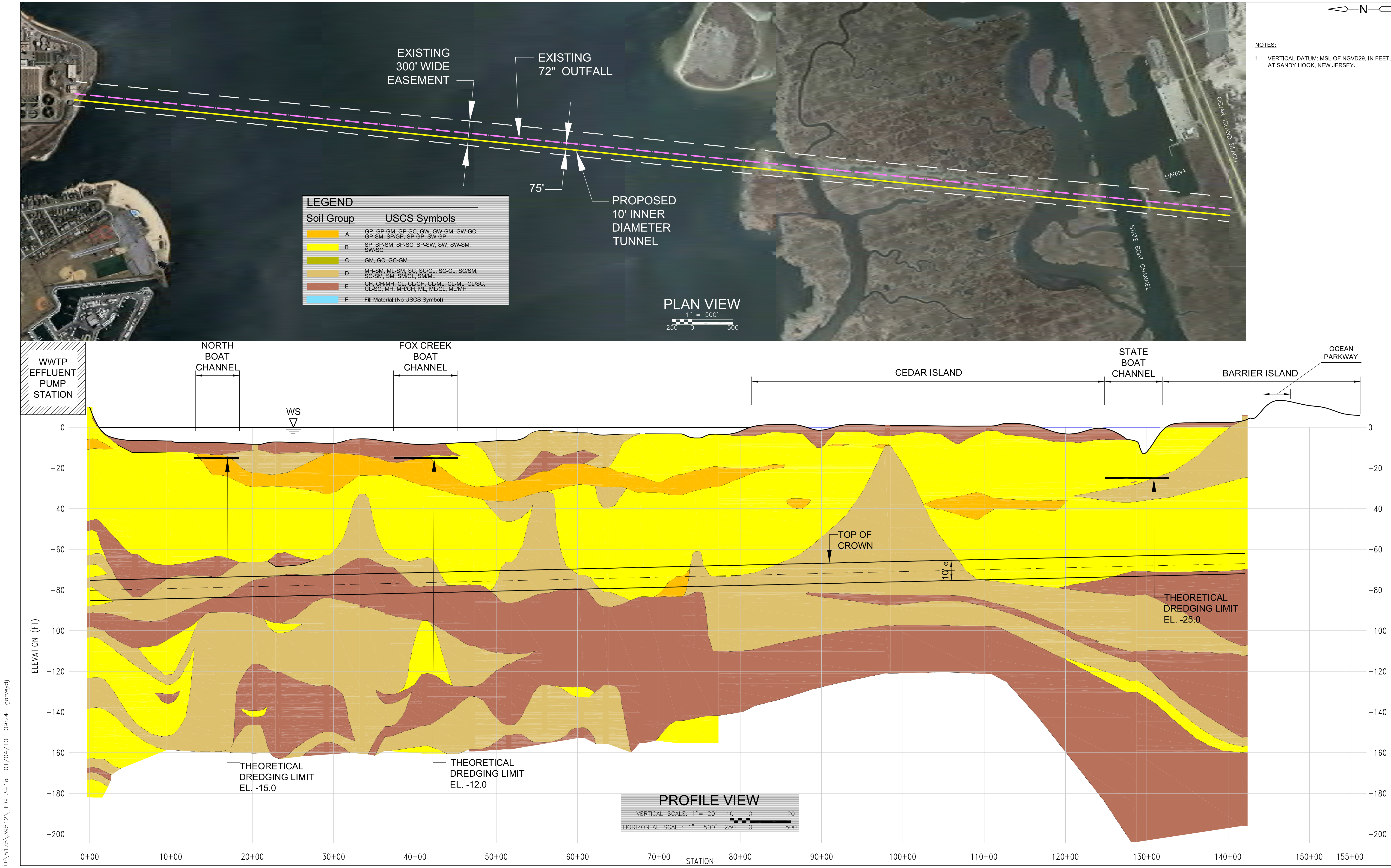


Figure 3-1a
Horizontal and Vertical Alignment of 10' Tunnel, Draining North
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

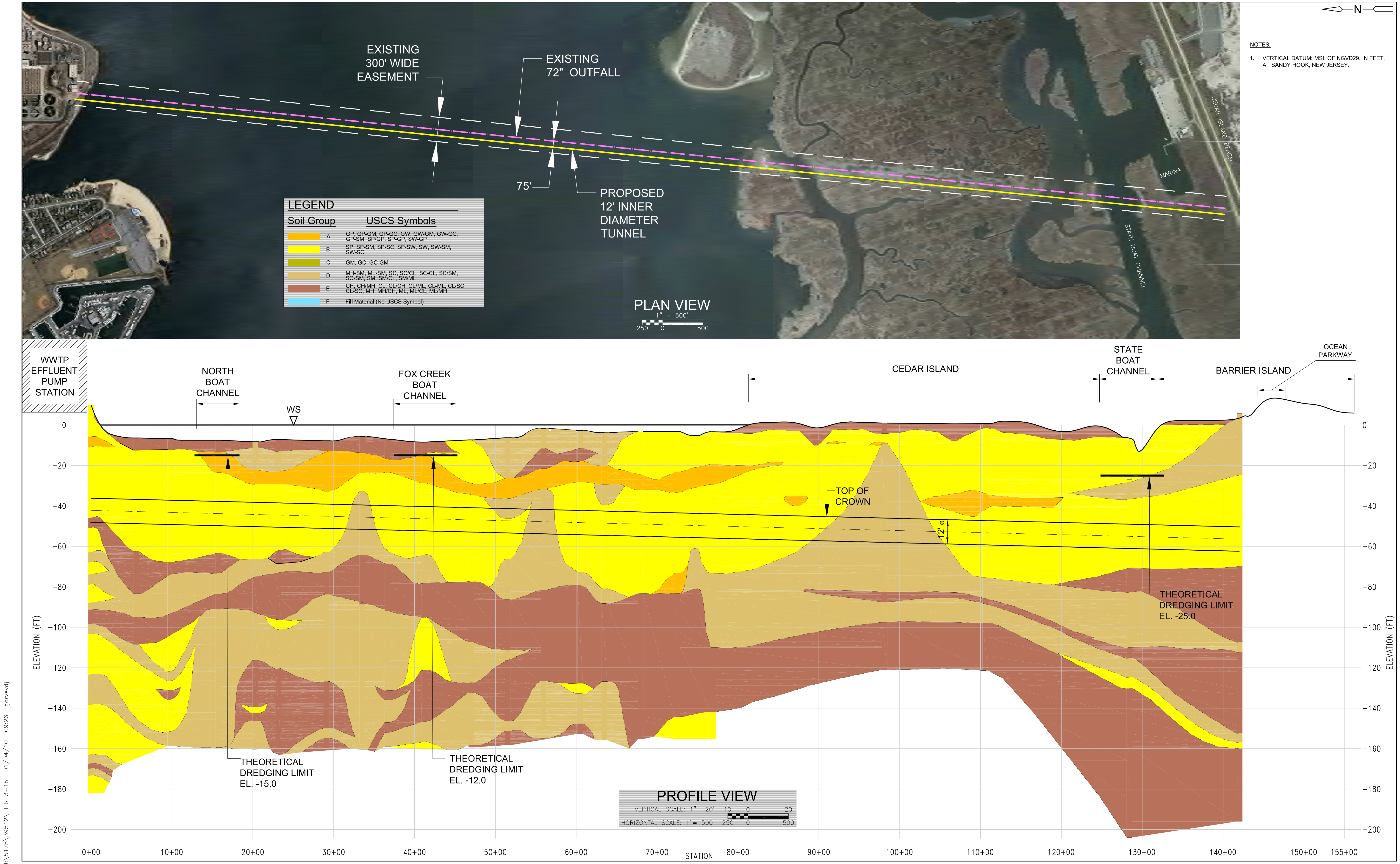


Figure 3-1b

Horizontal and Vertical Alignment of Proposed of 12' Tunnel, Draining South

Suffolk County Department of Public Works

Bergen Point WWTP Outfall Replacement Project

Engineering Report

CDM

consulting • engineering • construction • operations

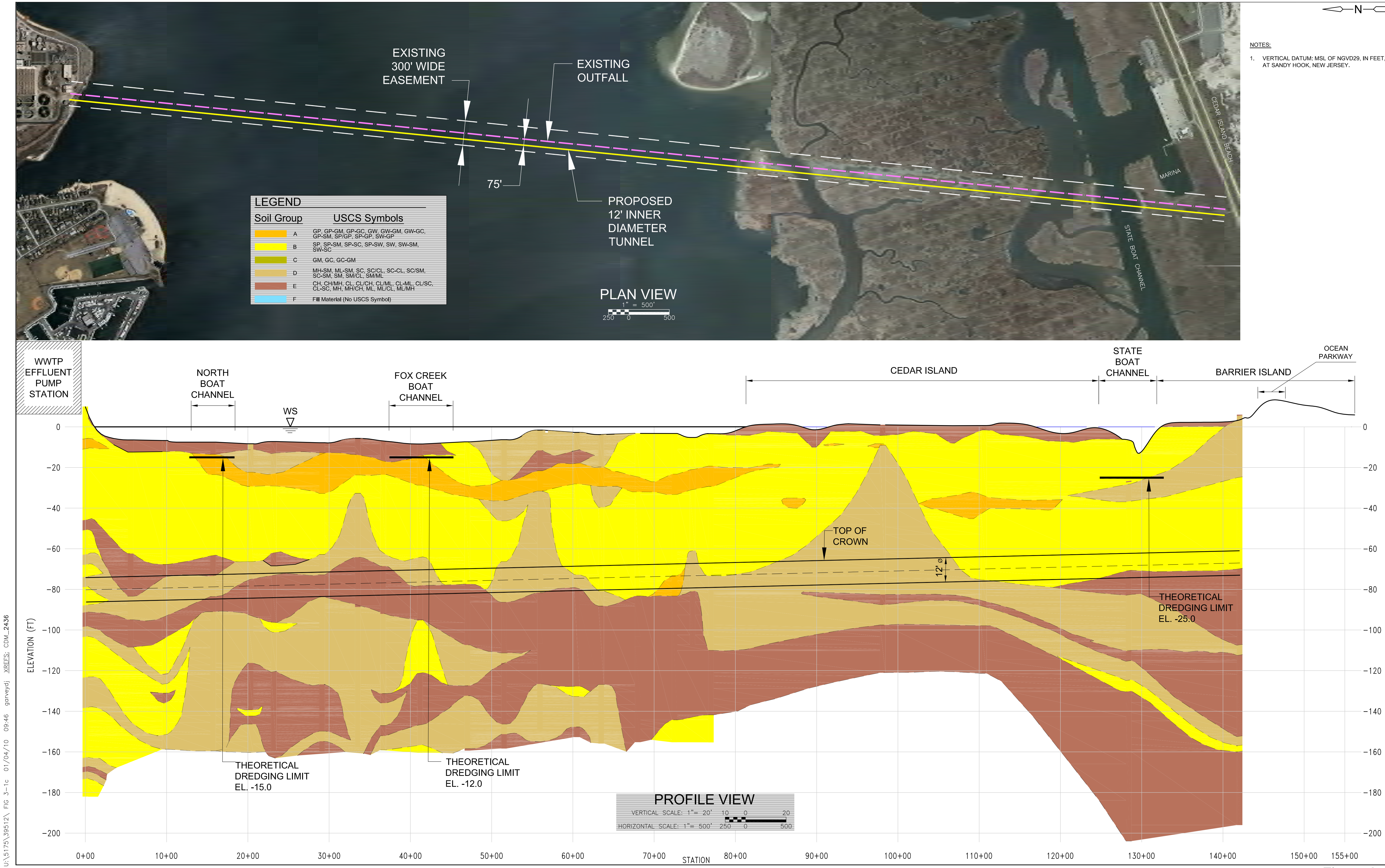


Figure 3-1c

Horizontal and Vertical Alignment of Proposed12' Tunnel-Draining North

Suffolk County Department of Public Works

Bergen Point WWTP Outfall Replacement Project

Engineering Report

CDM

consulting • engineering • construction • operations

3.1.1 Description of Alternative

3.1.1.1 Tunnel Construction

The vertical profile of the tunnel was established based on the dredge depths of the two boating channels, as shown on **Figure 3-1**. For constructability reasons, an adequate buffer zone between the bottom of the dredged channel and the tunnel crown must be maintained to provide the required pressure on the tunneling machine face. This buffer is critical during the tunnel construction period and is the most significant restriction on the vertical location of the tunnel. Based on soil data collected to date and laboratory testing, a tunnel depth of 2.5 tunnel bored diameters between dredge subgrade and tunnel crown is used, assuming a tunnel bored diameter of 12 or 14 feet (please see below).

The bored diameter of the tunnel was selected considering both the economical bored diameter to drive the tunnel, and the space needed to install the carrier pipe(s). For the tunnel drive, the contractor will consider the bored tunnel size based on the minimum size required for the carrier pipe(s) and the most economical size to transport crew and materials (lighting, ventilation and lining segments) to the tunnel heading and for removal of tunnel muck. Space within a tunnel is limited and haul times and related costs will need to be weighed against the TBM size, and the increased cost for a larger diameter tunnel. As a result of these considerations for a tunnel of approximately 14,200 linear feet, the minimum feasible inside diameter is 10 feet. The incremental cost increase that may be necessary to provide system redundancy is relatively small. The tunnel will be constructed using a TBM in soil (or in tunneling terms, as a soft ground tunnel).

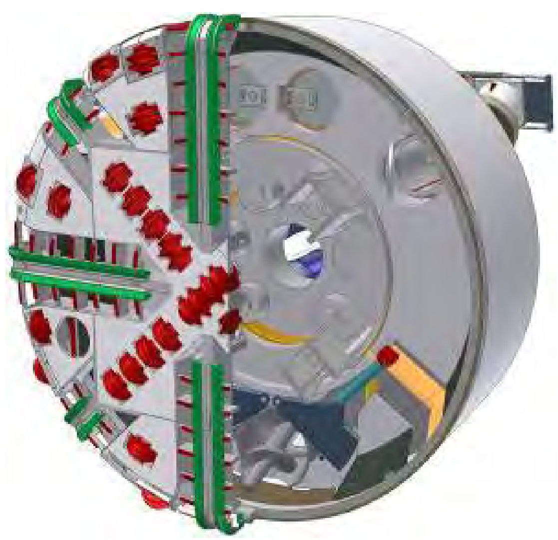


Figure 3-2
Face of Earth Pressure Balance TBM

The TBM required for this tunnel is a closed-face machine. There are two types of closed-face TBMs currently used in this country, the Earth Pressure Balance (EPB – TBM) shown in **Figure 3-2**, and the Slurry TBM. The closed-face means that the front end of the machine, called the heading, is closed, so a mechanism can be used to support the ground at the tunnel face. The face is the interface of the machine and the soil being excavated. The machine provides continuous support of the tunnel face by pressurizing a forward plenum chamber during tunnel excavation. The tunnel lining is then installed behind a bulkhead by a tunnel crew working in atmospheric conditions.

As soil is excavated, the exposed *in-situ* soil is subjected to unbalanced loads composed of soil and water. Under these conditions, the soil would flow into the tunnel. This is prevented by closing the face, and balancing the driving forces using a face shield that is controlled by pneumatic cylinders. The soil is excavated at the front of the TBM through a cased auger screw, as shown in **Figure 3-3**, deposited onto a conveyor belt, and then transferred to muck carts which transport the muck to the working or launch shaft and then out of the tunnel to the surface. The screw helps to reduce the pressure of the material from the higher pressures encountered at the tunnel face, to normal atmospheric pressure conditions existing within the tunnel. Limiting the screw rotation enables a pressure to be built up in the forward chamber that helps to support the tunnel face; providing the name "Earth Pressure Balance."

Figure 3-3
Screw Auger Depositing Tunnel Muck at Back Of Heading onto Conveyor Belt

By careful and continual monitoring of the face pressure (**Figure 3-4**) to balance the resisting force to maintain a stable heading and without applying excess pressure that can cause the soil to fail and result in disturbance to the Bay bottom, this tunnel can be driven without causing disturbance to the Bay. Today's tunneling machines are built to monitor these face conditions primarily because it means the safety to the workers in the tunnel and results in optimal economics to the contractor.

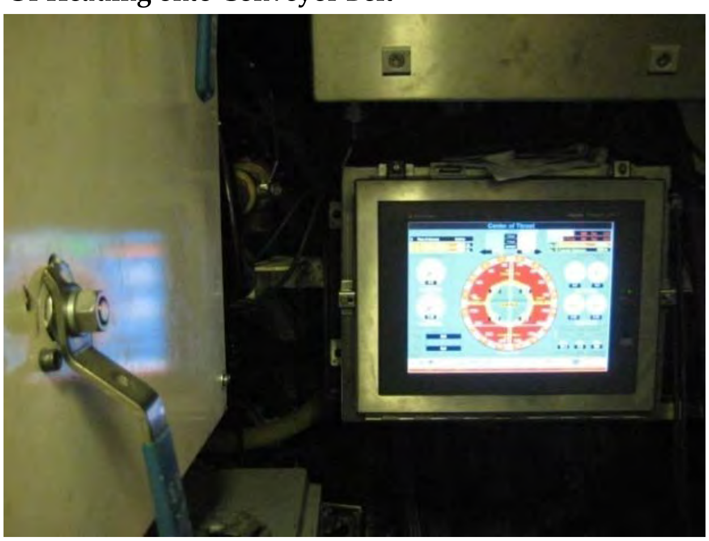


Figure 3-4
EBP-TBM Instrumentation Monitoring of Machine Loads and Location

The major components of an EPBM are shown on **Figure 3-5.**

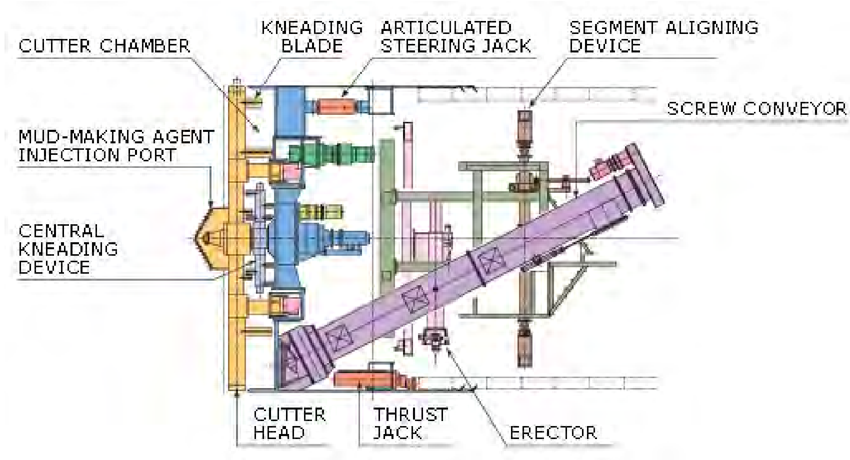


Figure 3-5 Major Components of Earth Pressure Balance Machine

As work is proceeding at the front of the TBM, a tunnel lining is installed within the tail of the machine. The subaqueous tunnel lining system consists of precast concrete ring segments with gaskets **(Figure 3-6)** that are assembled into a ring **(Figure 3-7).** The TBM then extends jacks against the newly assembled ring, exposing the ring to

Figure 3-6 (left) Stacked Precast Concrete Segments and Figure 3-7 (right) The Assembled Ring in the Tunnel with Lighting, Yellow Ventilation, Utility Pipes and Railroad Tracks in the Tunnel during Construction

the soil outside of the tunnel bore. As the tunnel is advanced in this manner, a cement grout is simultaneously injected through grout ports to fill the space between the outside of the ring and the soil to keep soil and water out of the tunnel. This process is repeated until the tunnel has been driven from one shaft to the other.

The TBM excavated diameter is determined considering the internal pipe diameter, sufficient space for placement and jointing of the carrier pipe(s), thickness of the tunnel lining, and the outer excavated annulus of the lining. In this case, either a single 72-inch diameter pipe or two 54-inch diameter pipes (for redundancy) would be considered.

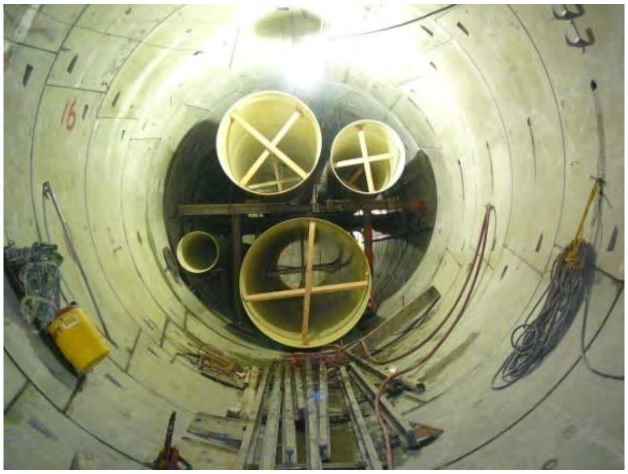


Figure 3-8
Stuffing the Tunnel with Carrier Pipes

After the tunnel has been completed from shaft to shaft, the next major construction activity will be to install the carrier pipe or pipes in the tunnel. As described in Section 2, welded steel pipe is the most feasible material to be used for the outfall carrier pipes. Based on the length of the tunnel, the pipe sections will be transported within the tunnel, and be installed in place by welding. This process is heavily influenced by the means and methods of the contractor. **Figure 3-8** shows how several different utility lines can be installed within a tunnel. In this particular 19.25-foot inside-diameter tunnel, four utilities pipes ranging in size from 12 inches to 72 inches were installed.

Figures 3-9 and **3-10** are conceptual cross-sectional views of a 72-inch diameter pipe installed within a 10-foot inner diameter tunnel, and two 54-inch diameter pipes installed within a 12-foot inner diameter tunnel respectively.

The preferred direction of a tunnel drive is up gradient. Tunneling in this direction provides the ability to drain the outfall pipe(s) back to the launch shaft at the treatment plant after the outfall pipe(s) is completed and in service. A slight up slope of 0.1% was selected as the gradient, since it is adequate for the long term function of draining the carrier pipe(s) within the tunnel and because it also provides the necessary slope for drainage during construction. Tunneling down gradient has also been evaluated, as described below.

3.1.1.2 Shaft Construction

To construct the tunnel, two shafts will be required, one on each side of Great South Bay. Shafts and staging areas are shown on **Figure 3-11**. The staging areas must be large enough to:

- Allow the TBM to be lowered into the shaft;
- Provide space for the shafts' equipment, tunnel lining material and excavated spoil removal;
- Provide space for construction equipment (e.g., cranes) and workshops;

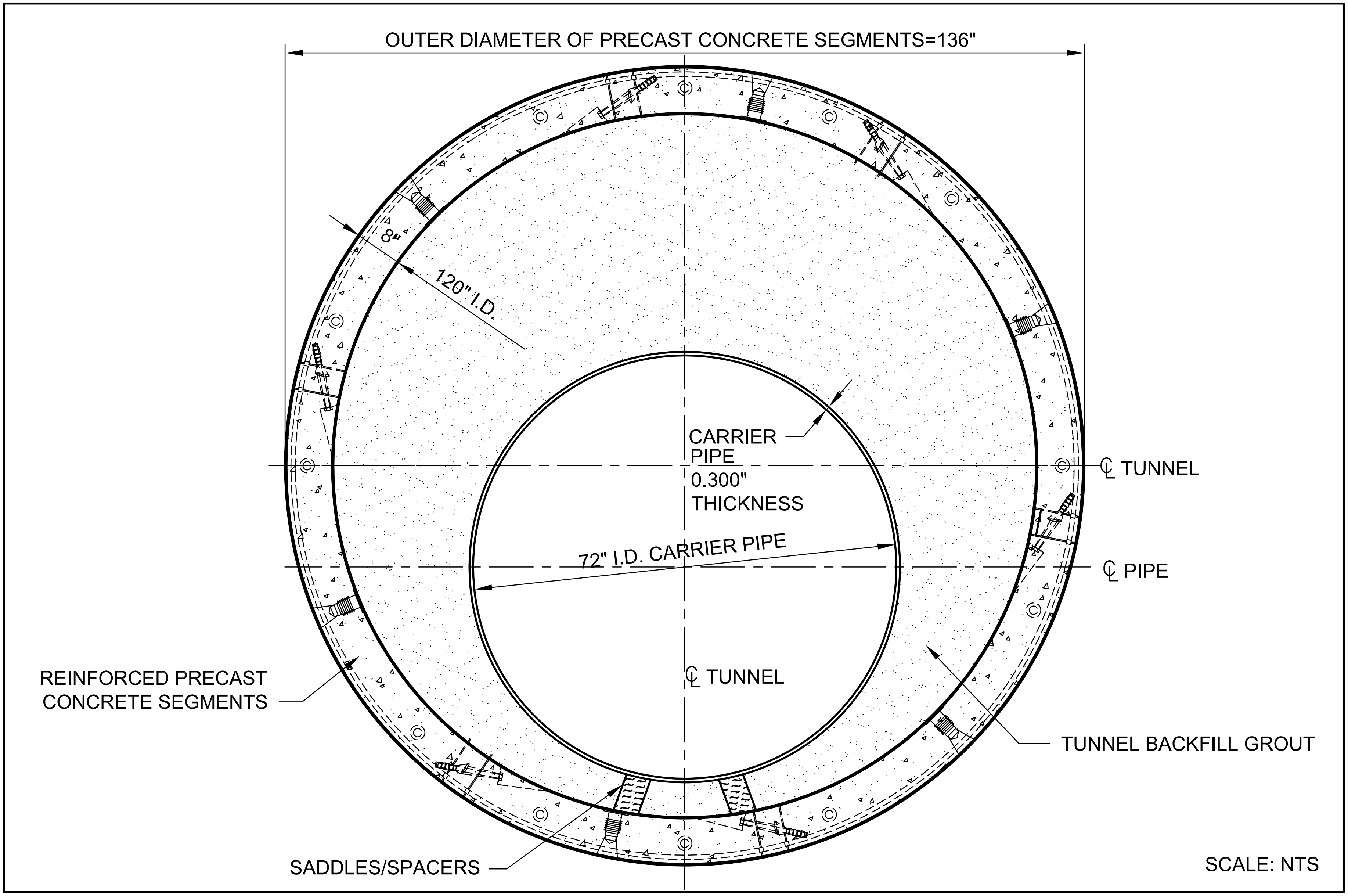


Figure No. 3-9
Single 72 Inch Outfall
Tunnel Detail
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

\\Wbysvr01\Cad3\5175\39512\ FIG 3-10 12/03/09 11:35 gencorellirj

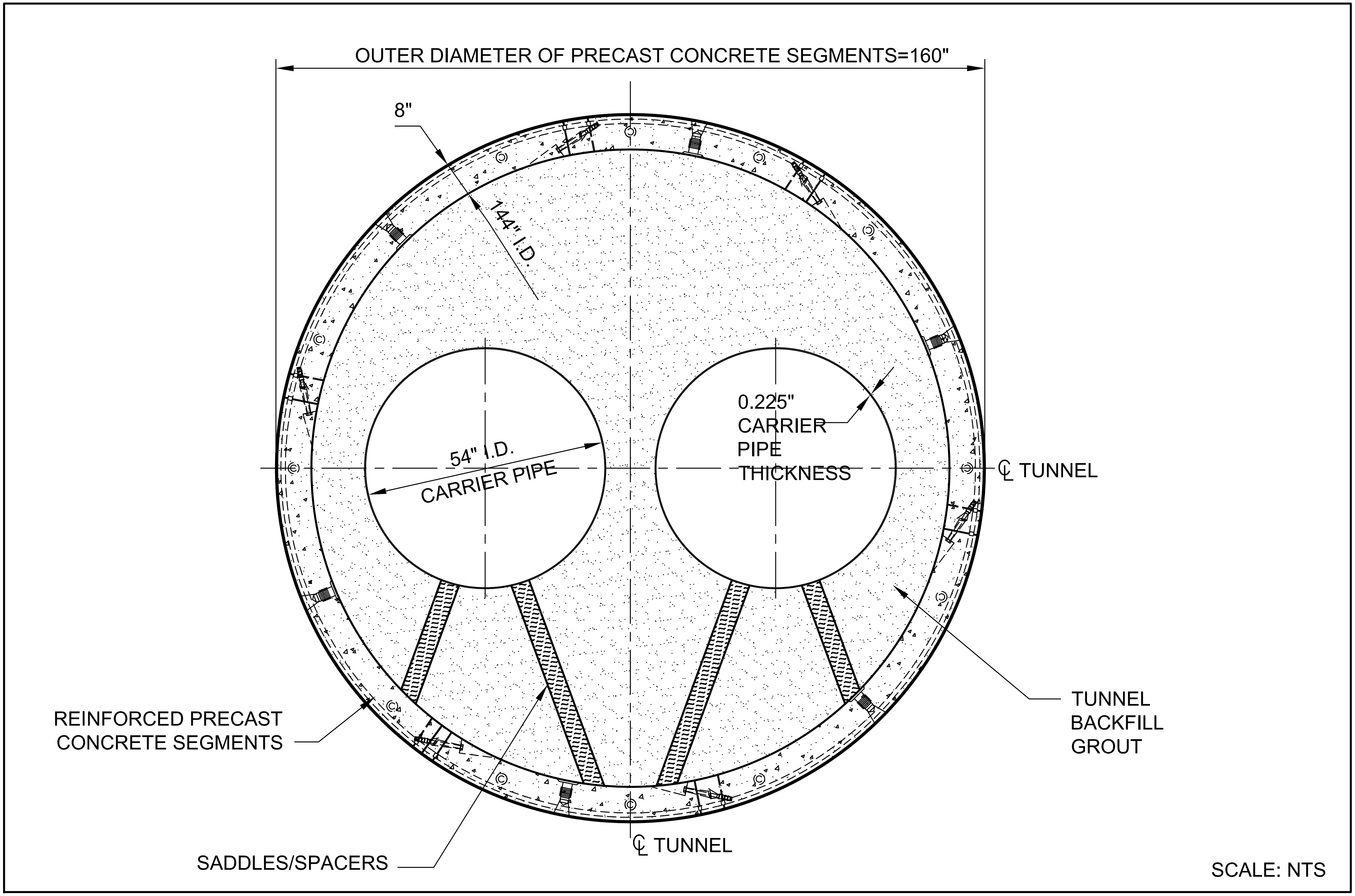


Figure No. 3-10
Dual 54 Inch Outfall
Tunnel Detail
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

\\Wbysvr01\Cad3\5175\39512\ FIG 3-11 12/03/09 10:01 gencorellirj XREFS: CDM_2436, CDM_2436(GTS)

CDM
consulting • engineering • construction • operations

Figure 3-11
Alternative 1
Approximate Locations of Working Shafts and Staging Areas
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

- Provide adequate power supply for the TBM and temporary utility connections for potable water, storm drainage, electricity;
- Access to the site for materials delivery.

It is anticipated that the staging area at the plant would be approximately 3 acres, and the staging area on the barrier island would be between 1 and 3 acres. The initial construction activity for the tunnel would be construction of a working tunnel shaft that will serve to set up the TBM and also to support the tunnel construction activities by providing a means of transporting both personnel and materials to the tunnel heading and a means of removing excavated soil or muck during the tunnel excavation. After the working shaft is completed, the contractor would likely hand mine a tail tunnel opposite to the direction of the tunnel drive. This tunnel would be used to extend the working area of the shaft at the bottom and would provide the room necessary to more efficiently move materials to the tunnel heading and expedite tunnel muck removal. The depth of the working shaft subgrade is from the ground surface to the bottom of the tunnel lining. One factor affecting the inside diameter of the shaft is the need to provide adequate working space to install the TBM. The shaft diameter is usually in the range of 2.5 to 3 times the outside diameter of the tunnel, or in this case approximately 35 feet. A similar process of excavating and supporting a second or exit shaft would be required to remove the TBM. Because there is less work associated with tunnel construction at the exit shaft, the diameter of this shaft is usually smaller than the working shaft diameter. There are several methods of making these excavations and supporting the walls of the excavation which are described in more detail in Appendix B.

3.1.1.3 Pipe Material and Installation

Based on the material analysis presented in Section 2.2, steel pipe with welded lap joints is the recommended material for the carrier pipes in the tunnel. Installation of the dual 54-inch pipes option is described in the following pages.

Pipe will be installed by segments in the tunnel. Due to the size of the tunnel working shaft, pipe sections would be a maximum of 25 feet in length. The dual steel 54-inch pipelines would be installed simultaneously. To maximize the space available in the tunnel, the dual pipes would be installed centered horizontally in the tunnel. Upon completion of the tunnel, the pipes will be brought in on the rail system and installed on temporary supports starting at the exit shaft and working north towards the work shaft. The rail system would be removed as the pipes are installed. The pipes will be grouted in place in segments and the process repeated until all piping is installed. **Figure 3-10** shows the dual pipe arrangement within the tunnel.

The total length of installation, including pipe lengths running vertically in the tunnel shafts and lengths to connect with the existing system at both ends, will be approximately 14,500 feet. With a dual 54-inch pipeline, the total length of steel pipe for a tunnel installation will be approximately 29,000 feet. Using 25-foot long pipe sections, a total of 580 pipe sections and a minimum of 579 joint welds will be required for each pipeline.

Joint welding will be performed on the inside of the pipe only. It is anticipated that welding of the full circumference of a single joint for the steel pipe can be completed in 6 hours. Including the time for lowering the pipe sections into the working shaft and inserting the pipe into the tunnel, the installation of each pipe segment will require approximately one man-day. It is assumed that one joint will be welded on each of the dual pipes at the same time, so that two welds will be completed in an eight-hour shift.

To maximize production and minimize the construction duration, it is assumed that the carrier pipes will be installed during two shifts per day, six days per week. Assuming that four joints will be welded per day, installation of the steel pipe would be completed in approximately 290 working days; installation and welding of the pipes will take approximately one year given some down time during pipe installation.

Forced ventilation will be required while construction activities are taking place within the tunnel. The ventilation will need to meet OSHA requirements for work in a confined space, underground construction and welding, cutting or other hot work. It is assumed that a minimum of six air changes per hour will need to be provided.

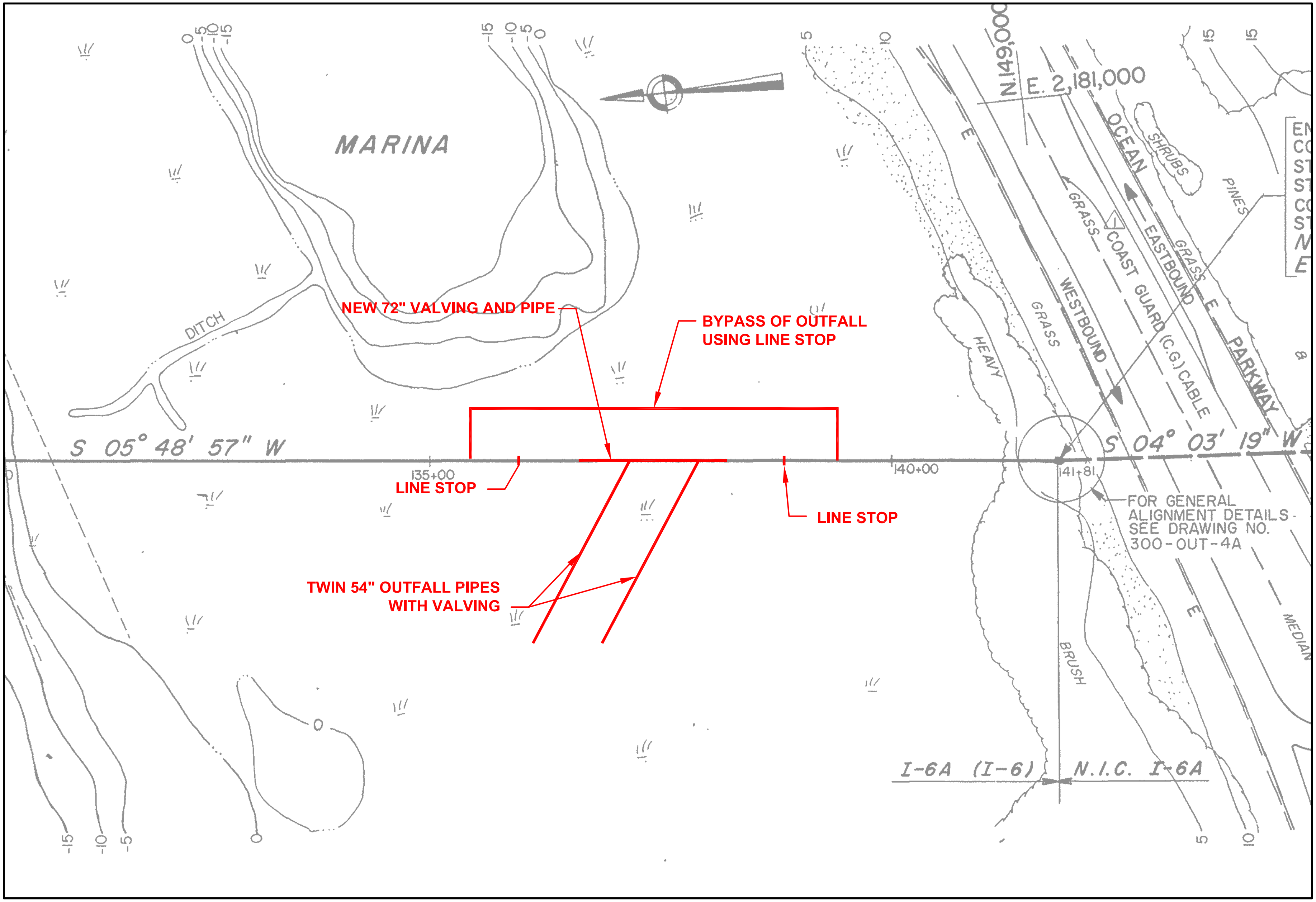
3.1.1.4 Connection to Existing Outfall

The outfall will connect to the existing ocean portion of the outfall near the existing sample chamber on the barrier island just north of the Ocean Parkway. The connection to the existing outfall must be made while it remains in operation. The connection will either be two 54-inch diameter pipes or a single 72-inch diameter pipe. To connect to the existing outfall, a bypass system with line stops will be installed as shown on **Figure 3-12**. The existing outfall would be tapped upstream and down-stream of the area of the new tunnelled outfall connection. The taps on each side of the work area are for a bypass connection and for a line stop. The bypass piping is installed followed by the line stops to direct the flow through the bypass piping and around the existing outfall piping to be removed and replaced. New piping with fittings and valving to isolate the new and existing outfalls would be installed and then the line stops and bypass piping removed and the exising outfall put back into normal operation. The tunnel outfall would then be connected to the existing outfall but the isolation valves will remain closed until the new outfall is ready for operation.

3.1.1.5 Disposal of Excavated Materials

Construction of the tunnel will generate a significant quantity of spoils that must be removed, managed and disposed. For the twelve-foot inner diameter upgradient driven tunnel, it is estimated that approximately 120,000 cubic yards of material will require disposal. It is anticipated that the materials removed from the sub-surface tunnel alignment will not be contaminated and could either be stock-piled on-site in

U:\5175\39512\ FIG3-12 01/20/10 11:27 garveydj



consulting • engineering • construction • operations

Figure 3-12
New Outfall Connection at Barrier Island
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

the spoils area for future use by the County, or transported off-site for disposal by the contractor.

3.1.2 Impacts

Impacts resulting from implementation of this alternative will be limited to short-term construction-related impacts in the shaft construction areas, as described below.

3.1.2.1 Short Term Construction Related Impacts

This alternative has been developed to avoid any direct construction-related impacts to Great South Bay. Most short-term construction related impacts would be limited to the shaft construction areas at the Bergen Point WWTP and on the barrier island. Increased truck traffic associated with delivery of construction materials to the shaft sites and removal of excavated soils from the site will be the most visible impact.

Using groundfreezing to provide lateral support of the excavation during shaft construction, a perimeter wall approximately 12 to 15 feet thick will be frozen for the full depth of the approximately 35-foot diameter shaft, extending down to the underlying clay stratum. After the excavation of the soils within the shaft is completed, and the concrete walls and mat are placed, the freeze system can be turned off. Within a period of 6 to 9 months after the system is turned off, the frozen soil wall will thaw and return to its natural condition. It is estimated that the total area disturbed by construction (e.g., for excavation, construction staging and materials storage) would be approximately three acres at the treatment plant site, and between one and three acres on the barrier island.

The tunnel drive itself will have no short term construction-related impacts, other than disposal of the excavated material. Excavated materials would be transported to the working shaft at the Bergen Point WWTP, and removed from the site for disposal. Maintenance of the TBM required during the drive would be performed from within the tunnel and inspections of the TBM face would be made by accessing the face through the tunnel.

3.1.2.2 Long Term Impacts

After construction is complete, treated effluent will continue to flow from the Bergen Point WWTP to ocean discharge, as has been the case for approximately thirty years. The construction staging and exit shaft area on the barrier island will be restored, except for manholes/valve pits and potentially, provision for a submersible pump connection for dewatering the tunnel piping, depending upon which way the tunnel is sloped. As a result of the on-going plant expansion and UV-disinfection programs that the County is implementing, all of the alternatives being considered will require additional energy for pumping to discharge. No other long term impacts are anticipated to result from implementation of this alternative.

3.1.3 Permit Requirements

Table 3-1 summarizes the permits that may be required for implementation of Alternative 1.

3.1.4 Schedule

A preliminary construction schedule for Alternative 1 is presented on **Figure 3-13**. Scheduled activities include:

- Pump Station Renovation
- TBM procurement
- Shaft construction
- TBM assembly
- Tunnel drive
- Lining installation
- Carrier pipe installation
- Grouting of annular space
- Site restoration

The schedule shown on **Figure 3-13** assumes that the project is completed in phases, with the pump station renovation bid and constructed first, and the outfall replacement notice to proceed to construction issued in 2015. Based on this schedule, the outfall replacement would be operational by the middle of 2019, or within approximately eight years.

One of the main factors influencing the schedule is procurement of a TBM. It is anticipated that a new machine would take between nine and twelve months for delivery to the site; use of a reconditioned machine could reduce this lead time

to six months. Use of a reconditioned machine should be evaluated during the risk management meeting, considering the main bearing life, required diameter availability and performance requirements associated with a reconditioned TBM. Shaft construction could take place simultaneously with TMB procurement. The schedule assumes that the shaft work and tunneling mobilization and carrier pipe installation will be performed during a 40-hour work week. It is assumed that pipe will be installed and welded two shifts per day, six days per week. During tunneling, it is assumed that the contractor will work twenty four hours a day, seven days a week; typically tunneling would progress for six days and scheduled maintenance and repairs would be accomplished on the seventh day.

Table 3-1

Potential Permits and Approvals for Alternative 1, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. Nationwide Permit 7 covers the construction/repair of an outfall while NWP 12 covers the installation of utility lines. Pre-construction notification is required to obtain coverage under these existing permits.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)

Table 3-1

Potential Permits and Approvals for Alternative 1, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
STATE				
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters. NYSDEC has issued/agreed to standard conditions associated with many of the NWP issued by ACOE.	Roger Evans, Regional Permit Administrator 631-444-0361
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
Air Registration	NYS Department of Environmental Conservation	Environmental Conservation Law Article 19 New York Code of Rules and Regulations Title 6, Part 200-203	Contractor maybe required to obtain permit for onsite generators required for ground freezing event on barrier island.	Roger Evans, Regional Permit Administrator 631-444-0361
Approval	NYS Parks – LI State	N.A.	Regulates access of parkland, including use	Scott Fish 631-669-1000

Table 3-1

Potential Permits and Approvals for Alternative 1, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
	Park Region		of commercial vehicles.	Michelle Somma Land Management and Regulatory Affairs Coordinator 631-321-3580
Divisible Load Permit Highway Work Permit for Utility Work	NYSDOT – Region 10	NYCRR Title 17, Part 126 – NYS Vehicle & Traffic Law Section 385 NY Highway Law Article 52	NYSDOT regulates the use of NYS roadways. Permit required by vehicles that exceed the road weight. Permit required to work within a NYS ROW &/or install MPTs	Gene Smith, Regional HWP Contact 631-952-6028
LOCAL				
Consultation	SCDPW		Approval of Plans and Specifications	John Donovan, Acting Chief Engineer 631-852-4204
Review and comment	SCDHS			Walter Hilbert, Chief, Office of Wastewater Management 631-852-5700 Walter Dawydiak, Chief Engineer Division of Environmental Quality 631-852-5800
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

Figure 3-13 Preliminary Schedule for Alternative 1, Construct Replacement Outfall by Tunneling with Carrier Pipes

3.1.5 Costs

Conceptual level capital costs were initially developed for the following three alternatives:

- **Alternative 1A -** 10-foot inner diameter tunnel with dedicated trains for support, tunneled downhill (gradient of -0.1%), one 72-inch diameter carrier pipe;

- **Alternative 1B** - 12-foot inner diameter tunnel with dedicated trains for support, tunneled downhill (gradient of -0.1%); two 54-inch diameter carrier pipes;

- **Alternative 1C** - 12-foot inner diameter tunnel with dedicated trains for support, tunneled uphill (gradient of 0.1%) two 54-inch diameter carrier pipes.

Because of the smaller diameter and less expensive cost assigned to the 10-foot TBM and associated costs for precast lining and grout filling costs, and the single pipe, Alternative 1A (10-foot diameter) was projected to be less expensive. However, there are risks involved with the installation of the carrier pipes because of the limited working space in the smaller size tunnel, and several constructability issues that will require further development as described below.

The conceptual cost for Alternative 1C was approximately one percent lower than the estimate for Alternative 1B; there is no significant difference in cost between the two alternatives at this stage of the design.

Tunneling downgradient reduces the depth of the working shaft, which reduced the cost for Alternative 1B, however, this benefit is offset by:

- Tunneling in more granular soil resulting in a higher cost for soil conditioners;

- Need for a more powerful train engine because the heavy load (muck removal) must be hauled up gradient; and

- The need to carry a pump and dewatering line along the full length of the tunnel to prevent the accumulated seepage water from causing problems at the heading.

The downgradient drive maintenance issue of having to dewater a carrier pipe by pumping the entire length of the outfall from shaft to shaft was not considered in this cost estimate comparison. The cost impact for the soil conditioning makes tunneling uphill more cost effective and reduces the risk for the personnel inside the tunnel during construction, as gravity moves the water out of the tunnel.

The preliminary estimated project cost for Alternative 1 (Alternative 1C, the 12-foot diameter tunnel with two 54-inch carrier pipes, the most cost-effective of the

Alternative 1 variations that includes the redundancy identified by the County), is summarized in **Table 3-2**.

Table 3-2
Preliminary Cost Estimate for Alternative 1 – Tunnel with Carrier Pipes

Project Component	12′
	(Uphill)
	($)
Pump Station	**$19,300,000**
Launch and Receiving Shafts	**$8,625,000**
Tunnel Boring Machine	**$20,000,000**
Tunnel Drive	**$110,000,000**
Pipe and Grouting	**$32,500,000**
Site Restoration	**$255,000**
Effluent Pump Station Connection	**$3,300,000**
Barrier Island Connection	**$850,000**
Subtotal	**$194,830,000**
Contingency @ 20%	**$38,966,000**
Total	**$233,796,000**
Escalation (2% for four years)	**$253,068,000**
Engineering (7%)	**$17,715,000**
Total Estimated Project Cost	**$270,783,000**

3.1.6 Summary of Advantages and Disadvantages

The primary advantages associated with implementation of Alternative 1 result from avoiding any direct impacts to Great South Bay – this is a significant benefit with respect to avoiding negative impacts on the Bay ecology, recreational users, and the local economy. Permitting requirements are significantly reduced. Avoiding construction within the Bay has a significant positive impact on the project schedule, as it reduces the impact of the Bay "no work" environmental windows that extend the duration of construction. At this time, it is anticipated that the only environmental window that will affect construction scheduling will be avoiding work within the barrier island shaft area in accordance with New York State Department of Environmental Conservation (NYSDEC) requirements. Compressing the project schedule and avoiding multiple contractor mobilizations/demobilizations also reduces project costs.

The primary disadvantages associated with implementation of Alternative 1 are the cost of the program, and that tunnel construction – and connection of the new section of the outfall to the existing system – are technically complex and challenging. However, the construction techniques associated with this work are proven and have been successfully used for years.

Several tunneling options were considered. The advantages and disadvantages of each are briefly summarized here. While a ten-foot inner diameter tunnel appears to be feasible and slightly less expensive than the twelve-foot diameter option, the following items need either further clarification or favor the larger diameter tunnel, to reduce the overall project risk:

- The width of the tunnel liner segments is estimated to be five feet; considering the smaller cross-sectional space of the 10-foot inner diameter tunnel, the height and/or width of the tunnel segments may prohibit passing of two trains at the bypass. California switches would need to be elevated to close to the springline of the tunnel, to provide sufficient width for passing of trains while the overhead room would be limited by the ventilation line in the crown of the tunnel. The alternative would be to use a limited width of trains to allow for the segments and muck cars to pass in the tunnel. Due to the space constraints in the smaller diameter tunnel, locomotives with sufficient power may not be available.

- Handling of the carrier pipes in the smaller diameter tunnel is more complicated.

- The smaller diameter tunnel will result in elongated muck cars. These will require a considerably longer tail tunnel, which requires an increased effort in ground freezing; this may not be feasible due to locations and load bearing characteristics of existing infrastructure near the work shaft.

Based on logistics and the ease of construction, the larger tunnel diameter is favorable; this alternative would also allow installation of two 54-inch pipes for redundancy.

3.2 Alternative 2 – Construct Replacement Outfall by Tunneling, No Carrier Pipes

Alternative 2 is a variation of tunnel Alternative 1 that would also replace the section of the existing outfall that extends from the Bergen Point WWTP south beneath Great South Bay to the barrier island by tunneling. The primary difference between Alternatives 1 and 2 is that no carrier pipes would be installed within the tunnel; the tunnel itself would serve as the outfall.

Most of the construction associated with this alternative would occur underground to avoid impacts to the Great South Bay and surrounding environment, although access shafts would be constructed on each end of the tunnel. The north shaft, which would serve as the launch or working shaft for the tunnel, would be located on Suffolk County property at the southwest side of the Bergen Point WWTP. The south, or exit shaft, would be located at Gilgo State Park on the barrier island just north of Ocean Parkway. On the barrier island, the new outfall would be connected to the existing ocean outfall to convey treated effluent to discharge.

3.2.1 Description of Alternative

3.2.1.1 Tunnel and Shaft Construction

Figures 3-14 provides a schematic plan and profile for Alternative 2, a ten foot inner diameter sloped north toward the plant. Tunnel and shaft construction would proceed in the same manner as described above in Section 3.1.1.1 and Section 3.1.1.2 with a ten foot inner diameter tunnel and a thirty foot diameter working shaft. The lined tunnel itself (as depicted above by **Figures 3-6** and **3-7**) would become the replacement outfall; no carrier pipes would be installed within the tunnel.

3.2.1.2 Connection to Existing Outfall

The outfall will be connected to the existing ocean portion of the outfall near the existing sample chamber on the barrier island just north of the Ocean Parkway. Because the connection to the existing outfall must be made while it remains in operation, a bypass system with line stops will be installed as shown above on **Figure 3-12**. The existing outfall would be tapped upstream and down-stream of the area of the new tunnelled outfall connection for a bypass connection and for a line stop. The bypass piping is installed followed by the line stops to direct the flow through the bypass piping and around the existing outfall piping to be removed and replaced. New piping with fittings and valving to isolate the new and existing outfalls would be installed, the line stops and bypass piping removed and the exising outfall put back into normal operation. The tunnel outfall would then be connected to the existing outfall but the isolation valves will remain closed until the new outfall is ready for operation.

3.2.1.3 Disposal of Excavated Materials

Construction of the tunnel will generate a significant quantity of spoils that must be removed, managed and disposed. For the ten-foot inner diameter upgradient driven tunnel, it is estimated that approximately 90,000 cubic yards of material will require disposal. It is anticipated that the materials removed from the sub-surface tunnel alignment would not be contaminated and could either be stock-piled on-site in the spoils area for future use by the County, or transported off-site for disposal by the contractor.

3.2.2 Impacts

Impacts resulting from implementation of this alternative will be limited to short-term construction-related impacts in the shaft construction areas, as described below.

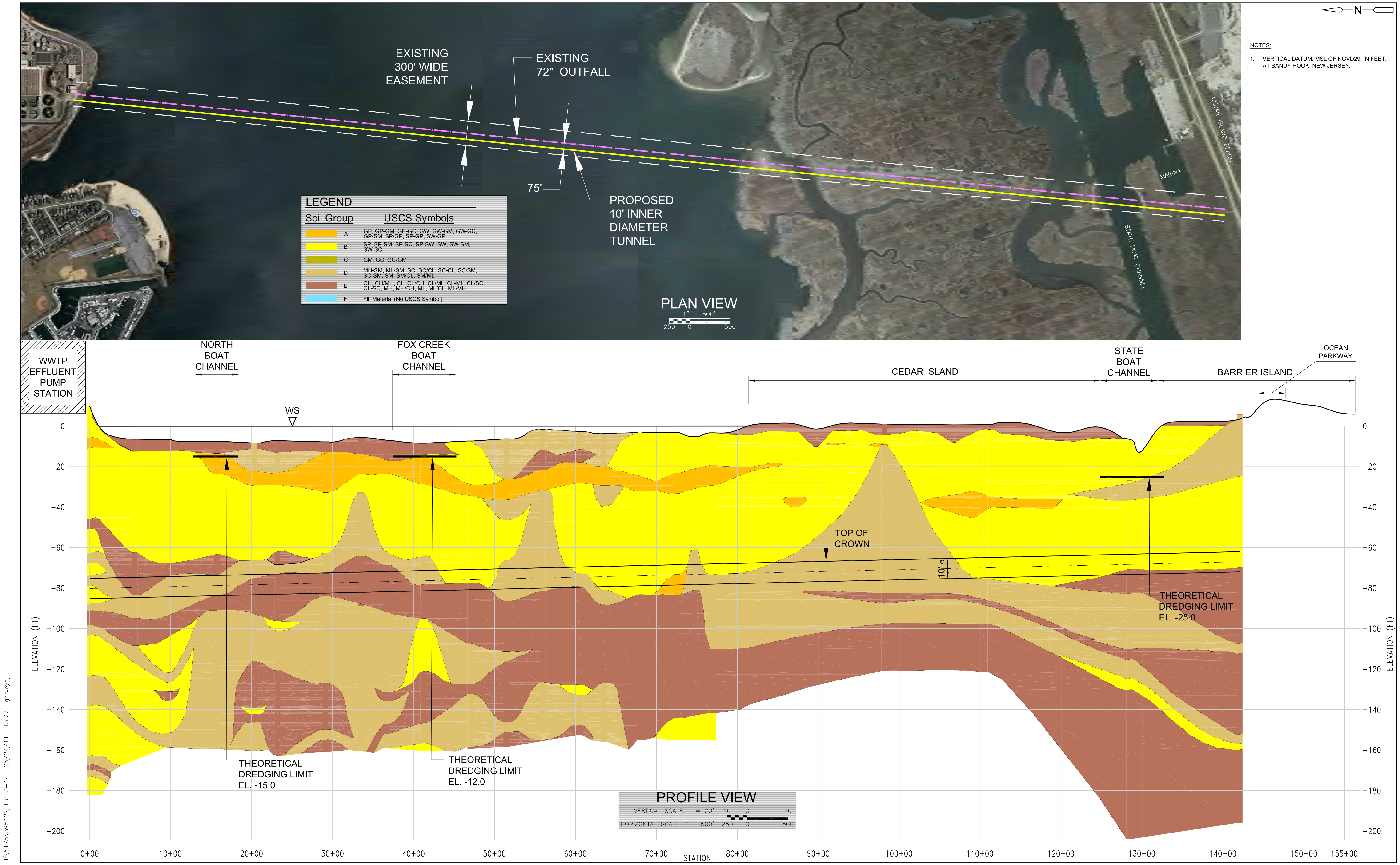


Figure 3-14
Alternative 2 - Horizontal and Vertical Alignment of 10' Tunnel
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

3.2.2.1 Short Term Construction Related Impacts

Like Alternative 1, this alternative has been developed to avoid any direct construction-related impacts to Great South Bay. Most short-term construction related impacts would be limited to the shaft construction areas at the Bergen Point WWTP and on the barrier island. The increased truck traffic associated with delivery of construction materials to the shaft sites and transportation of excavated soils from the site will be the most visible impacts.

Using groundfreezing to provide lateral support of the excavation during shaft construction as described above, a perimeter wall approximately 12 to 15 feet thick will be frozen for the full depth of the approximately 30-foot diameter shaft, extending down to the underlying clay stratum. After the excavation of the soils within the shaft is completed, and the concrete walls and mat are placed, the freeze system can be turned off. Within a period of 6 to 9 months after the system is turned off, the frozen soil wall will thaw and return to its natural condition. It is estimated that the total area disturbed by construction (e.g., for excavation, construction staging and materials storage) would be approximately three acres at the treatment plant site, and between one and three acres on the barrier island.

The tunnel drive itself will have no short term construction-related impacts, except for disposal of the excavated material. Excavated materials would be transported to the working shaft at the Bergen Point WWTP, and removed from the site for disposal. Maintenance of the TBM required during the drive would be performed from within the tunnel and inspections of the TBM face would be made by accessing the face through the tunnel.

3.2.2.2 Long Term Impacts

After construction is complete, treated effluent will continue to flow from the Bergen Point WWTP to ocean discharge, as has been the case for approximately thirty years. The construction staging and exit shaft area on the barrier island will be restored, except for manholes/valve pits. As a result of the on-going plant expansion and UV-disinfection programs that the County is implementing, all of the alternatives being considered will require additional energy for pumping to discharge. No other long term impacts are anticipated to result from implementation of this alternative.

3.2.3 Permit Requirements

Table 3-3 summarizes the permits that may be required for implementation of Alternative 2.

3.2.4 Schedule

A preliminary construction schedule for the shafts and tunnel work is presented on **Figure 3-15;** use of the tunnel as the outfall, in lieu of installing carrier pipes is estimated to reduce the construction schedule by just over one year. The schedule shown on **Figure 3-15** assumes that the project is completed in phases, with the pump station renovation bid and constructed first, and the outfall replacement notice to

Table 3-3

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. Nationwide Permit 7 covers the construction/repair of an outfall while NWP 12 covers the installation of utility lines. Pre-construction notification is required to obtain coverage under these existing permits.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)

Table 3-3

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

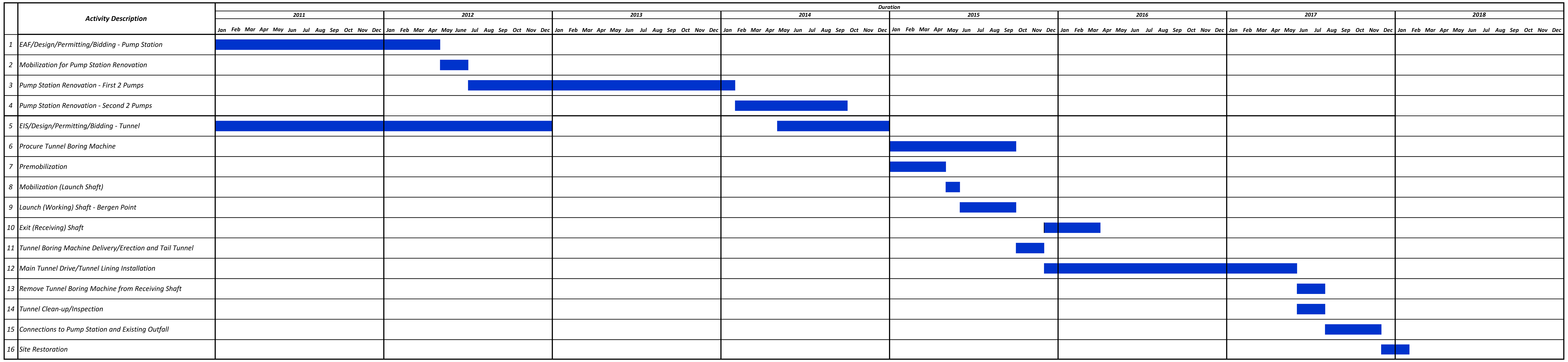
PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
STATE				
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters. NYSDEC has issued/agreed to standard conditions associated with many of the NWP issued by ACOE.	Roger Evans, Regional Permit Administrator 631-444-0361
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
Air Registration	NYS Department of Environmental Conservation	Environmental Conservation Law Article 19 New York Code of Rules and Regulations Title 6, Part 200-203	Contractor maybe required to obtain permit for onsite generators required for ground freezing event on barrier island.	Roger Evans, Regional Permit Administrator 631-444-0361
Approval	NYS Parks – LI State	N.A.	Regulates access of parkland, including use	Scott Fish 631-669-1000

Table 3-3

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
	Park Region		of commercial vehicles.	Michelle Somma Land Management and Regulatory Affairs Coordinator 631-321-3580
Divisible Load Permit Highway Work Permit for Utility Work	NYSDOT – Region 10	NYCRR Title 17, Part 126 – NYS Vehicle & Traffic Law Section 385 NY Highway Law Article 52	NYSDOT regulates the use of NYS roadways. Permit required by vehicles that exceed the road weight. Permit required to work within a NYS ROW &/or install MPTs	Gene Smith, Regional HWP Contact 631-952-6028
LOCAL				
Consultation	SCDPW		Approval of Plans and Specifications	John Donovan, Acting Chief Engineer 631-852-4204
Review and comment	SCDHS			Walter Hilbert, Chief, Office of Wastewater Management 631-852-5700 Walter Dawydiak, Chief Engineer Division of Environmental Quality 631-852-5800
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

Figure 3-15 Preliminary Schedule for Alternative 2, Construct Replacement Outfall by Tunneling



proceed to construction issued in 2015. If the project is bid as shown, the outfall replacement would be operational by early 2018, or within approximately seven years.

Construction activities include:

- Pump station renovation
- TBM procurement
- Shaft construction
- TBM assembly
- Tunnel drive
- Lining installation
- Site restoration

As described above, one of the main factors influencing the schedule is the procurement of a TBM. It is anticipated that a new machine would take between nine and twelve months for delivery to the site; if a reconditioned machine is used, this time period could be reduced to six months. Use of a reconditioned machine should be evaluated during the risk management meeting, as the main bearing life, required diameter availability, and performance requirements associated with a reconditioned machine should all be considered.

Shaft construction could take place simultaneously with TMB procurement. The schedule assumes that the shaft work and tunneling mobilization will be performed during a 40-hour work week. During tunneling, it is assumed that the contractor will work twenty four hours a day, seven days a week; typically tunneling would progress for six days and scheduled maintenance and repairs would be accomplished on the seventh day.

3.2.5 Costs

Conceptual costs were developed assuming a 10-foot inner diameter tunnel with dedicated trains for support, tunneled uphill (gradient of 0.1%).

The total preliminary estimated project costs (including a 20 percent contingency) are summarized on **Table 3-4**.

Table 3-4
Preliminary Cost Estimate for Alternative 2 - Tunnel

Project Component	10-foot Diameter Tunnel
	($)
Pump Station	**$19,300,000**
Launch and Receiving Shafts	**$8,625,000**
Tunnel Boring Machine	**$20,000,000**
Tunnel Drive	**$110,000,000**
Site Restoration	**$255,000**
Effluent Pump Station Connection	**$3,300,000**
Barrier Island Connection	**$850,000**
Subtotal	**$162,330,000**
Contingency @ 20%	**$32,466,000**
Total	**$194,796,000**
Escalation (2% for four years)	**$210,853,000**
Engineering (7%)	**$14,759,000**
Total Estimated Project Cost	**$225,612,000**

The estimated probable project cost, escalated to the midpoint of construction for Alternative 2 is $225,612,000.

3.2.6 Summary of Advantages and Disadvantages

As with Alternative 1, the primary advantages associated with implementation of Alternative 2 result from avoiding any direct impacts to Great South Bay – this is a significant benefit with respect to avoiding negative impacts on the Bay ecology, recreational users, and the local economy. Permitting requirements are significantly reduced. Avoiding construction within the Bay has a significant positive impact on the project schedule, as it reduces the impact of the Bay “no work” environmental windows that extend the duration of construction. At this time, it is anticipated that the only environmental window that will affect construction scheduling will be avoiding work within the barrier island shaft area in accordance with NYSDEC requirements. Compressing the project schedule and avoiding multiple contractor mobilizations/demobilizations also reduces project costs.

The primary disadvantages associated with implementation of Alternative 2 are the cost of the program, and that tunnel construction – and connection of the new section of the outfall to the existing system – are technically complex and challenging. However, the construction techniques associated with this work are proven and have been successfully used for years.

Because workers will not need to access the tunnel for pipe installation and joining, it is assumed that a ten-foot inner diameter tunnel will be the most feasible and economical size to implement. Removal of the piping from the tunnel results in reduction of both the project cost and project schedule that were presented for Alternative 1.

3.3 Alternative 3 – Construct Replacement Outfall by Open Cut Method

Alternative 3 would construct the approximately 14,500 foot long portion of the replacement outfall by an open cut method. Like Alternatives 1 and 2, the replacement portion of the outfall would bypass the existing 72-inch Price Brothers pre-stressed concrete cylinder pipe (PCCP) portion of the outfall between the Bergen Point WWTP site and the barrier island. Valves would be installed on the existing PCCP to divert flow to the replacement outfall. **Figure 3-16** depicts the replacement outfall configuration in plan and profile.

Construction of a replacement outfall across the Great South Bay by an open cut method presents a number of challenges due to several limiting constraints. Two of the most challenging constraints are the shallow 2 to 5 foot water depth across the Bay and the window of time established by NYSDEC during which no work can be performed in the Bay.

The shallow depth of the Bay limits the types of vessels that could be used and thus affects the methods of construction and the duration of construction activities. NYSDEC has established work windows to protect the various aquatic and bird species that use Great South Bay. Work on the length of outfall buried beneath the Bay is prohibited from January 15th through September 30th each year, to protect the spawning and early life stages of shellfish and of important finfish species such as the winter flounder. This reduces the window during which construction could proceed to the three and a half month period beginning October 1 and ending January 14. Adherence to the no-work window allows a total of 106 calendar days or 15 weeks for all in-water work to take place each year.

In addition, based upon the reported presence of bird or animal species of concern, additional no-work windows could be established to protect the habitat along the south end of the alignment on, or in the vicinity of Cedar Island and/or the Barrier Island. The Fish and Wildlife Service has identified Great South Bay as a significant coastal habitat, and the northern harrier, a threatened species, has been documented to over- winter in the area in the past. If wintering grassland bird species such as the northern harrier or short-eared owl were found to over-winter in the area, work would be prohibited for a longer period, leaving an even shorter window for excavation, pipe installation and testing and back-filling.

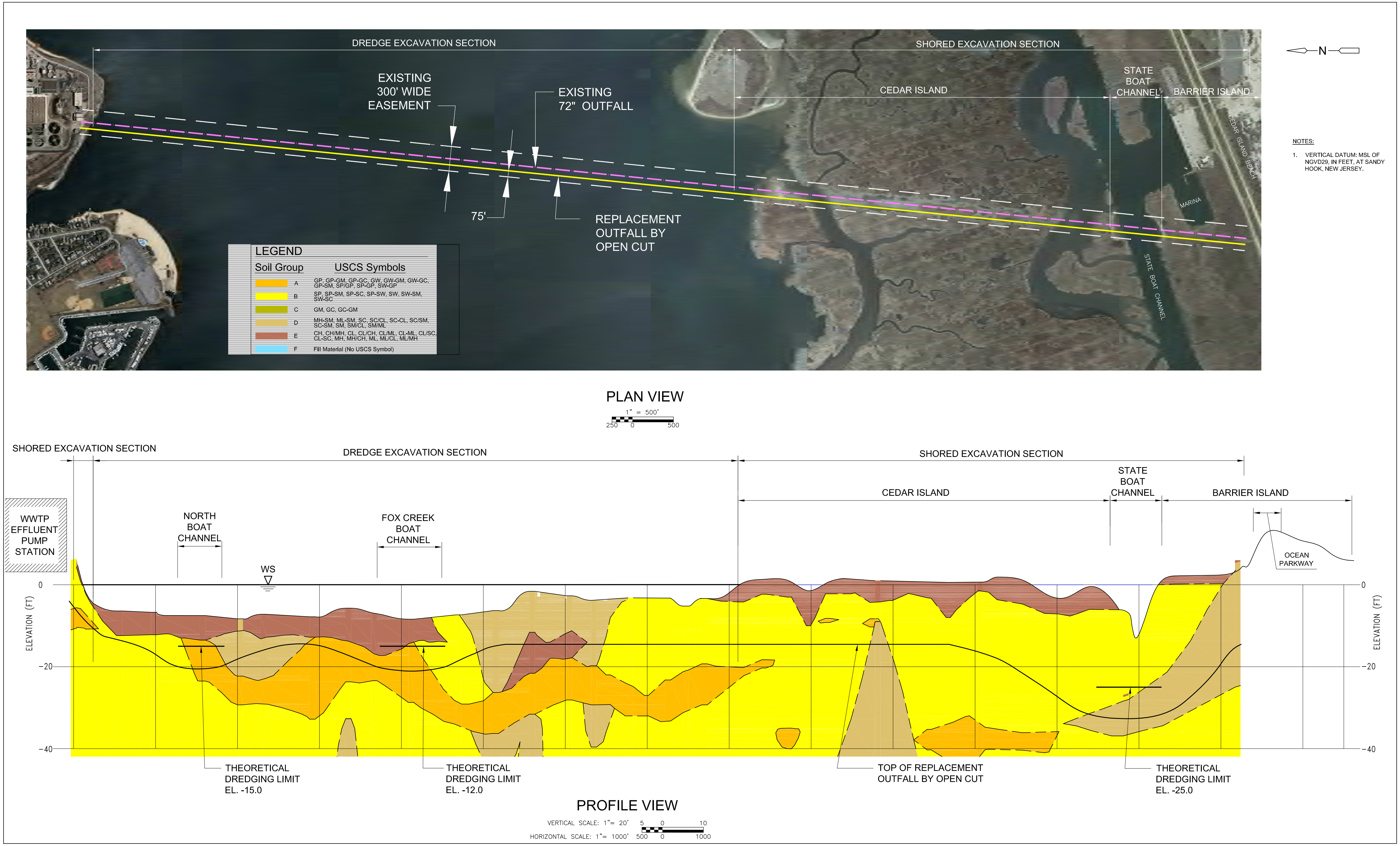


Figure 3-16
Alternative 3
Replacement Outfall by Open Cut
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

3.3.1 Description of Alternative

3.3.1.1 Size and Number of Pipes

Similar to Alternative 1, the two potential options for the replacement outfall are either a single 72-inch pipe or dual 54-inch pipes. The preliminary hydraulic analysis conducted as the basis for selection of either the single pipe or the dual pipe option is presented in section 2.1. Selection of either single or dual pipe, and the final selection of the pipe material, will determine the final dimensions of the open cut excavation as well as the scheduled duration of the work. Based on preliminary discussions with the County, dual 54-inch ductile iron pipes providing redundancy have been assumed.

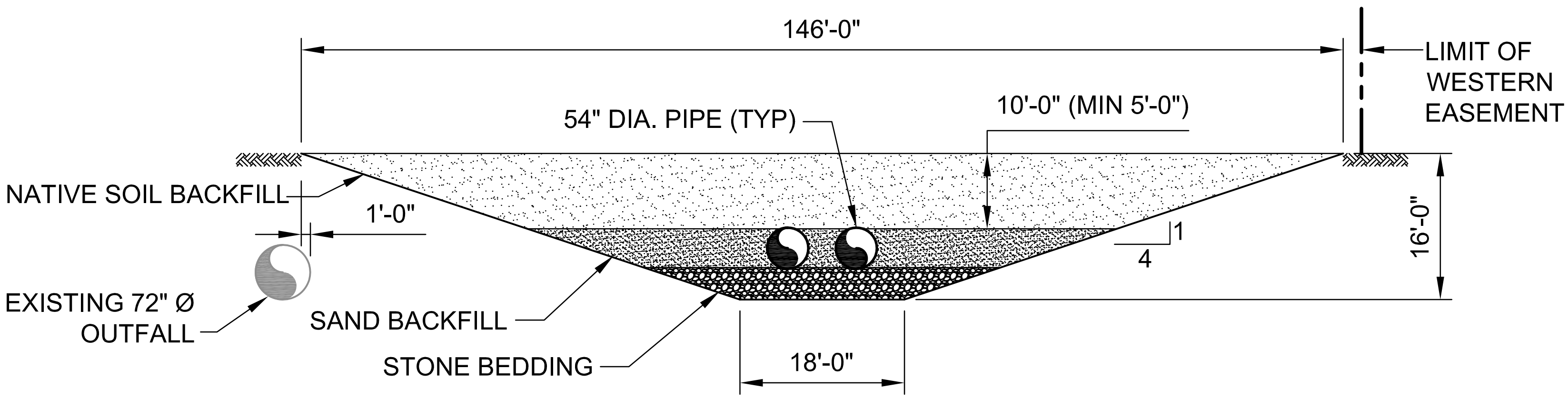
3.3.1.2 Replacement Outfall Alignment

To be in alignment with the treatment plant's effluent pump station, the replacement outfall would be constructed within the existing easement to the west of the existing outfall. As the existing outfall is situated at the approximate center of the 300-foot easement, the replacement outfall consisting of dual 54-inch pipes would be centered approximately 75 feet west of the existing outfall and would run parallel to the existing 72-inch outfall between the plant site and the barrier island. The pipe alignment would start just west of the existing effluent pump station and run due south across the Great South Bay to Cedar Island and the State Boat Channel, and would end approximately 1,100 feet into the barrier island in the vicinity of station 141+81 which marks the end of the Price Brothers pipe. The new outfall piping would be installed with a minimum of five feet of cover above the crown of the pipes, and so would also parallel the vertical alignment of the existing outfall, including vertical deviations in the pipeline to cross below the North Boat Channel, the Fox Creek Boat Channel and the State Boat Channel.

Use of two open cut excavation methods would be required for the approximately 14,500-foot replacement outfall – the shored excavation method and hydraulic dredging of the open cut using the segmental construction method to lay the pipes are assumed. The shored excavation method would be used across Cedar Island and for a short distance on the north side of the barrier island for the connection to the existing outfall pipeline from the plant. The shored excavation length is estimated at approximately 6,500 linear feet and the open cut portion of the alignment is approximately 8,000 linear feet. **Figure 3-16** shows the plan and profile along this alignment using the combination of shored excavation and open cut construction. The subaqueous open cut portion of the alignment would be excavated using hydraulic dredging. The longest portion of the construction would be the subaqueous portion, consisting of two distinct crossings, the Great South Bay and the State Boat Channel shown on **Figure 3-16. Figure 3-17** shows a cross section view of the subaqueous open cut portion of the alignment constructed using hydraulic dredging.

3.3.1.3 Subaqueous Crossings by Open Cut

The principal activities required for construction of the subaqueous portion of the replacement outfall by open cut are dredging, material handling, pipe installation and



NOTE:

ACTUAL SLOPES WOULD VARY FROM 3:1 TO 5:1 DEPENDING ON CONDITIONS.
MID-RANGE VALUE OF 4:1 IS DEPICTED

CDM
consulting • engineering • construction • operations

Figure 3-17
Dredged Trench Dimensions
Dual 54-inch Pipes
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

backfilling/restoration. Dredging will be used to excavate the pipe trench. Material handling is associated primarily with holding, backfilling and disposal of the spoil removed during the dredging operation, as well as transporting, staging and positioning the pipe materials. Pipe installation will involve the assembly, joining and lowering of the pipe sections into the excavation, as well as testing of the installed pipe.

Excavation Alignment and Geometry

The excavation for the replacement outfall would follow an alignment parallel to the existing outfall pipe through the western half of the existing outfall easement. The location of the existing outfall at the center of the easement limits installation of new piping to the 150-foot corridor west of the existing outfall. The dual pipes will be aligned at the center of the western half of the easement, approximately 75 feet west of the existing 72-inch outfall. This alignment crosses the Bay, the State Boat Channel and similar upland terrain as the existing outfall.

The depth of the subaqueous trench would be approximately 16 feet, to allow provision of a minimum of 5 feet of cover. To accommodate two 54-inch pipes with a minimal three-foot separation distance, and sufficient space along the sides of the pipes, the bottom of the trench would need to be approximately 18 feet wide. The width of disturbance of the work area is estimated based on the expected width of the opening at the top of the trench. The width at the top is determined by the expected angle of repose of the subaqueous soil. Conditions within the Bay indicate that an average slope ranging between 3H:1V to 5H:1V would be an attainable angle of repose with the fine sand found generally on the south shore of Long Island. The required width at the top of the trench would range between 114 and 178 feet, based upon the trench side slope. A 5H:1V (or even 4H:1V) side slope would result in the eastern part of the dredge zone extending above the existing outfall pipe; this potential would have to be considered during detailed design to avoid exposing or damaging the existing outfall or existing cathodic protection system. Based on discussions with NYSDEC, it is likely that sheeting would be required to reduce construction impacts to the surrounding area.

For the purposes of evaluation, an average slope of 4H:1V was assumed for the dredged trench corresponding to a cross sectional area of approximately 1,312 square feet. With an estimated length of 8,500 feet for the sub-aqueous crossing, this results in a dredged volume of approximately 413,000 cubic yards, without considering over-dredging or additional depths required within the North Boat Channel.

Dredging Method

There are two basic types of dredging methods that would be potentially applicable for excavation in the Bay, mechanical dredging and hydraulic dredging. Mechanical dredging uses a barge-mounted excavator or a crane with a clamshell bucket to mechanically remove material from the bottom of a water body. This method requires an adjacent barge in which to place the excavated material or dredge spoils. When the barge is full, it is towed away to be emptied. This method requires multiple instances of handling the material, which impacts both the cost and the dredging schedule. If the excavated material is to be used for backfilling, hopper barges or side casting, (placing the material in rows alongside the excavation), can be used.

Hydraulic dredging would utilize the Bay water to fluidize the sand to be dredged, and pumps the fluidized sand to a holding or disposal location that can be as far as several thousand feet away. A conventional hydraulic dredge has a cutter head at the end of a moveable shaft that penetrates the top layer of sediment and stirs the sediment as a dredge pump pulls in the water and sediment mixture. A flexible discharge line is used to convey the dredged material to a disposal or holding location. The discharge line floats on the surface of the water. Because the dredged material is removed with a high percentage of water, it needs to be dewatered after placement. Sedimentation basins are typically used for separating the water from the dredged sediments. The overflow from the sedimentation basins would be returned to the Bay. For dredging that is located near a shoreline, the dredged material that is to be disposed off-site can be pumped directly to land to minimize handling of the material.

Of the two methods, hydraulic dredging causes the least disturbance to the area adjacent to the excavation. Mechanical dredging, which lifts the removed material up through the water, causes more sediment dispersion and disturbance of the surrounding environment. Hydraulic dredging can also be more precise than mechanical dredging in achieving the desired geometry for a submerged excavation and can cover a wider corridor without repositioning than a barge-mounted mechanical dredge. When the material to be dredged consists of clean, flowable soils, such as silts and clean sands, hydraulic dredging can remove material at a rate approximately twice that of mechanical dredging. Mechanical dredging is the preferred method when the material to be removed is rocky or includes sizeable debris.

For the excavation size and material type to be dredged for this project, it is anticipated that a conventional hydraulic dredge would be used. Typical dimensions of a conventional hydraulic dredge are 36 feet long by 12 feet wide, with maximum digging depths between 20 and 60 feet. A conventional hydraulic dredge typically has a draft of approximately 2 feet, which could access the northern half of the Bay within the outfall easement, but which could be difficult across the shallow southern part of the Bay. **Figures 3-18** and **3-19** depict typical hydraulic dredges. A typical capacity for a conventional hydraulic dredge working in silty to sandy soils is in the range of 200 to 300 cubic yards per hour.

Figure 3-18
Conventional Hydraulic Dredge (*Courtesy of Ellicott Dredge*)

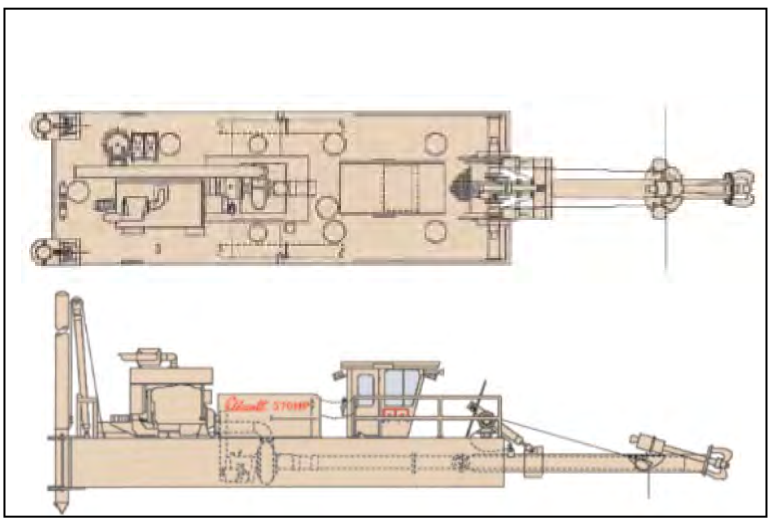


Figure 3-19
Conventional Hydraulic Dredge (*Courtesy of Ellicott Dredge*)

Dredging Operation

The material removed by the hydraulic dredge would be pumped to hopper barges to be held while pipe installation proceeds. Typical dimensions for a hopper barge are 195 feet by 35 feet. The removed material would settle in the hoppers and the overflow would be passed through a treatment process prior to being returned to the Bay. As segments of pipe are installed, the settled material would be removed from the hopper barges using a crane and clamshell bucket and returned to the excavation as native backfill. A silt boom (or silt curtain) would be utilized around the work areas for sediment control while work is ongoing.

The production rate of a hydraulic excavator with a 10 to 12-inch diameter intake pipe is anticipated to range between 200 to 400 cubic yards per hour. Given the geometry of the excavation for the subaqueous crossings, and using the 200 cubic yard per hour capacity as a conservative estimate, a conventional hydraulic dredge could excavate approximately 40 linear feet per day. The Bay crossing distance is approximately 8,500 linear feet. Construction time for the Bay crossing including the State Boat Channel at the above annual hydraulic dredging production rate will extend into at least four years, assuming that there is no down time for inclement weather, etc. The challenges associated with material and equipment movement in the shallow Bay may further extend this schedule.

Material Handling

Barges will be used to transport pipe and other materials to the work areas. The load each barge can carry will be limited based on the barge draft as it is filled or loaded. The location of the Contractor's staging area will be an important factor in terms of turnaround times for materials and equipment. Due to the shallow nature of the Bay, this is likely to require additional trips since fully loaded barges may have a draft of 7 to 8 feet or more. As the typical depth of this part of the Bay is 5 feet or less, this will have to be taken into account by the contractor.

The maximum holding capacity of a hopper barge is approximately 2,500 cubic yards. Dredging with a conventional hydraulic dredge is expected to remove approximately 2,000 cubic yards of spoil per day. A fully loaded hopper will have a draft of between 8 and 10 feet, which exceeds the current depth of two of the three boat channels in the area. Therefore, multiple hopper barges will be partially filled each day. Assuming conservatively that a hopper barge can be loaded to 1/2 capacity without setting on the Bay bottom, two hopper barges would be required each day for each operational dredge.

It is assumed that excess dredged material will be hauled to shore for off-site disposal. However, this would need to be discussed with the NYSDEC to determine if the material can be used within the Bay as it was on the original outfall installation. Sediment sampling along the trench alignment will be required to characterize the dredge spoils to identify suitable disposal options/locations. Based upon input from NYSDEC, samples would be required to characterize the depth of the excavation, and grain size analysis would be required for each sample. Analysis for metals, herbicides, pesticides, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydro-carbons (PAHs) would be required for all samples with particle distribution showing less than 90 percent sand. A sampling and analysis program specifying the sampling interval (along the trench alignment, and depths) and the specific sample collection and analytical protocols to be employed, would be developed and submitted to the County and NYSDEC for review and approval prior to implementation. The data would be used to identify suitable disposal methods for the dredge spoils, as well as the most suitable dredging methods to minimize impact to the Bay. If ocean disposal of the dredged material was to be considered, compliance with the U.S. Army Corps of Engineers (ACOE) requirements would also be necessary.

Excavation will be performed in segments. Each segment will be defined by the length of the sediment control area within which the construction would take place. All equipment and crew necessary for trench construction and pipe installation would be located within the sediment control area during construction. The sediment control area will be repositioned as trench construction and pipe installation progresses. The sediment control measures used during construction will likely increase the time required because barge transportation access points will need to be designed into the system and barges will need to wait for the sediment control system to be opened prior to exiting the work area.

Pipe Installation

The following four methods were considered for installation of the pipes for a dual 54-inch replacement outfall:

- Bottom pull
- Float and sink
- S-lay barge, and
- Segmental installation

The first two methods involve land assembly of pipe segments and the second two involve on-barge assembly. Based on the available land, it is anticipated that pipes will be assembled on a barge. Joints that are fully restrained, such as welded joints, will allow assembly of long segments of pipeline that are then floated out to the trench for lowering and joining to already installed pipe. Installation of dual pipelines would likely require two passes for laying the pipe. Typical dimensions for a crane barge used for trench excavation are 54 feet wide by 300 feet long. Material barges used for carrying the pipe sections and joining equipment are of similar size.

Bottom tow installation involves providing sufficient buoyancy to a segment of pipe so that it can be towed along the bottom of the water body. Because the Bay is so shallow, neither the 54-inch nor the 72-inch diameter pipe could be floated along much of the alignment, and this method would disturb long stretches of the bottom sediment. Installation via the bottom tow method also has the potential to damage the pipe if solid debris or any hard object is encountered along the tow.

The float and sink method involves attaching flotation to long segments of pipe that are assembled on land and towing the pipe out to the installation location. The shallow depth of the Bay, however, would preclude use of this method for pipe installation. The most buoyant of the various materials that were considered is HDPE. A segment of 63-inch outer diameter (OD) HDPE pipe assembled on land would be weighed down with ballast collars in the water and would require a minimum of 5 feet of water to be floated out into the Bay to the trench location. The same pipe without ballast collars would require a minimum of 3 feet of water depth to be floated out to the trench location.

The S-lay method is typically used with welded pipe and in open areas of deep water. Sections of pipe are welded on an on-board welding station and lowered off the stern as the vessel moves forward. The pipe is lowered using a stinger, a truss like circular structure used to support the pipe as it is released. As the pipe is released from the stinger, it forms an S-shape behind the vessel. The method is practical for a relatively long pipeline that is installed continuously. The S-lay method is not applicable for the Bergen Point WWTP outfall, because the lay length will be limited by the sediment control area; dual passes will be needed for installation of the dual pipes and the limited in-water work window will require installation of the pipeline in segments over several seasons.

The most practical method for installation of the replacement outfall, given the project-specific constraints, will be a segmental method, in which individual sections of pipe are positioned in the subaqueous trench from a material barge and joints are made mechanically underwater. A material barge would still, however, need to either reposition laterally or make two passes to install sections of the dual pipelines. The barge would need to reposition laterally to install one section for each of the dual lines, or would install several sections for one line and then reposition to install the same number of sections for the second line.

As sufficiently long segments of pipe are installed, the excavation will be backfilled with sand up to the crown, and then with the native soil removed by dredging, using a crane barge with clamshell bucket to remove the material from the hoppers. Since it is submerged, the backfill for the subaqueous trench will not require compaction.

As the hydraulic dredge excavates the sixteen foot trench for the replacement outfall, the construction vessels would have to follow in the newly created channel to carry excavated soils out from and bring materials to the work site. This will complicate logistics. Assuming that the contractor installs the carrier pipe and backfills the trench that is excavated before demobilizing each season, accessing the working area will be particularly challenging in the future seasons when the deeper channel provided by the outfall excavation is not available.

3.3.1.4 Open Cut Excavation – Shored Excavation Method

A shored excavation approach is anticipated for constructing the 6,500 linear foot section between Cedar Island, the State Boat Channel, and the barrier island. The width of the excavation between the sheet piling is assumed to be sufficient to accommodate the two 54-inch diameter pipes, and that width would be sufficient to allow the barge-mounted equipment to operate with adequate clearance between the sheeting. **Figure 3-20** provides a conceptual plan view and cross-sectional view of the shored excavation.

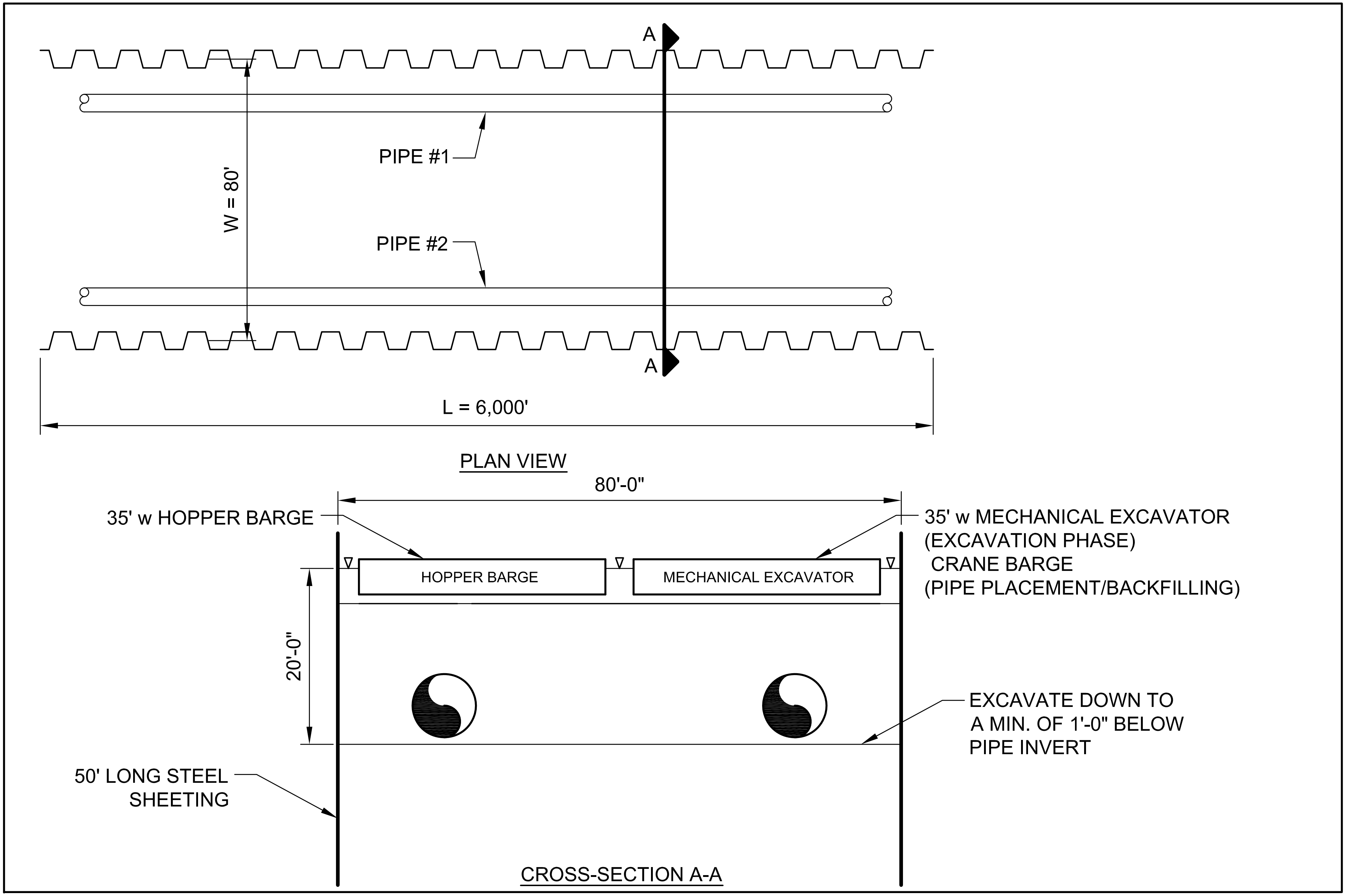


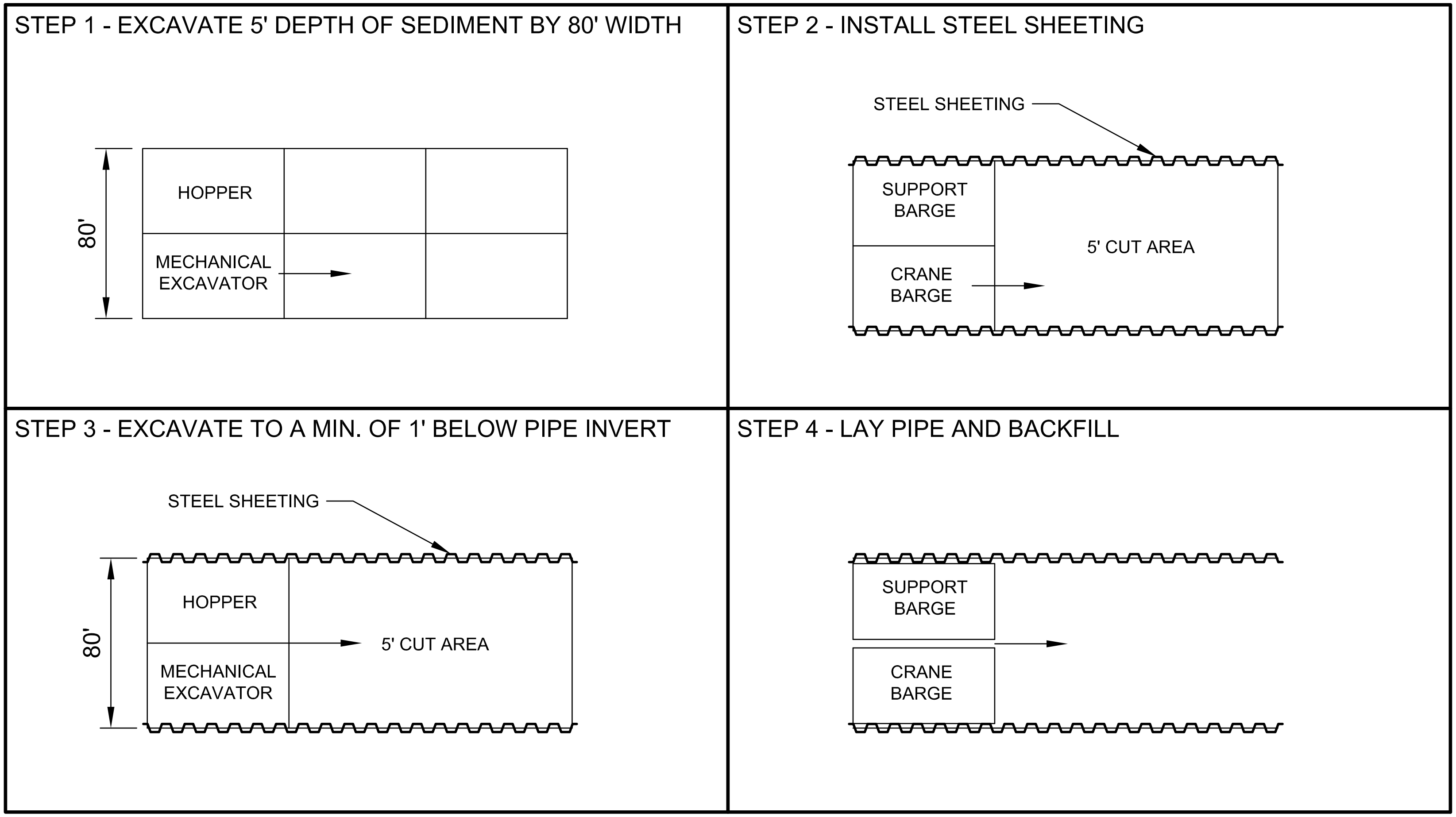
Figure 3-20
Typical Shored Excavation Plan & Cross-Section
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

The shored excavation section is anticipated to be constructed using the sequence presented in **Figure 3-21**. First, an excavation must be made within Cedar Island starting from the Bay or North Boat Channel. The first cut will excavate down to a sufficient depth to create the draft needed for the barge traffic required to install steel sheeting. The first pass is anticipated to create a draft between 5 to 8 feet below existing ground surface. The excavation is anticipated to be performed from a low draft barge or jack-up barge. The excavated material will be loaded onto a hopper barge located directly behind the excavation barge, until there is sufficient room laterally to allow for two 35- foot wide barges within the excavation. The excavated soils will be placed in a hopper barge located adjacent to the excavation barge. The two barges will travel within lanes moving within the shored excavation. The excavation barge and hopper barge will switch sides within the shored excavation after one lane has been completed and then repeat the excavation and removal process until two lanes have been excavated, resulting in an 80 foot wide area. The positioning of the two barges will be followed for all remaining steps of the shored excavation sequence. After a channel is cut through Cedar Island, steel sheeting will be installed along the perimeter of the shored excavation corridor. The steel sheeting will allow for near vertical excavation to occur within the limits of the sheeting, minimizing the horizontal impacts to Cedar Island. The third step will complete the remainder of the excavation within the steel sheeting down to a minimum of 1 foot below the bottom of the outfall pipes. The steel sheeting will be installed using a crane mounted on a barge supported by a flat deck barge. The excavation will be performed using a mechanical excavator mounted on a deck barge that will place the excavated sediments in a hopper barge. The fourth step will include placing the pipe bedding, laying the pipe at the bottom of the trench, backfilling with sand up to the springline of the pipe, and filling the remainder of the trench with excavated soils. The backfilling and pipe placement will be performed using a crane or excavator mounted on a barge supported by a flat deck barge to store the materials. The final step will include removing the steel sheeting.

Excavation Alignment and Geometry

The excavation for the replacement outfall would follow an alignment parallel to the existing outfall through the western half of the existing outfall easement, as described above in Section 3.2.1.3 for the subaqueous crossing. The depth of the subaqueous trench would be approximately 20 feet from the top of the existing ground surface to the bottom of the pipes to provide a minimum of 5 feet of cover. The width of the sheeted section would be dictated by the minimum surface area required for two barges to work side by side. The minimum width of the sheeted excavation would be approximately 80 feet, in order to accommodate two 35-foot wide barges. The location of the pipes within the sheeted excavation will be dictated by the reach of the equipment on the barge. The 80 foot wide excavation should allow the pipes to be placed between 5 feet and 35 feet from either side of the sheeting. The pipes would have a minimum separation of 10 feet at any location within the sheeted excavation. Transition zones will be required at either end of the shored excavation to connect the pipes installed along the sub-aqueous alignment and to the existing outfall.



NOTE: STEP 5 IS TO REMOVE SHEETING

Figure 3-21
Proposed Shored Excavation Sequence
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

For the purposes of this evaluation, a cross sectional area of approximately 1,600 square feet with an estimated length of 6,000 feet for the shored excavation section was assumed. This results in a excavated volume of approximately 356,000 cubic yards, without considering over-dredging or the additional depths required within the State Boat Channel.

Dredging Method

The excavation within the shored excavation section is anticipated to be performed using a mechanical excavator mounted on a jack-up barge or a low draft barge to perform the initial 80- foot wide cut within the barrier island. The jack-up or low draft barge will be required to continue the excavation in the shallow water depths adjacent to Cedar Island. The final excavation within the shored excavation may be performed using either mechanical or hydraulic excavation methods. For the purposes of this evaluation, mechanical excavation methods were assumed due to the potential that using a hydraulic excavator may not be able to remove sediments within 10 feet of the steel sheeting. Due to space limitations within the shored excavation and the reach angles of equipment from the water surface, the pipes may need to be placed within the 5 to 10 foot area that extends from either side of the sheeting.

Dredging Operation

The material removed by the dredge would be placed on hopper barges to be held while pipe installation proceeds. Typical dimensions for a hopper barge are 195 feet by 35 feet. The removed material will settle in the hoppers and the overflow will be passed through a treatment process prior to being returned to the Bay. As segments of pipe are installed, the settled material would be removed from the hopper barges using a crane and clamshell bucket and returned to the excavation as native backfill.

The production rate of a mechanical excavator with a 2 cubic yard bucket is anticipated to be approximately 700 cubic yards per day. Given the geometry of the excavation for the subaqueous crossings, and using the 700 cubic yard per day capacity as a conservative estimate, a mechanical dredge could excavate approximately 15 linear feet per day. The crossing distance is approximately 6,000 linear feet.

Material Handling

The material handling for the shored excavation section within Cedar Island will be performed as described above for the sub-aqueous work.

Pipe Installation

As described above, the most practical method for installation of the replacement outfall within the shored excavation, given the project-specific constraints, will be a segmental method, in which individual sections of pipe are positioned in the subaqueous trench from a material barge, and joints are made mechanically underwater.

3.3.1.5 Land Side Crossings

Excavation Alignment and Geometry

The land side crossings include the 100 foot section extending from the Bergen Point WWTP site into the Bay. The 100 foot section will be constructed within a shored excavation using a coffer dam. The shored excavation will be used to make the connection from the subaqueous portion of the pipeline. **Figure 3-22** provides a conceptual cross-section view of the excavation.

Excavation Method

Conventional sheeting and dewatering will be required for the land portion of the replacement pipeline. Steel sheeting installed below the bottom of the excavation would be used for excavation support. As excavation and pipe installation progresses, the excavation would be backfilled and the sheeting removed. A very shallow water table, with the water table at or above the ground surface elevation, exists along the replacement outfall alignment. A well point system would be required to dewater the excavation.

3.3.1.6 Constraints

Construction of the replacement outfall by open cut in the Bay and on Cedar Island would have to take place within NYSDEC's allowable work window of October 1 through January 14. The in-water no-work window established by the NYSDEC to protect the winter flounder runs from January 15th through September 30th. Based on the established work window, the construction window provides a total of 15 weeks for all mobilization, construction activity and demobilization. To define the actual dredging window, the following activities and durations have been assumed:

- Mobilization of Equipment and Vessels - 2 weeks
- Demobilization – 1 week

The preceding assumptions allow only 12 weeks of actual dredging/excavation time for pipe installation. If required and permitted, dredging could be conducted on a 24 hour per day, seven day per week schedule. One day of down time per week would be allowed for maintenance such as cutter head replacement. For the purposes of conceptual schedule development however, a 6-day work week, allowing one scheduled day for equipment maintenance, and double shifts (e.g., 16 hours of work each day) are assumed. Based on the allowable construction window, the following total durations are anticipated.

Subaqueous Crossing Section

- Hydraulic Dredging of 410,000 cubic yards – 22 weeks
- Placing pipe bedding, laying pipes, sand backfill, and trench backfill – 28 weeks (assumed average rate of 50 linear feet per day for all activities)

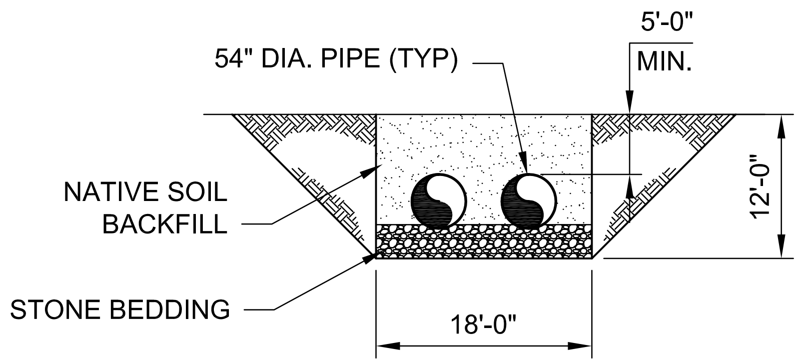


Figure 3-22
Landside Trench Dimensions
Dual 54-inch Pipes
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

The subaqueous crossing section could take up to 50 weeks, or 5 construction seasons due to the limited durations allowed for in-water activities assuming one dredging crew. The total duration could potentially be reduced to 25 weeks or 2 to 3 construction seasons if two dredging crews are used.

Shored Excavation Section

- Mechanical Dredging of 356,000 cubic yards – 54 weeks (assumes 1100 cubic yards per day during a 16 hour day)
- Installation 12,000 linear feet of Steel Sheeting – 20 weeks
- Placing pipe bedding, laying pipes, sand backfill, trench backfill, and move steel sheeting – 24 weeks (assumed average rate of 45 linear feet per day for all activities)

The shored excavation section could take up to 98 weeks or 9 construction seasons due to the limited durations allowed for in water activities using 1 crew. The total duration might be reduced to 49 weeks or 5 construction seasons if two dredging crews are used.

Based on the above durations and the project constraints, Alternative 3 cannot be implemented within one construction season. Alternative 3 is anticipated to be constructed over multiple construction seasons. The subaqueous crossing portion and the shored excavation portions potentially could be performed concurrently if there is sufficient capacity at the sediment disposal/dewatering area and if there are no restrictions on the volume of barge traffic in the area.

Based on the estimated production rates and constraints listed above, the following schedule and durations assume that two crews work concurrently on the subaqueous crossing, and two additional crews are concurrently working on the shored excavation portion of the alignment. This represents the minimum construction period, assuming that the weather is perfect throughout the twelve week potential work period, and that all four crews are available and working at full capacity throughout that time.

- Year 1 – Subaqueous dredging with 2 crews and shored excavation with 2 crews.
- Year 2 – Subaqueous dredging with 2 crews and shored excavation with 2 crews.
- Year 3 – Subaqueous dredging with 2 crews and shored excavation with 2 crews.
- Year 4 – Land crossing construction with 1 crew and shored excavation with 2 crews.
- Year 5 – Shored excavation with 2 crews.

The above schedule would increase barge traffic within the Bay and require significant coordination. The project would be implemented in accordance with the contractor's means and methods; if the contractor opted to use a single crew for subaqueous dredging and a single crew for the shored excavation portion of the crossing, the construction period could easily double. For scheduling and cost estimation purposes, it is assumed that the actual construction period is comprised of a combination of one and two crews working, resulting in a seven to eight year construction period.

3.3.2 Impacts

Impacts associated with construction of a replacement pipeline within the existing easement via open cut will result from the construction, rather than operation of the outfall.

3.3.2.1 Short Term Construction Related Impacts

Impacts from construction would occur along the entire 14,500 foot corridor, and would include:

- Disturbance of the Bay bottom/benthic layer along the width of the existing 300 foot easement, including loss of habitat;
- Release of sediment to the water column from excavation and backfilling operations;
- Temporary diversion of boat traffic throughout the construction period;
- Increased construction traffic on the Bay;
- Wetland vegetation impacts along outfall alignment;
- Disturbance of wetlands and habitat on Cedar Island and the barrier island;
- Shellfish impacts along easement;
- Finfish impacts in the work area;
- Commercial and recreational fishing impacts;
- Submerged aquatic vegetation impacts;
- Temporary drawdown of the water table on Cedar Island and the barrier island by dewatering system

Environmental Studies and Mitigation

Replacing the outfall via open cut technology will result in the destruction of all existing habitat/resources along the pipeline route and within the work areas from the barges/contractor equipment. Prior to any permit preparation/submission, NYSDEC has indicated that a minimum of three years of baseline monitoring would be required.

Discussion with NYSDEC has identified the following environmental studies and sampling requirements that will be required prior to final design/construction:

- A biological survey along the trench alignment will be required to inventory fish, shellfish, invertebrates, algae, and vegetation. This information would then be used to evaluate the need to move the proposed tunnel alignment to reduce impacts on marine habitat, if necessary, as well as to guide development of alternative impact mitigation measures and design of replacement habitat. The survey plan would be designed and submitted to SCDPW and NYSDEC for review and approval prior to implementation.

- The information from the biological and sediment surveys would be considered in the selection of the most appropriate dredging and construction methods, as well as in the assessment and selection of mitigation methods. For example, at this time, it appears likely that coffer dams would be required to protect the surrounding water column from increased turbidity and the Bay bottom from as suspended solids settle to the bottom and potentially submerge the adjacent benthic habitat during the excavation/pipe laying and assembly/back-filling work.

- Disturbed vegetated areas and habitat (e.g., vegetated marsh, submerged aquatic vegetation, dune land habitat) would require restoration and monitoring for a minimum five year post-construction period. Although it is not anticipated that habitat will be permanently destroyed, any such destruction would require a minimum three to one ratio of habitat creation as mitigation. New habitat would have to be maintained and monitored for a minimum of five years post-construction.

3.3.2.2 Long Term Impacts

While the new pipeline is installed and connected to the existing ocean discharge portion of the outfall, treated secondary effluent would continue to be discharged off-shore to the Atlantic Ocean as is the case today and there would be no other long term operational impacts.

Construction-related impacts to the wetlands area and the Bay bottom are not likely to be short-term, but would likely exist for some time after construction was completed. Mitigation of disturbed wetland areas would be required, and NYSDEC has indicated that a minimum of five years post-construction monitoring would be required.

3.3.3 Permits

Because construction activities will take place within the Great South Bay, a variety of federal, state, County and local permits will be required as summarized on **Table 3-5**.

3.3.4 Schedule

Figure 3-23 depicts a conceptual schedule for replacing the existing outfall via open cut. The schedule shown assumes that the project is completed in phases, with the

Table 3-5

Potential Permits and Approvals for Alternative 3 - Construction of Replacement Outfall by Open Cut

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. Because of the scope of this action, an Individual permit is assumed to be required.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)
STATE				
Tidal Wetland Permit	NYS Department of Environmental Conservation – Region 1	ECL Article 25 NYCRR Title 6, Part 661	Required for disturbance of tidal wetlands and their adjacent area (300 ft).	George Hammarth, Division of Environmental Permits 631-444-0371
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution	Project includes placement of fill or activities that result in a discharge to jurisdictional waters.	Roger Evans, Regional Permit Administrator 631-444-0361

Table 3-5

Potential Permits and Approvals for Alternative 3 - Construction of Replacement Outfall by Open Cut

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
		Control Act, Section 401		
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
Approval	NYS Parks – LI State Park Region	N.A.	Regulates access of parkland, including use of commercial vehicles.	Scott Fish 631-669-1000 Michelle Somma Land Management and Regulatory Affairs Coordinator 631-321-3580
Divisible Load Permit Highway Work Permit for Utility Work	NYSDOT – Region 10	NYCRR Title 17, Part 126 – NYS Vehicle & Traffic Law Section 385 NY Highway Law Article 52	NYSDOT regulates the use of NYS roadways. Permit required by vehicles that exceed the road weight. Permit required to work within a NYS ROW &/or install MPTs	Gene Smith, Regional HWP Contact 631-952-6028
River Bed Easement/Grant	NYS Office of General Services	Public Lands Law -Article 6 Section 75	Activities related to the use of underwater lands require permission from the State	John Hernick (518) 474-2195
Long Island Well Permit	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 NYCRR Title 6, Part 602	Required for well point dewatering system.	William Spitz 631-444-0419

Table 3-5

Potential Permits and Approvals for Alternative 3 - Construction of Replacement Outfall by Open Cut

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
LOCAL				
Consultation	SCDPW			John Donovan, Acting Chief Engineer 631-852-4204
Review and comment	SCDHS			Walter Hilbert, Chief, Office of Wastewater Management 631-852-5700 Walter Dawydiak, Chief Engineer, Division of Environmental Quality 631-852-5800
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

Figure 3-23 Preliminary Schedule for Alternative 3, Construct Replacement Outfall by Open Cut

	Activity Description	Duration														
		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1	EAF/Design/Permitting/Bidding - Pump Station															
2	Mobilization for Pump Station Renovation															
3	Pump Station Renovation - First 2 Pumps															
4	Pump Station Renovation - Second 2 Pumps															
5	EIS/Design/Permitting/Bidding - Open Cut Tunnel															
6	Mobilization, Construction in Great South Bay and Demobilization															
7	Mobilization Construction and Demobilization on Cedar and Barrier Islands															
8	Connections to Pump Station and Existing Outfall															
9	Site Restoration															

*Note - NYSDEC allowable in-water window runs from October 1st to January 14th (3.5 months or 15 weeks), schedule does not take into account all permitting requirements pump station renovation bid and constructed first, concurrently with an estimated minimum period of seven years of baseline monitoring, EIS preparation, design, permitting and bidding prior to initiation of the tunnel construction.

Based upon the allowable work window for protection of area resources described above, it is anticipated that work can only occur during a maximum of 15 weeks each year; requiring repeated mobilization and de-mobilization. This requirement would extend the tunnel construction period for eight years. The replacement outfall constructed via the open cut method is projected to be operational by 2024, with site restoration work continuing through 2025.

3.3.5 Costs

Estimated conceptual costs for the open cut method of outfall replacement are summarized below on **Table 3-6**.

Table 3-6
Alternative 3 - Preliminary Open Cut Cost Estimate

Project Component	($)
Pump Station	$8,300,000
Environmental Sampling	$19,300,000
Water Crossings	$70,210,000
Island Crossings	$61,000,000
Site Restoration	$650,000
Effluent Pump Station Connection	$3,300,000
Barrier Island Connection	$850,000
Subtotal	$163,610,000
Contingency @ 30%	$49,083,000
Total	$212,693,000
Escalation (3% for eleven years)	$294,417,000
Engineering (7%)	$20,609,000
Total Estimated Project Cost	$315,026,000

A slightly higher escalation rate of three percent was used for this estimate due to the uncertainty associated with the lead time and longer construction duration. The extensive baseline monitoring and permitting work associated with Alternative 3 can occur concurrently with the pump station upgrade; however, initiation of the tunnel construction activities are not anticipated to begin for at least seven years. Because of this extended schedule, it cannot be assumed that the low escalation rate observed in recent years will be maintained.

Because the open cut alternative has not been developed to the same level of detail tunneling alternatives 1 and 2, there is more uncertainty associated with the costs (e.g. mitigation requirements such as sheeting requirements, material disposal requirements, etc. that may be mandated by the regulatory agencies have not been completely defined), so a larger contingency factor of 30 percent has been used.

3.3.6 Summary of Advantages and Disadvantages

Because the Great South Bay has been designated as a No Discharge Zone, the open cut alternative is unlikely to be permitted. In addition, the long lead time associated with completion of the environmental baseline studies necessary to support a design, as well as the need to complete the construction work within the regulatory construction windows result in a project implementation schedule that approaches 15 years, which is not acceptable given the deteriorated condition of the existing outfall. Anticipated capital cost escalation associated with the protracted schedule is one of the factors that increases the cost of this alternative to over $300,000,000.

3.4 Alternative 4 – Construct New Outfall Discharging to Great South Bay

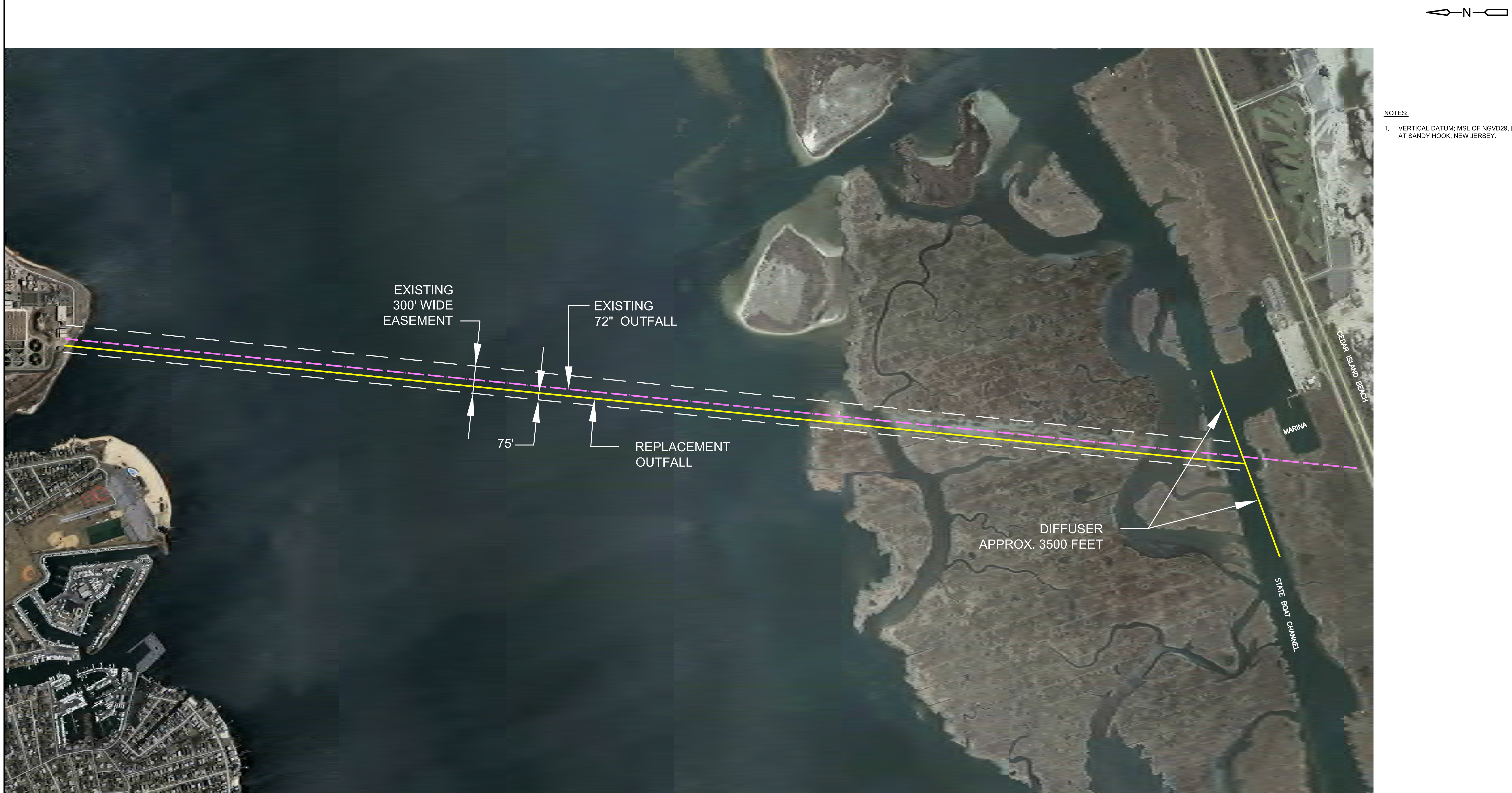
Alternative 4 would replace the existing ocean outfall with an outfall that discharges treated effluent to Great South Bay; one potential discharge option is depicted schematically by **Figure 3-24**. However, in November 2009, the U.S. Environmental Protection Agency (EPA) designated the entire South Shore estuary as a no-discharge zone, after approval of a petition developed by NYSDEC, Suffolk County, the Fire Island National Seashore and the south shore towns. This designation precludes issuance of the permits necessary to construct and operate this alternative. The discussions for Alternatives 1, 2, 3 and 5 identify short-term construction-related impacts to Great South Bay. In contrast, the impacts associated with implementation of this alternative are long-term impacts that would result in loss of the environmental and recreational resources that the Bay offers in this area.

Because this alternative cannot be implemented from an administrative stand-point, it is only briefly described for comparison purposes in the following pages.

3.4.1 Description of Alternative

Alternative 4 would include the following components, each of which is discussed below:

- **Baseline Environmental Studies** - Completion of the baseline environmental studies that will be required to establish required discharge limits, select construction methods and establish mitigation requirements, prior to any Bay discharge;



NOTES:

1. VERTICAL DATUM: MSL OF NGVD29, IN FEET, AT SANDY HOOK, NEW JERSEY.

Figure 3-24
Alternative 4
Replacement Outfall Discharging to Great South Bay
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

- **Upgrade of Bergen Point WWTP -** Upgrade of the Bergen Point WWTP to achieve more stringent discharge standards for nutrients, and potentially other constituents of sanitary wastewater;

- **Conveyance of Treated Effluent to Discharge -** Piping and diffuser network to discharge up to 110 mgd of treated sanitary effluent.

3.4.1.1 Baseline Environmental Studies

Prior to the designation of the South Shore estuary as a no-discharge zone, NYSDEC provided a preliminary outline of the baseline studies that would be required prior to any consideration of this option; these studies are briefly summarized below. NYSDEC indicated that a minimum of three years of baseline sampling would be required. The studies would be required to:

- Define baseline conditions in terms of recreational, environmental and economic value;

- Establish effluent discharge limits for parameters of concern, including nitrogen, metals, PAHs and potentially, pharmaceuticals and personal care products (PPCPs);

- Determine the most appropriate configuration for discharge structures (e.g., diffusers);

- Identify mitigation requirements both during construction and operation.

A dye study and program of receiving water quality sampling and analysis, followed by hydrodynamic and receiving water quality modeling would be required to:

- Assess circulation patterns and dilution under the range of anticipated conditions, considering tidal stage, prevailing wind speed and direction, precipitation, and effluent discharge rates. This would help to establish the areas of the Bay that would ultimately be impacted by the discharge, so that affected shellfish harvesting and contact recreation areas could be identified.

- Assess impacts of salinity to sensitive fish, shellfish or benthic species.

- Develop a Total Maximum Daily Load (TMDL) for contaminants of concern; this would include nitrogen, suspended solids and potentially metals, polyaromatic hydrocarbons (PAHs), pathogens and PPCPs. The TMDL would be used to establish SPDES permit limits for the parameters of concern, which in turn, would define treatment requirements.

Although the scope of these studies has not been defined with the regulatory agencies, based on other completed programs, it is anticipated that they would take approximately 5 years to complete, assuming that several of the evaluations would be performed concurrently. Costs to complete the field work, analytical work and modeling tasks are estimated to be at least $3,000,000. However, these costs could go much higher once the scope is fully defined with the NYSDEC.

In addition, the following additional studies would be required to develop the information necessary to design the new outfall diffuser system, as well as identify the required mitigation and long-term monitoring requirements:

- A biological survey of the area would be required to identify fish, shellfish, invertebrates, algae and aquatic vegetation in the area that will be disturbed by construction, and in the area that will be impacted by effluent discharge. This information is needed to modify potential discharge locations and to develop mitigating measures for implementation during construction and operation. Again, although the scope of the required effort has yet to be determined, it is estimated that it would take at least eighteen months to complete.

- Sediment sampling and analysis in the area of the proposed outfall pipe and discharge structures would be required to identify appropriate construction techniques and any sediment disposal requirements. All samples would be analyzed for grain size distribution, and for samples with less than 90 percent sand or larger particles, analysis for metals, herbicides and pesticides, PCBs and PAHs. The schedule and cost of the effort would depend on the number of samples requiring chemical analyses.

- Determination of current recreational uses in the area (swimming, boating, windsurfing, crabbing, finishing) that would be affected, as well as the economic impacts of restricting contact recreation, shellfishing and boating in the area. It is estimated that a study of this nature could be completed eighteen months after the first study is completed.

3.4.1.2 Upgrade of Bergen Point WWTP

The existing outfall from the Bergen Point WWTP discharges to the Atlantic Ocean which provides significant dilution to the constituents contained in secondary sanitary wastewater effluent. Great South Bay is a much smaller and shallower water body that provides both habitat and recreational opportunities, and consequently cannot assimilate the existing wastewater load without unacceptable water quality impacts.

A variety of typical wastewater constituents including pathogens, nutrients and toxics would require evaluation. SCDPW is presently upgrading Bergen Point's disinfection system to rely on UV-disinfection in lieu of chlorine. UV disinfection has been widely and successfully used to provide disinfection of wastewater; this on-going upgrade also addresses concerns associated with total residual chlorine (TRC) toxicity and the generation of harmful disinfection by products (DBPs) such as trihalomethanes.

The discharge of excess nitrogen to area receiving waters has been documented to cause algal blooms, reduce dissolved oxygen levels and in some cases, cause hypoxia and fish kills. As previously mentioned, a water quality modeling analysis would be required to estimate the acceptable nitrogen loading to Great South Bay, which would be likely to result in the establishment of a lower SPDES permit limit. Recently, effluent nitrogen levels from Bergen Point have ranged from 1.5 to 18 mg/L, and averaged close to 9 mg/L. Based on projected nitrogen limits at other area wastewater treatment plants, it is anticipated that reductions to a practical technological limit of approximately 4 mg/L or less would be required. The Bergen Point WWTP Upgrade Report (CDM D&B JV, June 2009) documents the analyses conducted to meet a total nitrogen discharge level of 10 mg/l, which would require seven additional aeration tanks and two additional final clarifiers from the present conditions. To achieve a total nitrogen discharge limit of 4 mg/L, either denitrification filters and/or membranes would be required to achieve this lower limit. As the existing WWTP site is limited in area for future expansion it is doubtful that all of the necessary equipment could fit within the existing plant site if conventional processes are used. The preliminary cost estimate to upgrade the plant to achieve a lower nitrogen limit is in excess of $100 million; it is anticipated that the work would take approximately five years to design, bid and construct, if feasible.

Depending upon a toxicity assessment of the effluent that is currently discharged, in order to discharge treated sanitary effluent to Great South Bay, additional treatment may be required to address concerns related to metals and/or pharmaceuticals and personal care products (PPCPs). The impact of PPCPs contained in wastewater effluent has been documented to cause feminization of fish in area waters. Because of Great South Bay's importance as habitat for the spawning and early life stages of finfish such as the winter flounder, as this situation is monitored and studied it is possible that limits for individual parameters may be imposed. Studies of the effectiveness of various treatment processes conducted to date indicate that membranes may be successful in reducing levels of some PPCPs.

3.4.1.3 Conveyance of Treated Effluent to Discharge

There are several alternative approaches to discharging the treated plant effluent that could be considered; however, due to the shallow nature of the Bay, all would affect the resource to some degree. The latest National Oceanic and Atmospheric Association (NOAA) chart shows that water depth in the area to the west and east of the existing outfall easement ranges from one to five feet deep.

Several alternatives could be considered, such as conveying the treated effluent out to the slightly deeper area of the Bay to the east of the existing easement (four to five feet deep) and constructing a network of diffusers along the Bay bottom or conveying the treated effluent to the State Boat Channel to discharge so that it would be removed from the Bay to the ocean more quickly.

Construction of a new outfall to carry the treated effluent south to the State Boat Channel to discharge would proceed within the existing easement, as described for Alternative 3, above. When the outfall reached the State Boat Channel, it is assumed that a diffuser would be constructed a distance of approximately 3,500 feet to the east and 3,500 feet to the west, to distribute the treated effluent for dilution, as shown on **Figure 3-24**.

3.4.2 Impacts

Construction of a new outfall discharging to Great South Bay would have significant short term construction-related and long term impacts on both the environment and on recreational users of the Bay.

3.4.2.1 Short Term Construction Related Impacts

Short term construction-related impacts would be significant in the area where the new outfall/diffusers were being constructed, as described above. Assuming that the outfall pipe extends to the State Boat Channel and a diffuser pipe extends lengthwise along the channel for approximately 7,000 feet (double the length of the existing ocean diffuser array), over 30 acres of the Bay bottom would be disturbed along the outfall alignment, resulting in loss of benthic habitat, and potentially submerged aquatic vegetation, finfish habitat and shellfish. The construction area of the Bay would also be unavailable for recreational use.

3.4.2.2 Long Term Impacts

Long term construction-related impacts would include:

- Addition of large volume of freshwater input to the Bay, which would change local salinity and affect the distribution of benthic organisms and finfish well beyond the area of construction.

- Due to the anticipated change in marine species composition, other aspects of the ecology are likely to be affected, including organisms that would have previously served as a food source for the benthic/finfish (e.g., plankton), and organisms that would have previously relied upon the benthic organisms/finfish as a source of food (e.g., birds).

- Depending upon the results of the water quality monitoring and modeling program, area shellfish beds are likely to be closed.

- The area of the Bay where the treated effluent is actively discharged is likely to be closed to recreation due to the navigation hazards posed by the diffusers.

- The benthic environment of the area of the Bay where the treated effluent is actively discharged will be irreversibly affected; due to the continued flow of ‘fresh water’ in the area, the habitat will be completely altered.

- Additional monitoring is likely to be required to ensure the continuing safety of shellfish, fin fish and bathing beaches.

3.4.3 Permits

Because construction activities will take place within the Great South Bay, a variety of federal, state, County and local permits would be required as summarized on **Table 3-7.** However, it is unlikely that most of the permits could ever be issued, given Great South Bay's designation as a no-discharge zone.

3.4.4 Schedule

It is estimated that the schedule to implement this alternative, if it could ever be permitted, could take up to seventeen years as illustrated conceptually on **Figure 3-25**. Because this alternative is the most disruptive to the Great South Bay and the associated environmental, economic and recreational resources, a number of focused data collection and evaluation activities must be completed before a design is initiated. Again, due to the intrusive nature of the alternative, it is assumed that the SCDPW would need to work very closely and collaboratively with NYSDEC and a myriad of other stakeholders in the design and identification of the least disruptive construction techniques; hence the design and permitting effort would be significant. It is estimated that it could take approximately five years to design, bid and construct the necessary improvements to the Bergen Point WWTP. Finally, it is anticipated that the window for construction work within the waters of the Great South Bay would exceed those described for Alternative 3, due to the additional in-water work that would be required.

3.4.5 Costs

Preliminary conceptual costs have been developed for Alternative 4, as summarized below on **Table 3-8**. The costs have not been developed to the same level of detail as the costs for the previous alternatives, due to the unlikelihood that the alternative is implementable from a regulatory perspective, and the uncertainty associated with the discharge requirements, should the concept of discharge to the Bay be approved. For example, it is assumed that a very low effluent nitrogen concentration would be required, but limits have not been established; consequently, treatment plant upgrade costs are approximate.

The lead time for development of baseline studies, permitting and design of this alternative is also significantly longer than for the previous three alternatives, and would be expected to add up to ten years to the project duration. Escalating the capital costs to the mid-point of construction, 2022 at an average escalation rate of 3%, increases the total estimated project cost to almost $600,000,000 if this alternative could be implemented. In addition to the estimated costs shown, the negative impact to the local economy in terms of lost recreational opportunities and habitat must also be factored into any meaningful economic assessment of the project.

Table 3-7

Potential Permits and Approvals for Alternative 4 - New Outfall Discharging to Great South Bay

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. As construction would be required in the Bay, an Individual permit is assumed to be required.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)
STATE				
Tidal Wetland Permit	NYS Department of Environmental Conservation – Region 1	ECL Article 25 NYCRR Title 6, Part 661	Required for disturbance of tidal wetlands and their adjacent area (300 ft).	George Hammarth, Division of Environmental Permits 631-444-0371

Table 3-7

Potential Permits and Approvals for Alternative 4 - New Outfall Discharging to Great South Bay

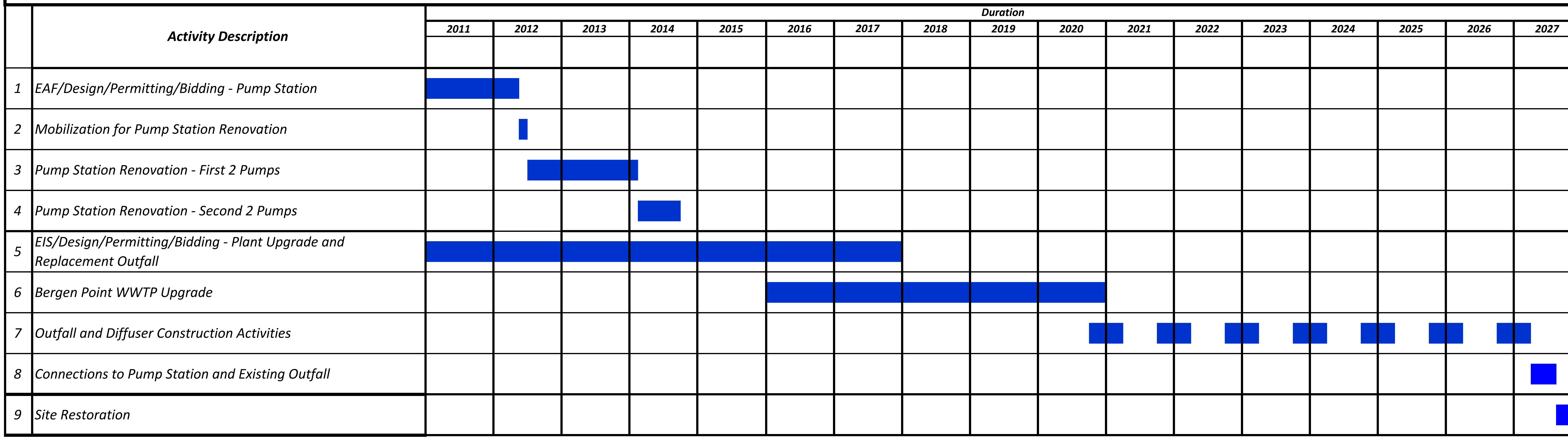
PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters.	Roger Evans, Regional Permit Administrator 631-444-0361
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
River Bed Easement/Grant	NYS Office of General Services	Public Lands Law -Article 6 Section 75	Activities related to the use of underwater lands require permission from the State	John Hernick (518) 474-2195

Table 3-7

Potential Permits and Approvals for Alternative 4 - New Outfall Discharging to Great South Bay

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
Modification to Bergen Point WWTP Existing SPDES Permit	NYS Department of Environmental Conservation – Region 1	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	WWTP process/treatment requires modification to meet anticipated discharge standards to the Great South Bay.	Roger Evans, Regional Permit Administrator 631-444-0361
LOCAL				
Approval	SCDPW		Approval of design changes to WWTP.	John Donovan, Acting Chief Engineer 631-852-4204
Review and comment	SCDHS		Approval of WWTP process/design change to meet more stringent effluent limitations.	Walter Hilbert, Chief, Office of Wastewater Management 631-852-5700 Walter Dawydiak, Chief Engineer, Division of Environmental Quality 631-852-5800
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

Figure 3-25 Preliminary Schedule for Alternative 4 Construct New Outfall Discharging to Great South Bay



**Note - NYSDEC allowable in-water window runs from October 1st to January 14th (3.5 months or 15 weeks), schedule does not take into account all permitting requirements*

Table 3-8
Alternative 4 - Preliminary Cost Estimate for New Outfall to Bay

Project Component	($)
Pump Station	$19,300,000
Environmental Sampling	$8,300,000
Bergen Point WWTP Upgrade	$100,000,000
Mobilization, Outfall Construction, Demobilization	$178,513,000
Effluent Pump Station Connection	$3,300,000
Site Restoration	$650,000
Subtotal	$310,063,000
Contingency @ 30%	93,019,000
Total	$403,082,000
Escalation (3% for eleven years)	$557,960,000
Engineering (10%)	$39,057,000
Total Estimated Project Cost	$597,017,000

3.4.6 Summary of Advantages and Disadvantages

Because the Great South Bay has been designated as a No Discharge Zone, this alternative could not be permitted. In addition, the long lead time associated with completion of the environmental baseline studies necessary to support a design, as well as the need to complete the construction work within the regulatory construction windows result in a project implementation schedule of approximately 17 years, which is not acceptable given the deteriorated condition of the existing outfall. Anticipated capital cost escalation associated with the protracted schedule is one of the factors that increases the cost of this alternative to almost $600M.

3.5 Alternative 5 – Lining Existing Pipe with Temporary Outfall to the Bay

3.5.1 Description of Alternative

The fifth alternative identified for consideration is slip-lining for rehabilitation of the segment of the Bergen Point outfall pipeline between stations 0+00 and 141+80. Slip-lining involves the installation of a new pipeline within the existing outfall. This technique is carried out by assembling the new pipe segments along a trench or within a pit, and then pulling or pushing the assembled pipe (slip-liner) through the existing pipe. The ends of the liner are joined with the existing pipeline at the ends using adapters, and the slip-liner is tested and entered into service. During installation of the slip liner, the existing outfall would have to be bypassed, and the treated effluent discharged through one of the following alternatives:

- On-site storage
- Removal from the site via tanker truck
- Temporary outfall to Atlantic Ocean
- Temporary outfall discharging to Great South Bay

Each of these alternatives is discussed following the description of required slip-lining work.

3.5.1.1 Slip-Lining Methods and Materials

Slip-lining was identified as a potential method to rehabilitate the Bergen Point outfall to avoid significant work within Great South Bay and the associated environmental impacts. There would be some disturbance of the Bay bottom where access ways are cut into the pipeline along the route, as well as disturbances that may result from the temporary bypass of the outfall.

The inside diameter of the existing PCCP outfall is 72 inches. The outfall includes three segments with vertical offsets that are necessary to cross the existing boat channels in Great South Bay. The vertical offsets are obstacles to the slip-lining construction technique and will require special fabrications, interior field welding, and special rigging procedures to implement.

Material Alternatives

Several slip liner materials were considered for the Bergen Point WWTP outfall, including centrifugally cast fiberglass, ductile iron and steel. The vertical offsets in the existing outfall under the boat channels make it necessary to assemble and fabricate semi-circular segments of pipe and fittings within the existing pipeline between the offsets. Because neither centrifugally cast fiberglass pipe nor ductile iron pipe can be joined or fabricated in the field by cutting and welding, they cannot be used as slip-liners within or between the vertically offset pipeline segments. Steel pipe can be cut and welded in the field and allows the installation of semi-circular segments of steel pipe within the interior of the existing outfall pipeline. Therefore, steel pipe was identified as the preferred material for the slip-liner.

Slip-Liner Design Requirements

The slip-liner for the outfall pipeline would be 68-inch diameter AWWA C200 spiral-welded carbon steel pipe. The pipe would be furnished bare, grouted in the annular space between the existing PCCP outfall and the steel liner pipe, and cement lined in the field after installation. Bonded dielectric coatings are not warranted for the slip-liner because they would likely be damaged during installation and welding, and cannot be repaired.

The slip-liner wall thickness, weld design and fittings would be designed for the maximum operating pressure, including surge. The test pressure would be 150 percent of the maximum operating pressure. The slip liner design pressure is 150 psi based on operating and surge pressures within the outfall.

- On-site storage
- Removal from the site via tanker truck
- Temporary outfall to Atlantic Ocean
- Temporary outfall discharging to Great South Bay

Each of these alternatives is discussed following the description of required slip-lining work.

3.5.1.1 Slip-Lining Methods and Materials

Slip-lining was identified as a potential method to rehabilitate the Bergen Point outfall to avoid significant work within Great South Bay and the associated environmental impacts. There would be some disturbance of the Bay bottom where access ways are cut into the pipeline along the route, as well as disturbances that may result from the temporary bypass of the outfall.

The inside diameter of the existing PCCP outfall is 72 inches. The outfall includes three segments with vertical offsets that are necessary to cross the existing boat channels in Great South Bay. The vertical offsets are obstacles to the slip-lining construction technique and will require special fabrications, interior field welding, and special rigging procedures to implement.

Material Alternatives

Several slip liner materials were considered for the Bergen Point WWTP outfall, including centrifugally cast fiberglass, ductile iron and steel. The vertical offsets in the existing outfall under the boat channels make it necessary to assemble and fabricate semi-circular segments of pipe and fittings within the existing pipeline between the offsets. Because neither centrifugally cast fiberglass pipe nor ductile iron pipe can be joined or fabricated in the field by cutting and welding, they cannot be used as slip-liners within or between the vertically offset pipeline segments. Steel pipe can be cut and welded in the field and allows the installation of semi-circular segments of steel pipe within the interior of the existing outfall pipeline. Therefore, steel pipe was identified as the preferred material for the slip-liner.

Slip-Liner Design Requirements

The slip-liner for the outfall pipeline would be 68-inch diameter AWWA C200 spiral-welded carbon steel pipe. The pipe would be furnished bare, grouted in the annular space between the existing PCCP outfall and the steel liner pipe, and cement lined in the field after installation. Bonded dielectric coatings are not warranted for the slip-liner because they would likely be damaged during installation and welding, and cannot be repaired.

The slip-liner wall thickness, weld design and fittings would be designed for the maximum operating pressure, including surge. The test pressure would be 150 percent of the maximum operating pressure. The slip liner design pressure is 150 psi based on operating and surge pressures within the outfall.

The grout in the annular space serves to prevent seawater from entering the annular space and will bond to the pipe exterior after curing. However, it is likely that the steel pipe will contract and pull away from the grout due to the contraction that will occur when the pipe is filled with 54˚F treated effluent. Over time, saltwater could potentially seep into the small crevasses between the slip-liner and the grout. Since the pipe exterior will be bare, corrosion must be controlled by use of cathodic protection. Cathodic protection of hydraulic and marine structures has been used effectively in the power, gas and petroleum industry. This would need to be further analyzed during detailed design.

For corrosion to occur, an anode, cathode, metallic path and an electrolyte must all be present. The anodes and cathodes at the pipe wall surface are deposited during the manufacturing process at the rolling mill. The metallurgy of the steel includes both anodic and cathodic crystalline materials that are unavoidable. The pipe serves as the metallic path and the seawater is the electrolyte. Since salt water is a strong electrolyte with very low resistivity, cathodic protection will be necessary to reverse the current between the anodic and cathodic areas of the pipe to prevent corrosion. Impressed current cathodic protection would be best for this installation because the current can be increased over time if necessary to meet the protection criteria, and a single rectifier can be used to protect the entire slip-liner.

Construction Methods

The existing outfall would have to be removed from service, dewatered and cleaned prior to installing the slip-liner. This could be a challenging task, as previous evaluations identified the potential for the dewatered pipe to collapse as a result of the external water pressure, if the prestressed wires are broken and the core is cracked. It is assumed that the existing effluent within the pipe would be disposed of by one of the alternatives listed above.

In addition, the low points in the pipeline at the three boat channel crossings would have to be pumped out separately and would require sheeted access points. Any solids remaining within the line would be cleaned and removed from the outfall to be treated at the Bergen Point WWTP. Access to the existing outfall in the vicinity of Ocean Parkway is extremely limited and a staging area will be required to support construction operations. Staging areas would be required at all access points along the outfall. Staging areas would include the WWTP site, the barrier island and barges.

Straight segments of pipe can be installed using conventional slip-lining methods from Bergen Point and Ocean Parkway, toward the nearest vertical offset. At the vertical offsets, semicircular pipe wall segments and fittings would be assembled within the vertical offsets and the long runs between them. Special rigging methods would be required to assemble and perform girth and longitudinal straight-seam welding within the existing pipeline. This will be a long process that would likely advance by one to two pipe segments per day to ensure high integrity welds and quality control during the installation.

Contractors would require the use of sheeted access pits within Great South Bay and the vicinity of Cedar Island to access the pipeline and increase productivity. Environmental impacts to the area would be similar to those described under Alternative 3, above, and would extend the project schedule due to the limited construction window required to protect the local flounder fishery.

After successful installation of the slip-liner, the process of grouting and lining the pipeline would be completed by conventional methods from within the slip-liner.

3.5.1.2 Temporary Discharge/Disposal of Treated Effluent

The second component of the slip-lining alternative results from the need to continue to dispose of treated secondary effluent during the estimated 27-month slip-lining process.

Four alternatives have been briefly considered:

- On-site storage
- Removal from the site via tanker truck
- Temporary outfall to Atlantic Ocean
- Temporary outfall discharging to Great South Bay

On-site Storage

Under the best-case scenario, slip-lining of the Bergen Point outfall could be completed in approximately 27 months, assuming that the access pits are installed during the winter work period and work continues throughout the year. Over that time period, assuming that the WWTP treats an average flow of 30.5 mgd, over 25,000,000,000 gallons of storage would be required. Assuming that the storage tanks have 15 feet of usable depth, over 5,100 acres of storage would be required to store this volume of water until the slip-lining was complete. (This does not account for storm flows of up to 110 mgd that would require additional storage.) This is clearly not feasible at the Bergen Point WWTP site; in addition, conceptual costs for this volume of storage are estimated to be on the order of hundreds of millions of dollars and the environmental impacts associated with disturbing an area this large would be significant.

Removal from the Site via Tanker Truck

Alternatively, the treated effluent could potentially be removed from the Bergen Point WWTP site via tanker truck, and discharged to an off-island treatment facility with excess capacity or elsewhere offsite. Using 5,000 gallon tanker trucks, under average daily flow conditions of 30.5 mgd, 6,100 tanker trucks would travel to and from the Bergen Point WWTP each day. This requires five trucks to be connected, filled and unconnected each minute. Again, during wet weather flows, the number of trucks required could more than triple. Considering the neighborhood road system, the need to process (e.g., move into position, connect to the effluent pump station, fill the truck, disconnect, and move off-site) five trucks per minute round the clock, and repeat the process in reverse for off-site disposal, this is not a feasible option.

Temporary Outfall to Atlantic Ocean

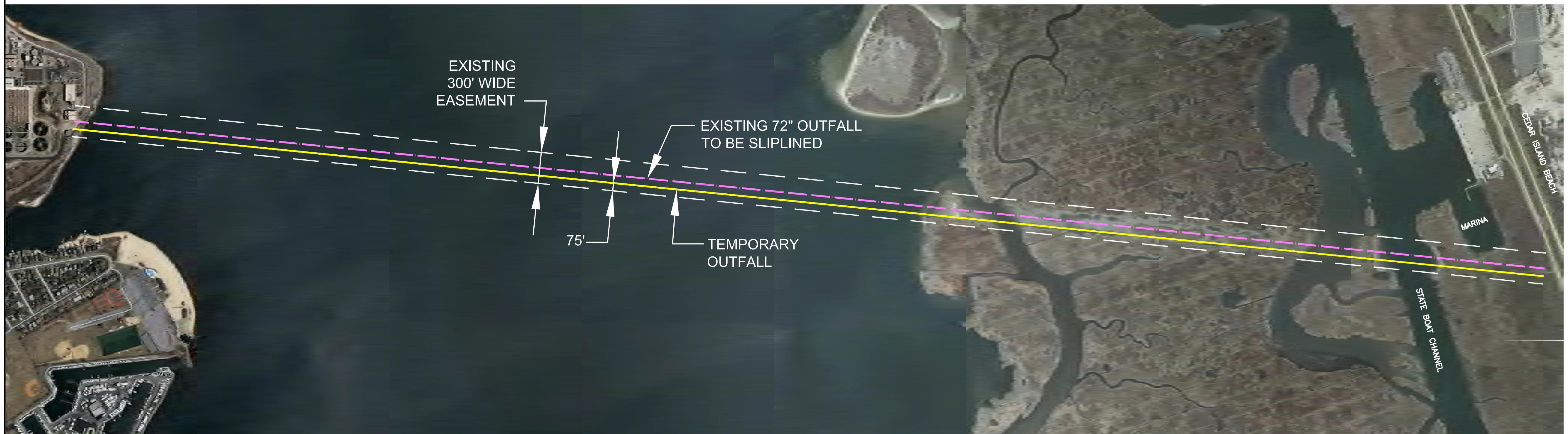
The possibility of 'floating' a temporary outfall, or laying it across the bottom of the Bay during the slip-lining process was also considered. The temporary outfall would discharge to a shaft connecting to the ocean outfall on the barrier island.

Because most of Great South Bay along the alignment of the existing outfall is approximately five feet deep or shallower, and assuming that the temporary outfall would be the same size as the permanent outfall, (e.g., 72-inch diameter) the outfall would protrude from the water; this is illustrated on **Figure 3-26**, which is based on recent bathymetric survey of the outfall easement. In these areas, the temporary outfall would be a hazard to boat traffic. The temporary outfall would also impact circulation in this area of the Bay with potentially significant local impacts (e.g., stagnant water/low dissolved oxygen in areas where shallow water was 'trapped'; sediment deposition in areas adjacent to the temporary outfall; scouring in other areas where velocities increased to maintain tidal flow). NYSDEC has indicated that disturbing the bottom of the Bay from the period from January 15th to September 30th would not be permitted, due to the area's importance for winter flounder.

This alternative is not feasible due to the impacts on both recreational users of Great South Bay, and the as yet undefined impacts on the water quality and ecology of Great South Bay of cutting off this area of the Bay from circulation. Use of a temporary pipe would be a hazard to boaters. Depending upon the materials of construction, the temporary pipe could also be more vulnerable to damage from environmental conditions or vandalism, which could result in the release of treated effluent to Great South Bay. The temporary pipe would significantly modify the circulation patterns of the Bay, which would have to be evaluated further as described in the discussion of Alternative 4, above. It would also cause localized impacts to water quality and aquatic and benthic habitat.

Temporary Outfall to Great South Bay

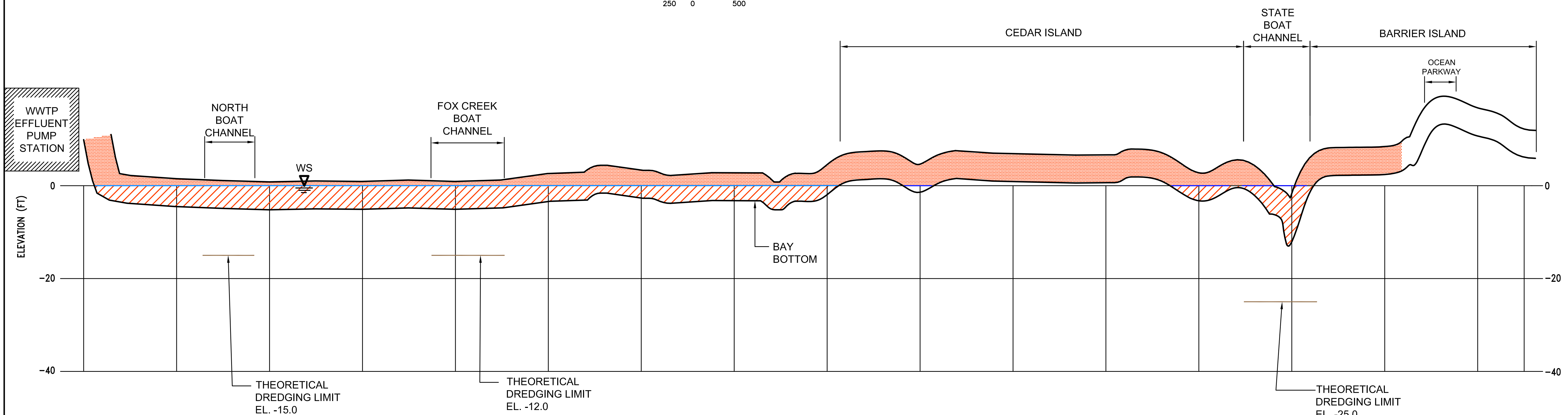
The fourth alternative considered to convey treated effluent from the Bergen Point WWTP during the slip-lining process was a temporary outfall discharging to Great South Bay. Similar to the approach identified in the SCDPW Sewer District 3 Southwest Outfall Emergency Response Plan, conveying the treated effluent to manholes set on the Bay bottom; effluent would flow upwards out of the manhole to prevent erosion of the Bay bottom, reduce the velocity of the effluent and provide dispersion of the effluent. **Figure 3-27** presents a potential layout of the discharge of the pumping system into the Bay. The manholes would be located outside of the boat channels and would be marked by buoys. However, if the effluent quality is required to meet more stringent standards, a plant upgrade would be required prior to the implantation of this alternative as well as the studies listed in Section 3.4. As mentioned in the Alternative 4 discussion, Great South Bay has been designated as a



PLAN VIEW

1"= 500'
250 0 500

NOTES:
1. VERTICAL DATUM: MSL OF NGVD29, IN FEET, AT SANDY HOOK, NEW JERSEY.



PROFILE VIEW

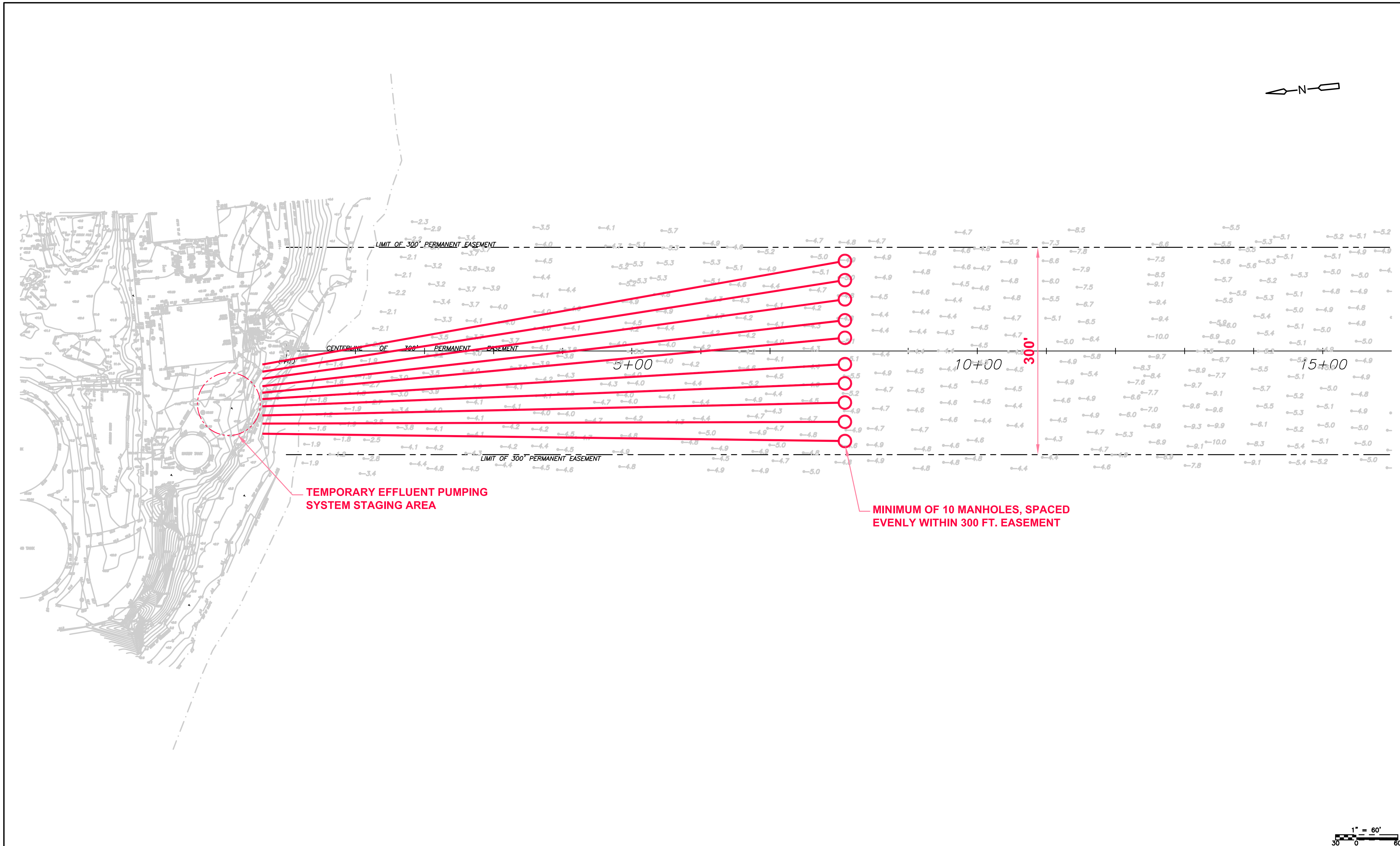
VERTICAL SCALE: 1"= 20' 5 0 10
HORIZONTAL SCALE: 1"= 1000' 500 0 1000

LEGEND
PIPE ABOVE WATER SURFACE
PIPE BELOW WATER SURFACE

U:\5175\39512\ FIG 3-26 05/16/11 11:16 garveydj XREFS: CDM_2436, CDM_2436(GTS)

CDM
consulting • engineering • construction • operations

Figure 3-26
Alternative 5 - Lining Existing Outfall Pipe and Temporary Outfall
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report



U:\5175\39512\ FIG 3-27 05/24/11 13:45 gorveydj

CDM
consulting • engineering • construction • operations

Figure 3-27
Alternative 5
Temporary Discharge to Great South Bay
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

No Discharge Zone and it is unlikely that this alternative could be permitted, as the 'temporary' discharge would exist for over two years.

3.5.2 Impacts

The slip-lining alternative would be developed to minimize impacts to Great South Bay to the greatest extent possible. Nonetheless, in order to line those sections of pipe with vertical off-sets, and the sections adjacent to the barrier island, there would likely be short term construction impacts. Impacts associated with implementation of this alternative are primarily associated with construction/operation of the temporary bypass.

3.5.2.1 Short Term Construction Related Impacts

The short-term impacts associated with construction would be manifested over the 27 month duration of the construction program. These impacts to the ecologic and recreational resources of the Bay would be similar to those described above for Alternatives 3 and 4.

3.5.2.2 Long Term Impacts

After slip lining is completed, and the temporary discharge structures removed from the Bay, treated secondary effluent would continue to be discharged off-shore to the Atlantic Ocean as is the case today and there would be no other long term operational impacts.

Construction-related impacts to the wetlands area and the Bay bottom are not likely to be short-term, but would likely be visible for some time after construction was completed. Mitigation of disturbed wetland areas would be required. It is not known whether removal of the temporary discharge structures to restore the original benthic habitat would be advisable, or whether the structures would provide beneficial habitat for aquatic life.

3.5.3 Permits

Federal, state and local permits associated with the slip-lining alternative are summarized below on **Table 3-9**.

3.5.4 Schedule

A conceptual schedule for construction of a temporary outfall and slip-lining the existing outfall is provided by **Figure 3-28**. Similar to the schedules developed for Alternatives 3 and 4, it shows an estimated minimum period of five years of baseline monitoring and permitting prior to initiation of construction, and an additional five years of construction, based upon the allowable work window for protection of area resources such as the winter flounder. Lining of the existing outfall is estimated to be completed by 2027.

Table 3-9

Potential Permits and Approvals for Alternative 5 - Lining Existing Outfall with Temporary Discharge to the Bay

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. As this alternative would require the construction of a temporary discharge to the Bay, an individual permit is assumed to be needed.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)
STATE				
Tidal Wetland Permit	NYS Department of Environmental Conservation – Region 1	ECL Article 25 NYCRR Title 6, Part 661	Required for disturbance of tidal wetlands and their adjacent area (300 ft).	George Hammarth, Division of Environmental Permits 631-444-0371

Table 3-9

Potential Permits and Approvals for Alternative 5 - Lining Existing Outfall with Temporary Discharge to the Bay

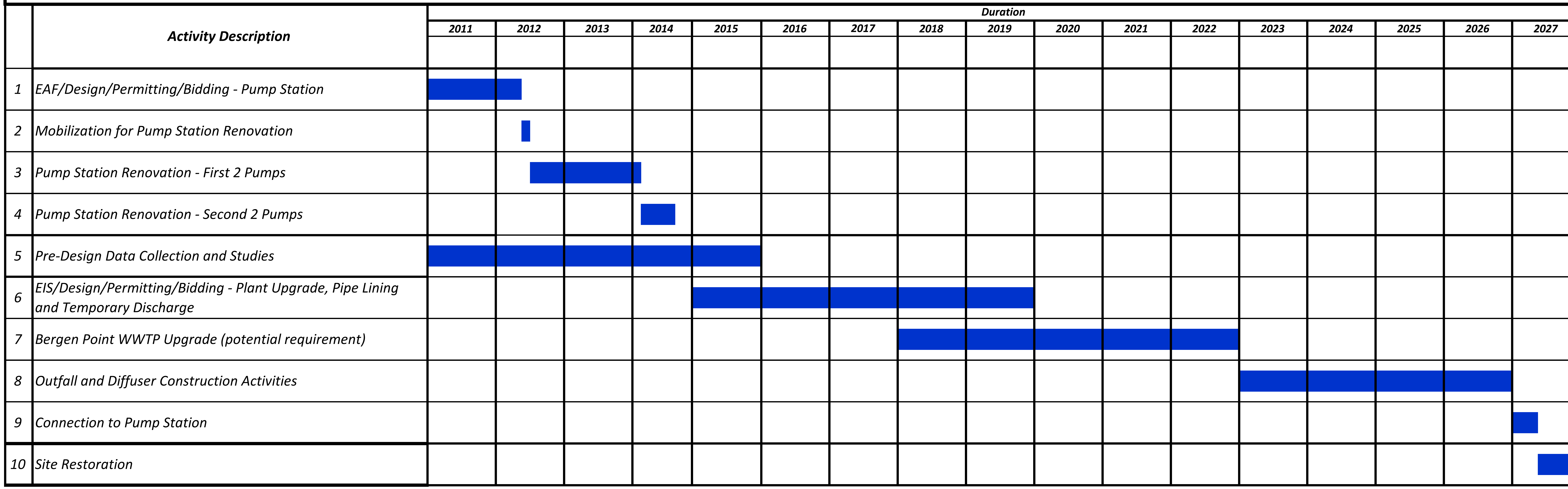
PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters.	Roger Evans, Regional Permit Administrator 631-444-0361
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
Approval	NYS Parks – LI State Park Region	N.A.	Regulates access of parkland, including use of commercial vehicles.	Scott Fish 631-669-1000 Michelle Somma Land Management and Regulatory Affairs Coordinator 631-321-3580
Divisible Load Permit Highway Work Permit for Utility Work	NYSDOT – Region 10	NYCRR Title 17, Part 126 – NYS Vehicle & Traffic Law Section 385 NY Highway Law Article 52	NYSDOT regulates the use of NYS roadways. Permit required by vehicles that exceed the road weight. Permit required to work within a NYS ROW &/or install MPTs	Gene Smith, Regional HWP Contact 631-952-6028
Modification to Bergen Point WWTP Existing SPDES Permit	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	WWTP process/treatment requires modification to meet anticipated discharge standards to the Great South Bay.	Roger Evans, Regional Permit Administrator 631- 444-0361

Table 3-9

Potential Permits and Approvals for Alternative 5 - Lining Existing Outfall with Temporary Discharge to the Bay

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
River Bed Easement/Grant	NYS Office of General Services	Public Lands Law -Article 6 Section 75	Activities related to the use of underwater lands require permission from the State	John Hernick (518) 474-2195
LOCAL				
	SCDPW		Approval of plans and specifications	John Donovan, Acting Chief Engineer 631-852-4204
Review and comment	SCDHS			Walter Hilbert, Chief, Office of Wastewater Management 631-852-5700 Walter Dawydiak, Chief Engineer, Division of Environmental Quality 631-852-5800
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

Figure 3-28 Preliminary Schedule for Alternative 5 - Lining Existing Outfall, with Temporary Discharge to Great South Bay



**Note - NYSDEC allowable in-water window runs from October 1st to January 14th (3.5 months or 15 weeks), schedule does not take into account all permitting requirements*

3.5.5 Costs

Preliminary conceptual costs for Alternative 5 are summarized on **Table 3-10**.

Table 3-10
Alternative 5 - Preliminary Cost Estimate for Slip Lining

Project Component	($)
Pump Station	$19,300,000
Environmental Sampling	$8,300,000
Treatment Plant Upgrade (potential)	$100,000,000
Slip Lining and Temporary Discharge	$104,189,000
Effluent Pump Station Connection	$3,300,000
Site Restoration	$650,000
Subtotal	$235,739,000
Contingency @ 30%	$70,722,000
Total	$306,460,700
Escalation (3% for eleven years)	$424,213,000
Engineering (10%)	$29,695,000
Total Estimated Project Cost	$453,908,000

This cost estimate assumes that treated effluent is temporarily discharged to Great South Bay, as this appears to be the only alternative that is physically feasible. Because the slip lining alternative has not been developed to the same level of detail tunneling alternatives 1 and 2, there is more uncertainty associated with the costs (particularly with respect to the requirements associated with the temporary discharge to Great South Bay and the ability to dewater/clean the existing outfall so that slip lining could proceed), so a larger contingency factor of 30 percent has been incorporated into the cost.

The slightly higher escalation rate of three percent was used for this estimate due to the uncertainty associated with the lead time and longer construction duration. Because of this extended schedule, it cannot be assumed that the low escalation rate observed in recent years will be maintained.

3.5.6 Summary of Advantages and Disadvantages

While slip-lining is a technique that has been successfully used on many PCCP pipeline rehabilitation projects, there are several project components that make implementation of the alternative infeasible for the Bergen Point outfall:

- No feasible options for temporary discharge/disposal of treated secondary effluent for the approximately 27 month project duration have been identified; while temporary discharge to the Great South Bay has been assumed here it is not likely to be permitted, given that the Bay is a designated “no discharge zone”.

- Cleaning the outfall/removal of any settled sludge/debris from the pipeline prior to lining – the ability to safely dewater the existing outfall has not been confirmed; previous evaluations identified the potential for the dewatered pipe to collapse from the external water pressure if the prestressed wires are broken and the core is cracked. Pumping the sludge and debris out will take significant time to stage and very large equipment to carry out.

- Staging area/access required to install the segmented fittings and pipe segments at the locations of the vertical offsets will be difficult. This method would be viable if the boat channel offsets did not exist and the pipeline could be accessed from each end, but the need for the segmented fittings and pipe segments makes this alternative very difficult and impractical.

Because there is no feasible method of conveying treated secondary effluent to ultimate disposal during the 27- month construction period, and because of the difficulties in cleaning the existing outfall and lining the pipe sections crossing the boat channels, implementation of this alternative is not recommended.

In addition, the long lead time associated with completion of the environmental baseline studies necessary to support a design, as well as the need to complete the construction work within the regulatory construction windows result in a project implementation schedule of over 15 years. Anticipated capital cost escalation associated with the protracted schedule is one of the factors that increases the cost of this alternative to over $450,000,000.

3.6 Alternative 6 – Replace the Outfall with Upland Recharge

Alternative 6 would replace the existing ocean outfall with a new upland effluent force main to recharge of the treated effluent via recharge basins and/or injection wells located to the north of the Bergen Point WWTP.

3.6.1 Description of Alternative

Implementation of Alternative 6 would include the following components, each of which is described in more detail below:

- Upgrade of Bergen Point WWTP to provide the higher level of treatment required to achieve groundwater (drinking water) standards;

- Upgraded effluent Pump station and potentially booster pump station(s) to convey the treated wastewater from the Bergen Point WWTP to the recharge/injection locations;
- Piping/distribution network to convey the treated wastewater from the effluent pump station to the recharge/injection locations;
- A network of recharge basins/injection wells to recharge the treated effluent to the groundwater system;
- Instrumentation and SCADA system to monitor water levels/heads at the recharge locations and turn pumps on/off at specific recharge locations;
- Network of monitoring wells to enable routine testing of the groundwater downgradient of the effluent recharge locations.

3.6.1.1 Bergen Point WWTP Upgrade

Because groundwater provides Long Island's sole source of potable supply, NYSDEC regulates all discharges via imposition of State Pollutant Discharge Elimination System (SPDES) permits to protect the quality of this irreplaceable resource. Typically, discharges of treated sanitary effluent must achieve the criteria summarized in **Table 3-11.**

Since upland recharge will directly impact groundwater, the DEC will require tertiary or advanced treatment prior to injecting or "ponding" treated effluent into the ground. Based on NYSDEC's discharge limits and Suffolk County Department of Health Services (SCDHS) standards for sewage disposal systems, total nitrogen must be removed to less than 10 mg/L. In this case, it is possible that removal of nitrogen to less than 6 mg/L or even 4 mg/L may be required, because most of the recharge sites would be located in Hydrogeologic Zones I or II, where the target nitrogen concentration is 6 mg/L for drinking water supply protection. Recently, effluent nitrogen levels from Bergen Point have ranged from 1.5 to 18 mg/L, and averaged close to 9 mg/L. Effluent discharge limits for other parameters of potential concern that are found in treated sanitary effluent may also be regulated by NYSDEC. Parameters of potential concern include pathogens, chlorinated organics and PPCPs.

The **Bergen Point WWTP Expansion Report** (CDM – D&B JV, June 2009), documents the analysis conducted to meet a total nitrogen discharge level of 10 mg/l, which would require seven additional aeration tanks and two additional final clarifiers from the present conditions. To achieve a total nitrogen discharge limit of 4 mg/l, either denitrification filters and/or membranes would be required to achieve this lower limit. As the WWTP site is limited in area for future expansion it is doubtful that all this equipment could fit within the existing plant site. The preliminary cost to upgrade the plant to achieve a lower nitrogen limit is in excess of $100 million; it is anticipated that the work would take approximately five years to design, bid and construct, if feasible.

Table 3-11
Drinking Water Standards for Water Quality Parameters (USEPA, NYSDOH, NYSDEC, 2006)

Category of Analysis	Constituent	USEPA Drinking Water Standards					New York State Drinking Water Standards MCL	Note	NYS Ambient Ground Water Standards	Note
		Primary				Secondary				
		MCL	Note	MCLG	Note					
Asbestos (mf/L)	Asbestos	7		7		N/A	7		7	
Physical	Color	**		**		15 units	15 units		15 units	
	Odor	**		**		3 units	3 units		3 units	
Other (mg/L)	Foaming Agents	**		**		0.50			0.50	
Inorganic (mg/L)	Aluminum	**		**		0.05 - 0.20	**		0.10	
	Antimony	0.006		0.006		N/A	0.006		0.003	
	Arsenic	0.01		0		N/A	0.01		0.025	
	Barium	2		2		N/A	2		1	
	Beryllium	0.004		0.004		N/A	0.004		-	
	Cadmium	0.005		0.005		N/A	0.005		0.005	
	Chloride	**		**		250	250		250	
	Chromium (total)	0.10		0.10		N/A	0.10		0.05	
	Copper	1.3	**TT**	1.3	**[1]**	1.0	1.3	**[1]**	0.20	
	Cyanide, Free	0.20		0.20		N/A	0.20		0.20	
	Fluoride	4		4		2.0	2.2	**[2]**	1.5	
	Iron	**		**		0.30	0.3	**[3]**	0.30	***
	Lead	0.015	**TT**	0	**[1]**	N/A	0.015	**[1]**	0.025	
	Manganese	**		**		0.05	0.3	**[3]**	0.30	***
	Mercury	0.002		0.002		N/A	0.002		0.0007	
	Nickel	**		**		N/A	**		0.10	
	Nitrate as N	10		10		N/A	10	**[4]**	10	
	Nitrite as N	1		1		N/A	1	**[4]**	10	****
	Perchlorate	**		**		N/A	0.018	**AL**	-	
	Selenium	0.05		0.05		N/A	0.05		0.01	
	Silver	**		**		0.10	0.10		0.05	
	Sodium	**		**		**	-	**[5]**	20	
	Sulfate	**		**		250	250		250	
	Thallium	0.002		0.0005		N/A	0.002		0.50	+
	Zinc	**		**		5	5		-	

Table 3-11
Drinking Water Standards for Water Quality Parameters (USEPA, NYSDOH, NYSDEC, 2006)

Category of Analysis	Constituent	USEPA Drinking Water Standards					New York State Drinking Water Standards MCL	Note	NYS Ambient Ground Water Standards	Note
		Primary				Secondary				
		MCL	Note	MCLG	Note					
Corrosivity	Corrosivity	**		**		noncorrosive	-		-	
	pH	**		**		6.5-8.5	-		6.5-8.5	
	Total Dissolved Solids (mg/L)	**		**		500	**		200-500	
Pesticides & SOCs (µg/L)	Acrylamide	TT		0		N/A	see notes		5	
	Alachlor	2		0		N/A	2		0.50	
	Aldicarb	**		**		N/A	3		0.35	^
	Aldicarb Sulfone	**		**		N/A	2		2	+
	Aldicarb Sulfoxide	**		**		N/A	4		4	+
	Aldrin	**		**		N/A	5		-	
	Atrazine	3		3		N/A	3		7.5	
	Benzo (a) Pyrene (PAHs)	0.2		0		N/A	0.20		No Detection	
	Butachlor	**		**		N/A	50		3.5	
	Carbaryl	**		**		N/A	50		29	
	Carbofuran	40		40		N/A	40		15	+
	Chlordane, Total	2		0		N/A	2		0.05	
	2,4-D	70		70		**N/A**	-		50	
	Dalapon	200		200		N/A	50		50	+++
	Di (2-Ethylhexyl) Adipate	400		400		N/A	50		20	
	Di (2-Ethylhexyl) Phthalates	6		0		N/A	6		-	
	1,2-Dibromo-3-chloropropane (DBCP)	0.2		0		N/A	0.20		0.04	
	Dicamba	**		**		N/A	50		0.44	
	Dieldrin	**		**		N/A	5		0.004	
	Dinoseb	7		7		N/A	7		1	++
	Diquat	20		20		N/A	20		20	^^^
	Endothall	100		100		N/A	50		-	
	Endrin	2		2		N/A	2		No Detection	
	Epichlorohydrin	TT		0		N/A	see notes		-	
	Ethylene dibromide (EDB)	0.05		0		N/A	0.05		0.0006	
	Glyphosate	700		700		N/A	50		-	
	Heptachlor	0.40		0		N/A	0.40		0.04	
	Heptachlor Epoxide	0.20		0		N/A	0.20		0.03	
	Hexachlorobenzene	1		0		N/A	1		0.04	

Table 3-11
Drinking Water Standards for Water Quality Parameters (USEPA, NYSDOH, NYSDEC, 2006)

Category of Analysis	Constituent	USEPA Drinking Water Standards					New York State Drinking Water Standards MCL	Note	NYS Ambient Ground Water Standards	Note
		Primary				Secondary				
		MCL	Note	MCLG	Note					
	Hexachlorocyclopentadiene	50		50		N/A	50		5	
	3-Hydroxycarbofuran	**		**		N/A	50		-	
Pesticides & SOCs	Lindane	0.20		0.2		N/A	0.20		-	
(µg/L)	Methomyl	**		**		N/A	50		0.35	^
(con't..)	Methoxychlor	40		40		N/A	40		35	
	Metribuzin	**		**		N/A	50		50	
	Oxamyl (Vydate)	200		200		N/A	50		50	
	Pentachlorophenol	1		0		N/A	1		1	++
	Picloram	500		500		N/A	50		50	+++
	Polychlorinated Biphenyl (PCB)	0.50		0		N/A	0.50		0.09	
	Propachlor	**		**		N/A	50		35	
	Propylene glycol	**		**		N/A	1,000		-	
	Simazine	4		4		N/A	4		0.50	
	Toxaphene	3		0		N/A	3		0.06	
	2,3,7,8-TCDD (Dioxin)	0.00003		0		N/A	0.00003		0.0000007	
	2,4,5-TP (Silvex)	50		50		N/A	10		-	
Principal Organic	Benzene	5		0		N/A	5		1	
Contaminants	Bromobenzene	**		**		N/A	5		5	
(µg/L)	Bromochloromethane	**		**		N/A	5		5	
	Bromomethane	**		**		N/A	5		5	
	n-Butylbenzene	**		**		N/A	5		5	
	sec-Butylbenzene	**		**		N/A	5		5	
	tert-Butylbenzene	**		**		N/A	5		5	
	Carbon Tetrachloride	5		0		N/A	5		5	
	Chlorobenzene	100		100		N/A	5		5	
	Chloroethane	**		**		N/A	5		5	
	Chloromethane	**		**		N/A	5		-	
	2-Chlorotoluene	**		**		N/A	5		5	
	4-Chlorotoluene	**		**		N/A	5		5	
	Dibromomethane	**		**		N/A	5		5	
	m-Dichlorobenzene	**		**		N/A	5		3	
	o-Dichlorobenzene	600		600		N/A	5		3	
	p-Dichlorobenzene	75		75		N/A	5		3	

Table 3-11
Drinking Water Standards for Water Quality Parameters (USEPA, NYSDOH, NYSDEC, 2006)

Category of Analysis	Constituent	USEPA Drinking Water Standards					New York State Drinking Water Standards MCL	Note	NYS Ambient Ground Water Standards	Note
		Primary				Secondary				
		MCL	Note	MCLG	Note					
	Dichlorodifluoromethane	**		**		N/A	5		5	
	1,1-Dichloroethane	**		**		N/A	5		5	
Principal Organic Contaminants (µg/L) *(con't..)*	1,2-Dichloroethane	5		0		N/A	5		0.60	
	1,1-Dichloroethene	7		7		N/A	5		5	
	cis-1,2-Dichloroethene	70		70		N/A	5		5	
	trans-1,2-Dichloroethene	100		100		N/A	5		5	
	Dichloromethane	5		0		N/A	5		5	
	1,2-Dichloropropane	5		0		N/A	5		1	
	1,3-Dichloropropane	**		**		N/A	5		0.40	^^
	cis-1,3-Dichloropropene	**		**		N/A	5		0.40	^^
	trans-1,3-Dichloropropene	**		**		N/A	5		0.40	^^
	2,2-Dichloropropane	**		**		N/A	5		5	
	1,1-Dichloropropene	**		**		N/A	5		5	
	Ethylbenzene	700		700		N/A	5		5	
	Hexachlorobutadiene	**		**		N/A	5		0.50	
	Isopropylbenzene	**		**		N/A	5		5	
	p-Isopropyltoluene (Cymene)	**		**		N/A	5		5	
	Methyl Tert. Butyl Ether (MTBE)	**		**		N/A	10		-	
	n-Propylbenzene	**		**		N/A	5		5	
	Styrene	100		100		N/A	5		5	
	1,1,1,2-Tetrachloroethane	**		**		N/A	5		5	
	1,1,2,2-Tetrachloroethane	**		**		N/A	5		5	
	Tetrachloroethene	5		0		N/A	5		5	
	Toluene	1,000		1,000		N/A	5		5	
	1,2,3-Trichlorobenzene	**		**		N/A	5		5	
	1,2,4-Trichlorobenzene	70		70		N/A	5		5	
	1,1,1-Trichloroethane	200		200		N/A	5		5	
	1,1,2-Trichloroethane	5		3		N/A	5		1	
	Trichloroethene	5		0		N/A	5		5	
	Trichlorofluoromethane	**		**		N/A	5		5	
	1,2,3-Trichloropropane	**		**		N/A	5		0.04	
	1,2,4-Trimethylbenzene	**		**		N/A	5		5	
	1,3,5-Trimethylbenzene	**		**		N/A	5		5	
	Vinyl Chloride	2		0		N/A	2		2	

Table 3-11
Drinking Water Standards for Water Quality Parameters (USEPA, NYSDOH, NYSDEC, 2006)

Category of Analysis	Constituent	USEPA Drinking Water Standards					New York State Drinking Water Standards MCL	Note	NYS Ambient Ground Water Standards	Note
		Primary				Secondary				
		MCL	Note	MCLG	Note					
	m-Xylene	10,000	**[6]**	10,000	**[6]**	N/A	5		5	
	o-Xylene		**[6]**		**[6]**	N/A	5		5	
	p-Xylene		**[6]**		**[6]**	N/A	5		5	
Principal Organic Contaminants		**		**		N/A	5		5	
Unspecified Organic Contaminants		**		**		N/A	50		-	
Total Principal and Unspecified Organic Contaminants		**		**		N/A	100		-	
Microbiological	Cryptosporidium	**TT**	**[7]**	0		N/A	-		-	
	Giardia lamblia	**TT**	**[7]**	0		N/A	-		-	
	Heterotrophic plate count	**TT**	**[7]**	N/A		N/A	-		-	
	Legionella	**TT**	**[7]**	0		N/A	-		-	
	Total Coliforms (including fecal coliform and E. Coli)	5.00%	**[8]**	0		N/A	5.00%	**[8]**	50/100 mL	
	Turbidity	5, **TT**	***, [7]**	N/A		N/A	5 units		5 units	
	Viruses (enteric)	**TT**	**[7]**	0		N/A	-		-	
Disinfectants (mg/l)	Chloramines (as Cl_2)	4	MRDL	4	MRDLG	N/A	-		-	
	Chlorine (as Cl_2)	4	MRDL	4	MRDLG	N/A	-		-	
	Chlorine dioxide (as ClO_2)	0.8	MRDL	0.8	MRDLG	N/A	-		-	
Disinfection Byproducts (mg/l)	Bromate	0.01		0		N/A	0.01		-	
	Chlorite	1		0.8		N/A	1		-	
	Haloacetic acids (HAA5)	0.06		N/A	**[9]**	N/A	-		-	
	Monochloroacetic acid			-		N/A	-		-	
	Dichloroacetic acid			0		N/A	-		-	
	Trichloroacetic acid			0.3		N/A	-		-	

Table 3-11
Drinking Water Standards for Water Quality Parameters (USEPA, NYSDOH, NYSDEC, 2006)

Category of Analysis	Constituent	USEPA Drinking Water Standards					New York State Drinking Water Standards MCL	Note	NYS Ambient Ground Water Standards	Note
		Primary				Secondary				
		MCL	Note	MCLG	Note					
	Bromoacetic acid			-		N/A	-		-	
	Dibromoacetic acid			-		N/A	-		-	
Disinfection	Total Trihalomethanes	0.08		N/A	**[9]**	N/A	0.08		-	
Byproducts (mg/l)	Chloroform			-		N/A	-		7	
(con't..)	Bromodichloromethane			0		N/A	-		0.05	+
	Dibromochloromethane			0.06		N/A	-			
	Bromoform			0		N/A	-		0.05	+
Radiological (pC/L)	Gross Alpha Activity	15		0		N/A	15		15	
	Ra 226 and Ra 228 (combined)	5		0		N/A	-		5	
	Gross Beta and Photon Emitters (millirems/year)	4		0		N/A	-		1,000 pC/L	
	Uranium (ug/L)	30		0		N/A	-		-	

KEY:

mg/L	Milligrams per liter (parts per million);	µg/L	Micrograms per liter (parts per billion)	pC/L	Picocuries per liter
Mf/L	million fibers per liter	N/A	Not Applicable		

Action Level (AL)

Maximum Residual Disinfectant Level (MRDL) - The highest level of a disinfectant allowed in drinking water.

Maximum Residual Disinfectant Level Goal (MRDLG) - The level of a drinking water disinfectant below which there is no known or expected risk to health.

Treatment Technique (TT) - A required process intended to reduce the level of a contaminant in drinking water.

[1] Action level set at 0.015 mg/L for lead, action level set at 1.3 mg/L for copper

[2] In supplies that fluoridate, the fluoride level must be maintained in the range of 0.80 to 1.2 mg/L

[3] Combined concentration of iron and manganese should not exceed 0.50 mg/L

[4] Total nitrate and nitrite should not exceed 10.0 mg/L; An MCL of 20 mg/L may be permitted at a noncommunity water system if the supplier of water demonstrates that: the water will not be available to children under six months of age;
a notice that nitrate levels exceed 10 mg/L and the potential health effects of exposure will be continuously posted according to the requirements of a Tier 1 notification; the State will be notified annually of nitrate levels that exceed 10 mg/L; and no adverse health effects shall result.

[5] The NYSDOH recommends that the sodium level not exceed 20.0 mg/L for severely restricted sodium diets and 270.0 mg/L for moderately restricted sodium diets

[6] Total Xylenes – 10,000 mg/L

[7] EPA's surface water treatment rules (**not applicable in Suffolk County**) require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

Cryptosporidium : (as of1/1/02 for systems serving >10,000 and 1/14/05 for systems serving <10,000) 99% removal.

Giardia lamblia : 99.9% removal/inactivation

Viruses: 99.99% removal/inactivation

Legionella : No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, *Legionella* will also be controlled.

Turbidity: At no time can turbidity (cloudiness of water) exceed 1 nephelolometric turbidity units (NTU; as of January 1, 2002); Turbidity must not exceed 0.3 NTU in 95% of daily samples in any month.

HPC: No more than 500 bacterial colonies per milliliter.

Long Term 1 Enhanced Surface Water Treatment (Effective Date: January 14, 2005); Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, Cryptosporidium removal requirements, updated watershed control requirements for unfiltered systems).

Filter Backwash Recycling; The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

[8] more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or E. coli if two consecutive TC positive samples, and one is also positive for E.coli fecal coliforms, system has an acute MCL violation.

[9] Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants.

*	0.5-1.0 NTU for filtered systems;	^^^	free or salt
**	Monitoring requirements only – no MCL or MCLG specified.	+	Guidance Value
***	0.50 combined with Mn or Fe.	++	Total Phenols
****	combined with Nitrate as N	+++	Includes related forms that convert to organic acid upon acidification at pH ≤ 2 and esters of organic acid.
^	Combined concentration of aldicarb and methomyl; ^^		
^^	combined cis and trans concentrations; ^^^		

Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows:

Acrylamide = 0.05% dosed at 1 mg/L (or equivalent)

Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent)

Under a separate project, SCDPW will initiate the replacement of the existing chlorination system with UV-disinfection in 2011 which will achieve anticipated SPDES limits for pathogens, and also reduce the potential discharge of chlorinated organics.

3.6.1.2 Upgraded Pump Station(s)

Treated effluent must be pumped from the Bergen Point WWTP to the north, and then distributed to each of the recharge basin and injection well locations. The existing effluent pump station would be rehabilitated as previously discussed but the pumps would be sized for the head conditions associated with pumping the treated effluent to the higher upland elevations. The number of new pumps and associated control system would not change.

To provide the required head to each recharge basin/well, it is assumed that booster pump stations will be located at each recharge site. Each pump station will include a minimum of two pumps, local controls and security systems.

3.6.1.3 Piping/Distribution System

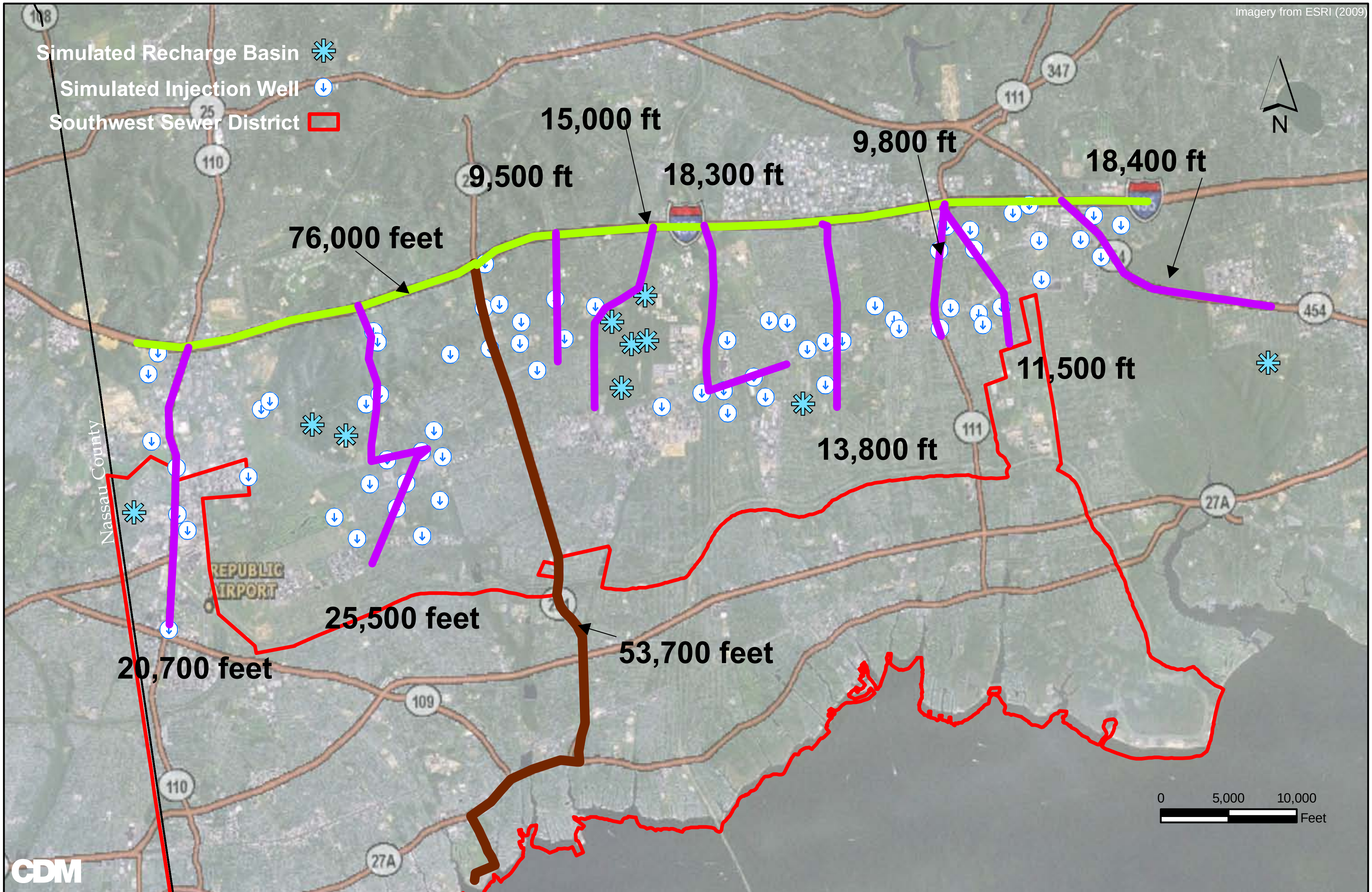
For redundancy, a dual 54 inch force main would be utilized to convey the flow from the WWTP to the upland recharge corridor. Potential locations of recharge basins and injection wells have been identified, as described below in Section 3.5.1.4. Based on these potential locations, it is assumed that treated effluent from the plant would be conveyed north to Montauk Highway, east to Route 231, and then north to the Long Island Expressway, as depicted schematically on **Figure 3-29**.

To distribute the flow along the recharge corridor, the force mains would be installed within the Long Island Expressway right-of-way, running in an east –west direction. The recharge sites would be fed from the east-west force mains utilizing a network of smaller ductile iron distribution pipes. The distribution system will include booster pump stations and automated valves to direct flow to the various recharge sites at the required head and flow conditions.

3.6.1.4 Network of Recharge Basins/Injection Wells

Upland recharge will require adequate land area that satisfies the depth and space requirements for recharging the treated effluent while considering impacts on the County's sole source aquifer, and the surrounding communities. Suffolk County has established standards for the siting and design of recharge beds for treated effluent that identify maximum bed depth, design flow and buffer and redundancy requirements, summarized in Appendix C. SCDHS Division of Environmental Quality, Office of Wastewater Management reviews and approves proposed sewage collection and treatment systems, including recharge facilities.

Recharge via recharge basins, leaching pools and/or injection wells was considered. Based upon a wet weather flow of up to 90 MGD, and, assuming that each recharge basin/leaching pool/injection well site must accommodate up to 1 MGD, the land area required to dispose of the treated effluent was estimated. (In recent years, the



Suffolk County Department of Public Works

Alternative 5 - Bergen Point WWTP Outfall Replacement Project

Figure 3-29

maximum wet weather flow has reached 110 MGD, which would require additional land area for disposal.)

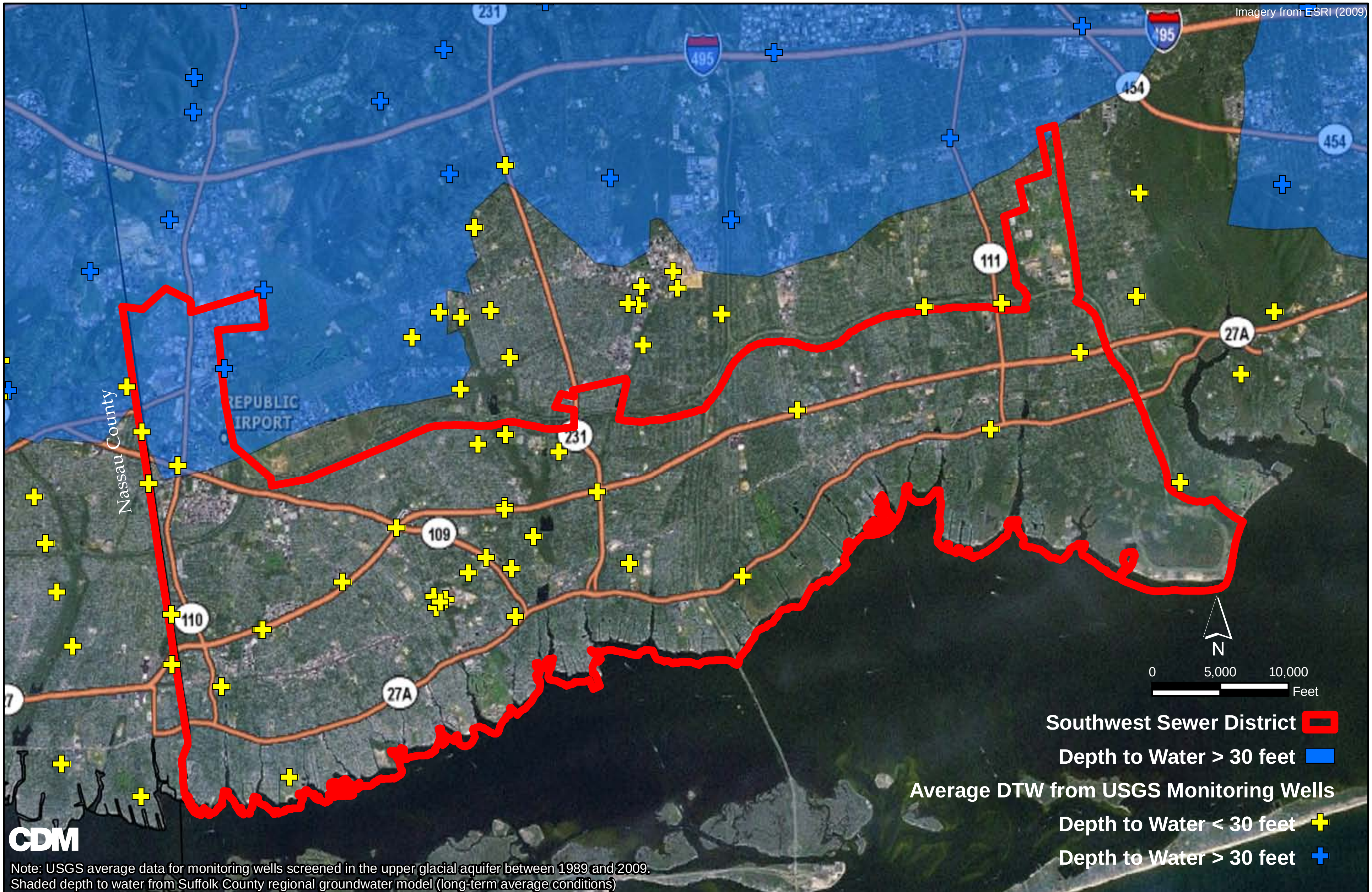
Based on 100 percent redundancy, a minimum distance of 300 feet to nearby structures and/or property lines, and a design flow of 5 gallons per day per square foot (gpd/sf) for each recharge basin based on established SCDHS standards, a 10 acre plot was calculated as the space necessary for siting the recharge basins or the leaching pools. The 10 acre plot includes the 4.6 acres (200,000 sf) and the 0.04 acre (1600 sf) at 100 percent redundancy necessary for each recharge basin. It is assumed that the basins will be constructed with a maximum depth of 4 feet.

SCDPW recently estimated (Mastic-Mastic Beach-Shirley Sewer Feasibility Study) that for each 1 mgd of wastewater to be recharged, 800 leaching pools would be required; because recharge of up to 110 mgd would be required, construction of leaching pools was not considered further during this assessment.

Based on typical applications, it is estimated that each injection well site will require a minimum area of 6,000 sf. It is assumed that four injection wells would be sited at each parcel; two would be operational, and two would be on stand-by. Each injection well would be designed to recharge 0.5 mgd. Injection wells are known to have higher maintenance requirements and have operational concerns associated with clogging; hence 100 percent redundancy would be required.

To avoid flooding of basements, depth to groundwater of more than 30 feet was identified as a requirement for locating the potential recharge sites. The existing calibrated Suffolk County groundwater model was used to identify the area north of the Southwest Sewer District (SWSD) and south of the Long Island Expressway, where average depth to groundwater exceeds 30 feet. The extent of the area was confirmed with depth to water measurements from USGS monitoring wells. **Figure 3-30** shows the area where recharge facilities could be sited based on acceptable depth to groundwater.

The calibrated Suffolk County regional groundwater model used for New York State's Source Water Assessment Program evaluations and in support of the Suffolk County Comprehensive Water Resources Management Plan (**Figure 3-31**) was first used to confirm that limiting recharge to areas where the depth to groundwater was equal to or greater than 30 feet was appropriate and adequately protective of existing structures. The model was run under long term average conditions of water supply pumping, precipitation and recharge, based on public water supply wells that were active in 2007 and used in the current Suffolk County Comprehensive Water Resources Management Plan (CDM, 2009). The discretization of the regional model was significantly increased within the study area to better represent the impact of the recharged treated sanitary wastewater at the simulated recharge basins and the spacing of potential injection wells (**Figure 3-32**). More than 75,000 nodes (150,000 elements) were added from the regional model and node spacing within the study area (defined here as the area between the Long Island Expressway and Sunrise

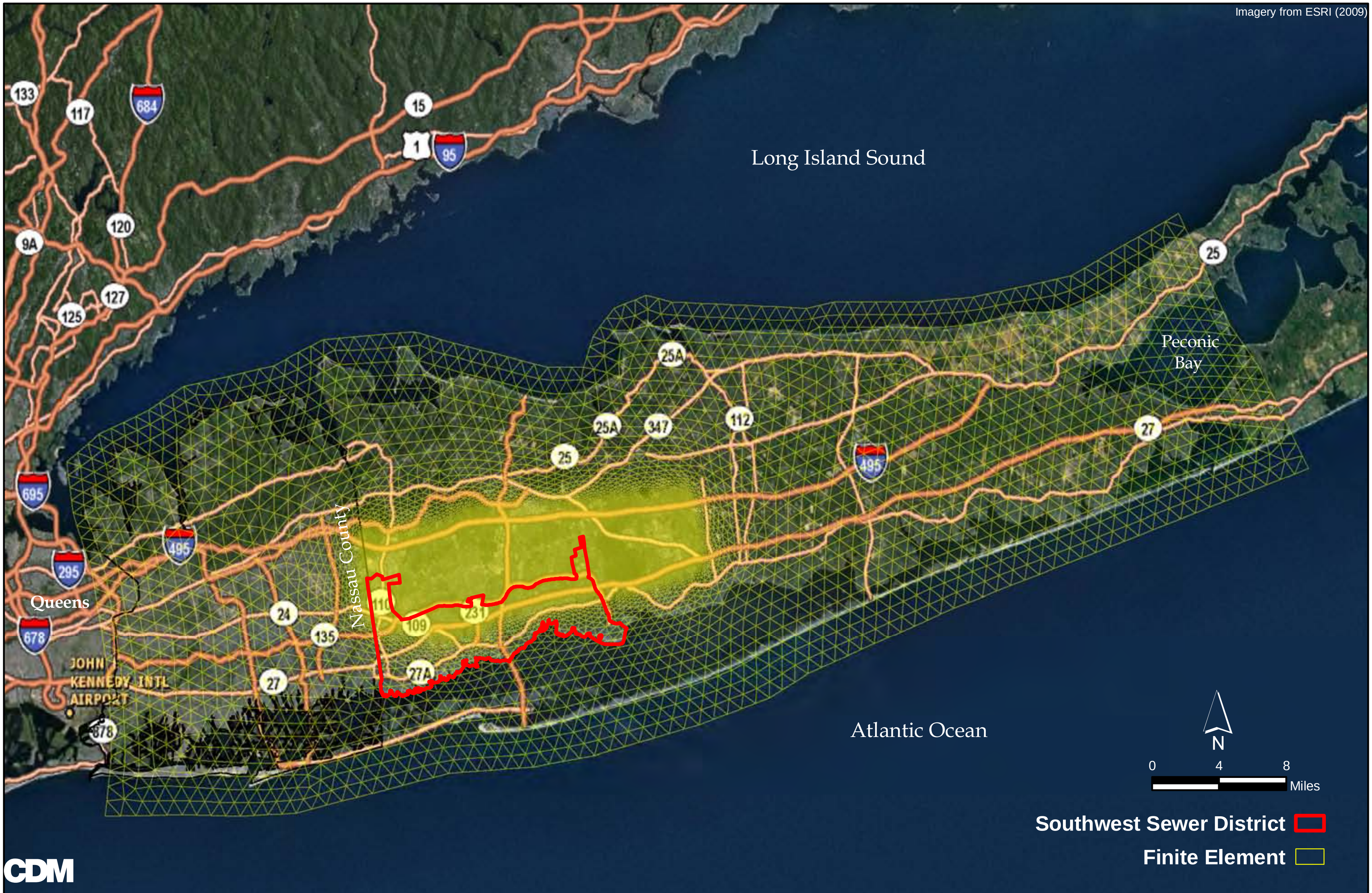


Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Areas where depth to the water table is > 30 feet below ground surface

Fig. 3-30

Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Finite Element Grid for Suffolk County Regional Groundwater Model

Figure 3-31



Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Revised Finite Element Grid for Recharge Simulations

Fig. 3-32

Highway within the vicinity of the Southwest Sewer District) increased from approximately 3,000 feet in the regional model to approximately 200 feet in the revised model. All hydrogeologic properties and boundary conditions from theregional model were incorporated and the revised model was run under steady-state conditions (long-term average pumping and recharge) and used as the basis for this analysis.

A spatial analysis using GIS was conducted to identify potential available locations for the recharge basins and injection wells based upon lot size, existing land use and a minimum depth of more than 30 feet to the water table. Please refer to Appendix C for a GIS plot of Suffolk County potential recharge basin and injection well locations. All locations were field verified for proper identification as well as their accessibility. The survey indicated a potential of up to 65 parcels in the targeted area for siting recharge basins, and a potential listing of 328 parcels to site injection wells.

Recharge via recharge basins was identified as the preferred means of discharging the treated effluent, as it is more reliable and less energy-intensive than injection wells. Hence, for the purposes of this evaluation, it was assumed that recharge would be accomplished first using the potential recharge basin sites and the remainder of the treated effluent would be recharged via injection wells. The initial 65 parcel list of potential recharge basin sites was reduced based on site characteristics obtained from a review of aerial photography. An additional filter was applied to the recharge sites by applying the 300-foot setback for effluent recharge beds as defined by SCDHS design standards. The 300-foot setback requirement eliminated many of the long and thin parcels (less than 600 feet wide) and reduced the list of potential sites to 21, of which only 10 are large enough to recharge 1 mgd (**Table 3-12**). SCDHS standards require at least two soil borings located within the proposed recharge area; these would have to be completed before the suitability of each for recharge was confirmed.

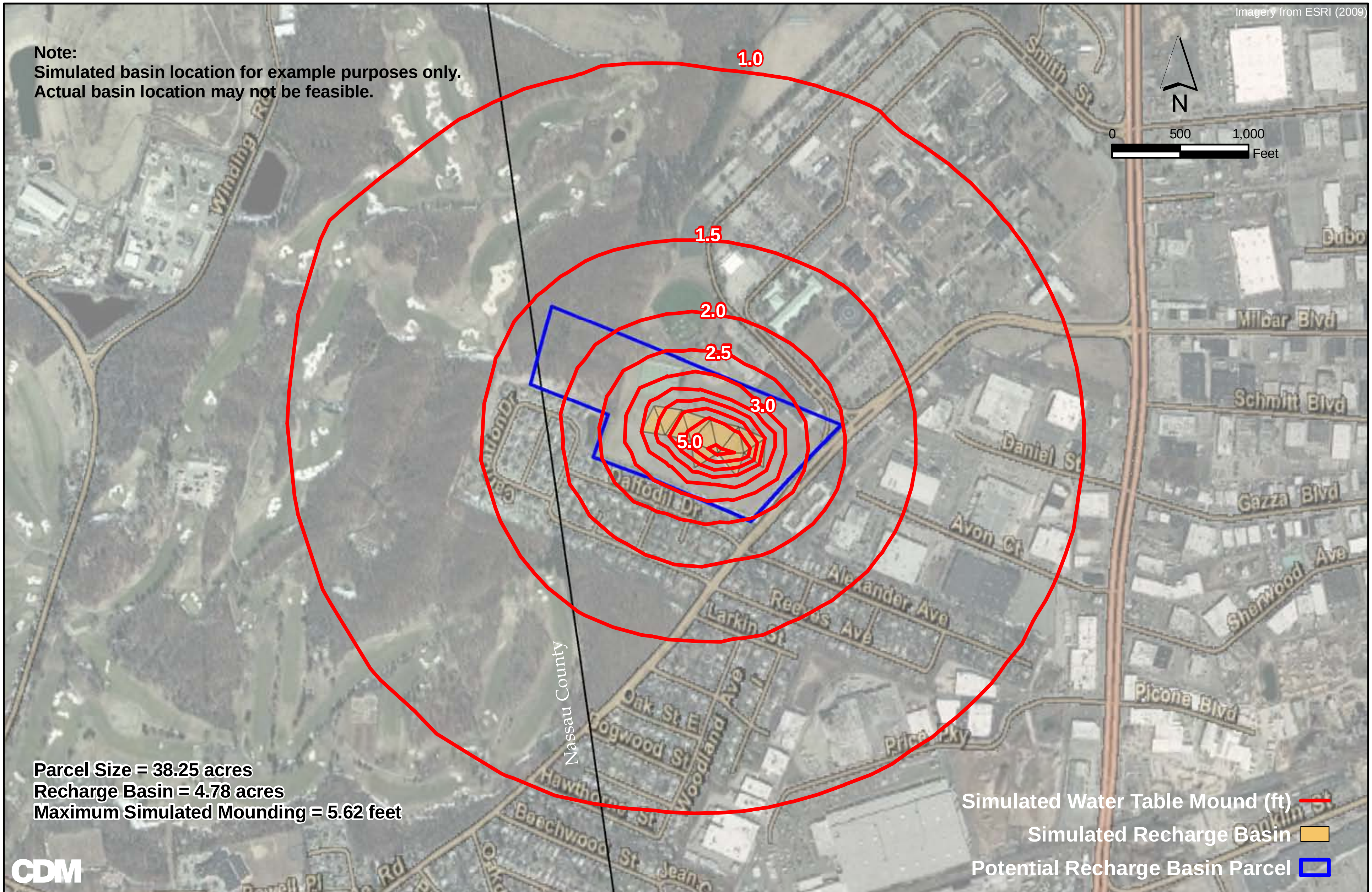
Potential sites for injection wells were based on parcels that currently have a vacant land use, have a minimum depth to water of at least 30 feet below the ground surface and are at least 6,000 square feet in area. A total of 328 parcels were included in the evaluation.

Localized water table mounding was initially evaluated by simulating recharge of 1 mgd into a recharge basin and a separate evaluation by injecting 1 mgd into an injection well. Results are shown on **Figures 3-33 and 3-34** for the recharge basin and injection well, respectively. For the recharge basin scenario, 1 mgd was applied to the water table and a maximum water table mounding of 5.62 feet was simulated under steady-state conditions. The injection well scenario was also simulated under steady-state conditions in which water was injected over a 60 foot screen interval, spanning the saturated zone of the upper glacial aquifer. Maximum simulated mounding was 4.98 feet at the well screen. Simulated mounding was less for the injection well scenario than the recharge basin scenario due to the increased hydraulic conductivity in the horizontal direction as opposed to the vertical direction in the upper glacial aquifer. This evaluation confirmed that depth to groundwater of 30 feet was an appropriate assumption to avoid basement flooding when recharging treated effluent.

Table 3-12
Potential Parcels for Recharge Analysis

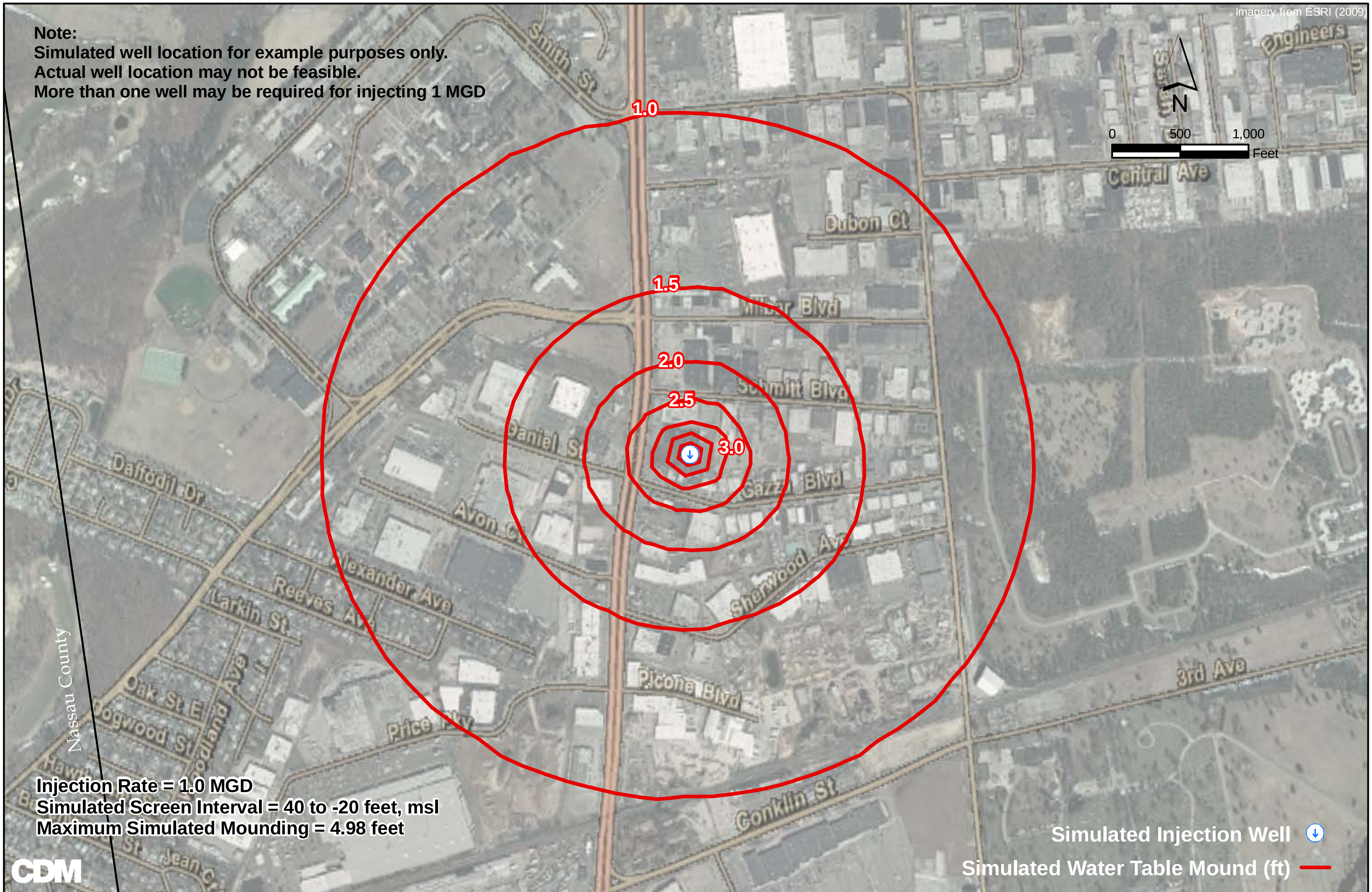
Parcel ID	Area for Recharge (sq ft)	Acres	Max Recharge (MGD)	Use for Recharge Analysis?
0400285000100079008	20608.46965	0.473105364	0.10	N
0400273000100065000	21760.3155	0.499548106	0.11	N
0400273000100063000	35168.2549	0.807352041	0.18	N
0400254000200046006	36133.2436	0.829505133	0.18	N
0400267000100013001	40445.72205	0.928506016	0.20	N
0400285000100079009	58657.3469	1.346587394	0.29	N
0100098000100105001	102229.7193	2.346871426	0.51	N
0400254000100007003	142022.6948	3.260392443	0.71	N
0400266000100007003	146954.1846	3.373603869	0.73	N
0400264000300001000	170734.5011	3.919524819	0.85	N
0400285000100077001	188485.1085	4.327022692	0.94	N
0100001000100006000	208020.3179	4.775489392	1.04	Y
0100029000100002010	279504.6916	6.416544803	1.40	Y
0500182000200061000	437284.114	10.03866194	2.19	Y
0100029000100002009	513215.2053	11.78179994	2.57	Y
0400285000100079006	1297181.51	29.77918985	6.49	Y
0400271000100062000	1613064.148	37.03085739	8.07	Y
0400285000100079003	2918223.935	66.99320329	14.59	Y
0500211000100002000	3262306.055	74.89224186	16.31	Y
0100011000100002000	5631219.004	129.2750001	28.16	Y
0100029000100002008	12508770.02	287.1618461	62.54	Y

Steady-state simulations were then conducted recharging 90 mgd across an area between the Long Island Expressway and Sunrise Highway at the potential recharge sites discussed above. The 10 recharge basin sites were utilized, in which each basin recharged 1 mgd, except for one larger basin to the east, which was assumed to recharge 2 mgd. The remainder of the recharge was added using 79 injection wells, dispersed throughout the area. The original list of 328 potential injection well parcels was filtered by eliminating one or more sites that were directly adjacent to each other to avoid increased local mounding, as well as those sites that were clearly surrounded by residential homes (i.e., a vacant lot in the middle of a neighborhood). Additional effort would be required to optimize the selection of the injection well sites, as potential sites were identified on a very preliminary basis, and because the results depicted on **Figure 3-35** indicate that water table mounding exceeds 20 feet in localized areas. In reality, it is not likely that recharge of 90 to 110 mgd would be required for an extended length of time, and extended periods of recharge of less than half this rate would generate much smaller water level increases. Depth to groundwater in these areas is sufficiently greater than 30 feet such that this would be



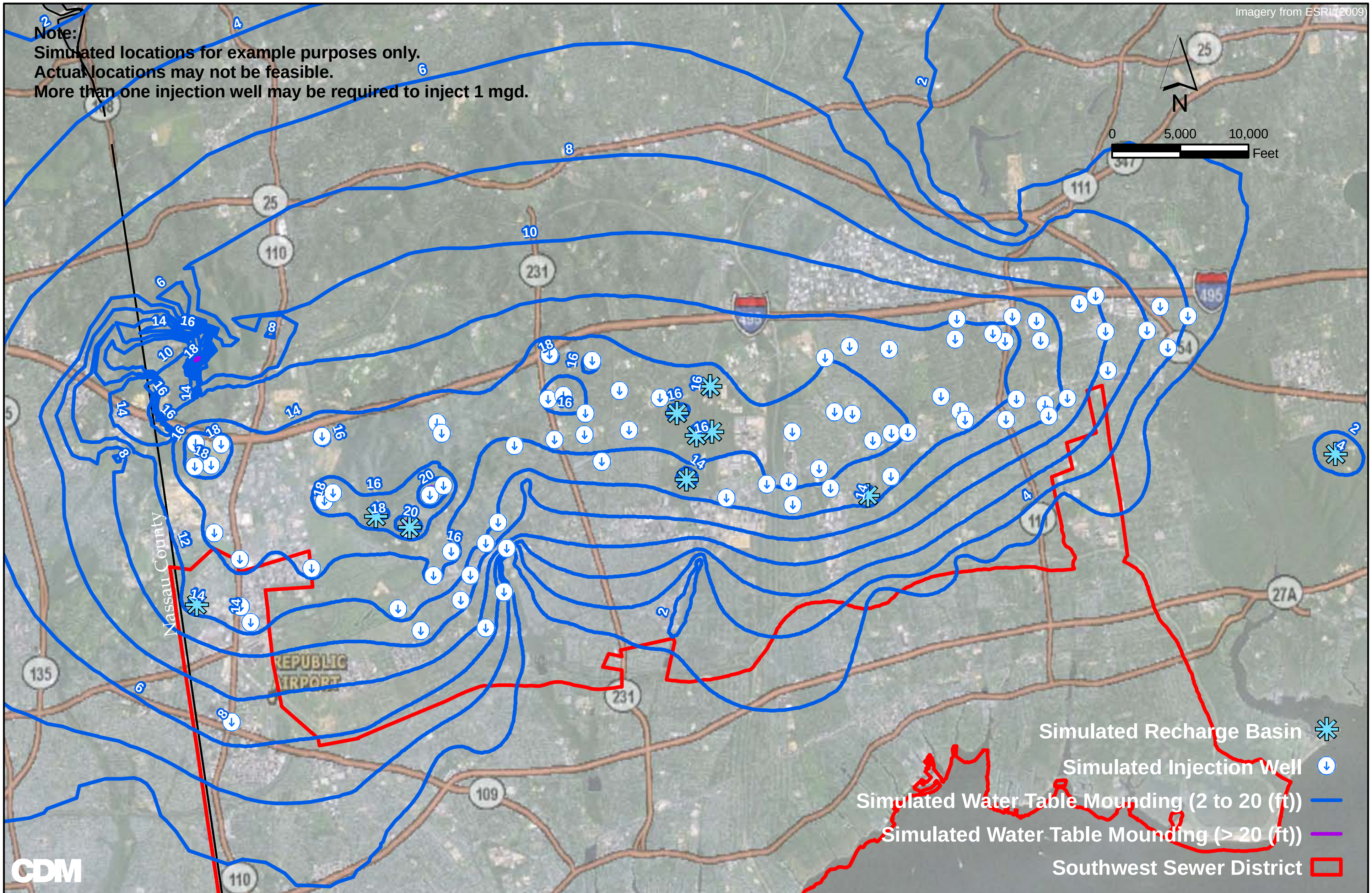
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Simulated Water Table Mounding from Recharging 1 MGD into a Recharge Basin

Figure 3-33



Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Simulated Water Table Mounding from Recharging 1 MGD into an Injection Well

Figure 3-34



Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Simulated Water Table Mounding from Recharging 90 MGD

Fig. 3-35

- acceptable; nevertheless, it would be advisable to spread the recharge over more widely separated injection well sites.

Although **Table 3-12** indicates that much more than 2 mgd could potentially be recharged at many of the sites, initial model simulations showed that recharge in excess of 1 mgd at the recharge basin sites, coupled with the recharge at nearby injection wells, created unacceptable localized water table mounding in some areas. Therefore, recharge was limited to no more than 2 mgd per basin. Actual recharge rates are site specific and should this alternative move forward, additional analyses should be conducted to evaluate if large basins can effectively recharge a higher flow rate without excessive water table mounding.

Additional requirements such as proximity to public water supply well source water areas would also have to be considered during final design and may further limit the number of viable recharge sites. In addition, security would have to be provided at each location, as the recharge sites could prove to be 'attractive nuisances'.

3.6.1.5 Instrumentation and SCADA System

The recharge piping network would be equipped with flow meters and flow control valves at key distribution points to distribute flow to the appropriate recharge facilities. The system would be monitored through a SCADA system that would indicate active recharge sites, operating pumps, flow distribution, ground water levels, recharge basin levels, operational use and alarm conditions. The central control system would be located at the Bergen Point WWTP. The means to transmit the data to the Bergen Point WWTP could be through radio, phone lines or a cable system. These details would be addressed during final design of the system.

3.6.1.6 Long Term Maintenance and Monitoring Requirements

The recharge sites will have to be maintained and monitored. One maintenance concern for both injection wells and recharge basins is sustaining adequate infiltration rates to the aquifer. Some procedures that may be used to maintain design infiltration rates for the recharge basins (documented in Long Island Water Resources Bulletin 14, USGS and Nassau County DPW, 1980) include:

- Alternating a period of water ponding with a dry period (also known as an application and rest cycle),
- Scraping the basin floor in the event to remove fines and any clogging associated with microbial activity,
- Mulching the soil to increase porosity and permeability,
- Covering the basin floor with gravel to disperse clogging material, and
- Planting vegetation on the infiltration area to increase soil porosity and permeability and to provide root channels for water percolation.

Procedures that will be required to maintain design infiltration rates for the injection wells include:

- Alternating recharge and rest periods
- Periodically cleaning the well screen to remove any fines, clogging associated with microbial activity, or clogging associated with iron coming out of solution.

Water levels in the recharge basins and discharge rates at the monitoring wells will have to be measured and monitored as described above to prevent flooding.

SCDHS currently requires a minimum of one upgradient and one downgradient monitoring well at each site recharging treated sanitary wastewater. Each recharge site is typically associated with a single sewage treatment plant. In this case, all of the recharge sites would be associated with the same treated effluent, however it is likely that groundwater quality will also have to be monitored downgradient of each recharge/injection site. SCDHS currently requires that monitoring wells downgradient of leaching beds are monitored for SPDES-specific contaminants, including nitrate, on a quarterly basis.

3.6.2 Environmental Impacts and Constraints

A wide variety of potential short term and long term impacts are associated with this alternative. While implementation of Alternative 6 would have no impacts on Great South Bay, both short term and long term construction-related impacts to the upgradient areas of Babylon and Islip would be significant.

3.6.2.1 Short Term Construction Related Impacts

Short term construction-related impacts will occur on the Bergen Point WWTP site as a result of the plant upgrade and pump station construction. Potential impacts include increased construction-related traffic, noise, and dust. Short-term impacts associated with the construction of the pump station(s) and extensive pipe distribution network required to convey the treated effluent to discharge will also extend northward through the Southwest Sewer District. These impacts will be similar to those observed during the construction of the SWSD, and will include the inconveniences to local residents and businesses associated with road closures, noise, dust, and traffic.

3.6.2.2 Long Term Impacts

Alternative 6 will generate the most significant long-term impacts in the area south of the Long Island Expressway and north of the Southern State Parkway where the treated effluent will be discharged to the aquifer. Long term impacts will include loss of existing open space including existing parkland in the study area to recharge basins, potential odors and vectors. Even more significantly, recharge of treated sanitary effluent will introduce low concentrations of contaminants of concern to the sole source aquifer. In addition, it is likely that additional land will need to be provided to accommodate the Bergen Point WWTP upgrade.

3.6.3 Permits

A variety of federal, state, County and local permits will be required prior to constructing facilities to recharge treated effluent upgradient of the Bergen Point WWTP, as summarized on **Table 3-13**.

3.6.4 Schedule

A preliminary schedule to implement Alternative 6 is presented in **Figure 3-36**. It is anticipated that the project would take up to 15 years to implement.

3.6.5 Costs

Conceptual level costs have been developed for each of the project components as follows; these are summarized on **Table 3-14**.

Table 3-14
Conceptual Cost Estimate for Alternative 6 – Upland Recharge

Project Component	($)
Pump Station	$19,300,000
Treatment Plant Upgrade	$100,000,000
Distribution and Recharge	$426,160,000
Subtotal	$545,460,000
Contingency (30%)	$163,638,000
Total	$709,098,000
Escalation (3% for 10 years)	$952,968,000
Engineering (7%)	$66,708,000
Cost	$1,019,676,000

Costs include very preliminary costs to upgrade Bergen Point, assuming that additional treatment processes to remove nitrogen are required. Based on recent information from local realtors, vacant land in Babylon and Islip is currently priced at an average over $300,000/acre. Depending on the mix of recharge basins, and injection wells constructed to discharge the 90 mgd, between $50,000,000 and $270,000,000 would be expended for land alone. Redundancy requirements would add additional costs. Land costs associated with recharge basin implementation would be greater than land costs for injection wells, however future operational costs would be much higher for injection wells.

The cost to construct the recharge facilities themselves would depend largely upon the recharge mechanism selected. Construction of recharge basins would be the least costly. Based upon recent estimates for proposed SCDPW sewering projects, construction of a 1.0 mgd recharge basin would be approximately $2,000,000; cost to

Table 3-13
Potential Permits and Approvals for Upland Recharge of Treated Effluent

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
STATE				
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters.	Roger Evans, Regional Permit Administrator 631-444-0361
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review518-474-6000
Approval	NYS Parks – LI State	N.A.	Regulates access of parkland, including use of	Scott Fish

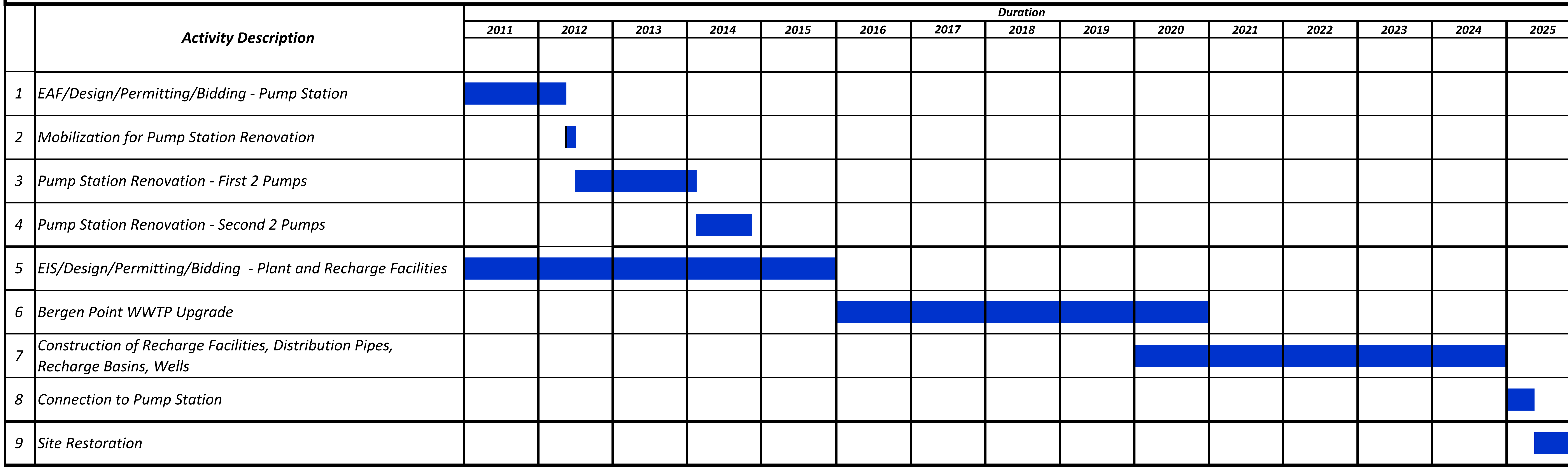
Table 3-13
Potential Permits and Approvals for Upland Recharge of Treated Effluent

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
	Park Region		commercial vehicles.	631-669-1000 Michelle Somma Land Management and Regulatory Affairs Coordinator 631-321-3580
Modification to Bergen Point WWTP Existing SPDES Permit	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	WWTP process/treatment requires modification to meet anticipated discharge standards to the sole source aquifer.	Roger Evans, Regional Permit Administrator 631- 444-0361
Long Island Well Permit	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 NYCRR Title 6, Part 602	Required for well point dewatering system.	William Spitz 631-444-0419
Freshwater Wetland	NYS Department of Environmental Conservation – Region 1	Environmental Conservation Law Article 124 - NCRR Title 6, Parts 663-665	Required for excavation or fill of wetlands or their 100 foot adjacent area.	George Hammarth, Division of Environmental Permits 631-444-0371
LOCAL				
Approval	SCDPW		Approval of plans and specifications	John Donovan, Acting Chief Engineer 631-852-4204
Approval of Design	SCDHS		Approval of WWTP modification.	Walter Hilbert, Chief, Office of Wastewater Management 631-852-5700 Walter Dawydiak, Chief Engineer, Division of Environmental Quality

Table 3-13
Potential Permits and Approvals for Upland Recharge of Treated Effluent

PERMIT/ APPROVAL	REGULATORY AGENCY(S)	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
				631-852-5800
Highway Road Opening Permit	Town of Babylon		Permit required to work in a Town road or its ROW.	
Notification	SC Police		SC Police are to be notified a minimum of 48 hours in advance of construction work.	
Highway Road Opening Permit	Town of Islip		Permit required to work in a Town road or its ROW.	
Highway Road Opening Permit	Town of Huntington		Permit required to work in a Town road or its ROW.	

Figure 3-36 Preliminary Schedule for Alternative 6 - Replace Outfall with Upland Recharge



**Note - NYSDEC allowable in-water window runs from October 1st to January 14th (3.5 months or 15 weeks), schedule does not take into account all permitting requirements*

recharge 90 mgd would be approximately $180,000,000, without any allowance for redundancy. Costs for leaching pool construction were based on costs estimated by SCDPW in 2010 and documented in the Mastic-Mastic Beach-Shirley Sewer Feasibility Study. SCDPW estimated that for each 1 mgd of recharge, 800 leaching pools would be required, at an installed cost of $7.25M, for a total of $625M. Addition of 50 percent more for redundancy would add an additional $312 M. To successfully recharge 80 mgd via injection wells as presented above, approximately 160 injection wells would be required, assuming that each can successfully recharge 0.5 mgd. Based on other injection well programs, at least one hundred percent redundancy would be required, as the wells, and surrounding aquifer system are prone to clog ging, and frequent maintenance is likely. It is assumed that each of the potential injection sites shown would accommodate two wells; one would be in use, and one out of service for maintenance. Assuming that each well was 150 feet deep, and using a $400/foot cost based upon recent bid estimates for injection wells elsewhere in Suffolk County, the cost for injection wells would approach $10M; costs would be expected to double to provide 100 percent redundancy. Additional costs would be associated with vaults, headers, well development, etc.

Finally, assuming that one upgradient and one down-gradient monitoring well are required at each recharge/injection sites, including redundant sites, assuming 200 foot deep wells, 168 200-foot deep monitoring wells at $40,000 each would add an additional $13,000,000 to the capital cost.

3.6.6 Summary of Advantages and Disadvantages

It is not feasible to assume that nearly all available vacant and parkland in the study area could be used for effluent recharge. In addition, the extensive effluent distribution piping network would be a significant disruption to area traffic, businesses and residents, and the operational costs associated with operating, maintaining and monitoring the recharge facilities are significantly higher than the operating costs associated with any other alternative, recharge of the treated effluent is not recommended for further consideration. At best, it is estimated that Alternative 6 would take a minimum of 15 years to implement, at an escalated cost that would exceed $1B. Two advantages to implementation of Alternative 6 were identified. First, there would be no impacts to Great South Bay during construction or operation of the alternative. In addition, no groundwater baseflow would be diverted from the streams, ponds and wetlands areas within the Southwest Sewer District.

3.7 Results and Conclusions

The advantages and disadvantages of implementing each of the six potential Bergen Point WWTP outfall replacement alternatives are compared on **Table 3-15**.

Replacement of the existing outfall pipeline beneath Great South Bay by Alternative, 2, the tunnel, is recommended for a variety of reasons as listed below. In summary, it is the least expensive of the two alternatives that will have the least impact to the County's surface and groundwater resources, and the environment, and it can be

Table 3-15
Comparison of Bergen Point WWTP Outfall Replacement Alternatives

Criteria	Alternative 1- Tunnel with Carrier Pipes	Alternative 2 – Tunnel	Alternative 3 Open Cut	Alternative 4 Discharge to Great South Bay	Alternative 5 Line Existing Pipe/Temporary Discharge to Bay	Alternative 6 Upland Recharge of Treated Effluent
Implementability						
Permittable	Yes	Yes	Potential	No	No	Potential
Impacts						
Short Term Impacts to Great South Bay	Low	Low	Localized Significant	Potential Significant	Potential Significant	None
Long Term Impacts to Great South Bay	None	None	Potential Significant	Potential Significant	Potential	None
Short Term Impacts to Upland Neighborhoods	Minor – Construction Traffic	Minor – Construction Traffic	Minor – Construction Traffic	Minor – Construction Traffic	Minor – Construction Traffic	Significant
Long Term Impacts to Upland Neighborhoods	None	None	None	None	None	Significant
Impacts to Aquifer	None	None	None	None	None	Significant
Implementation Schedule						
Short (0 to 5 Years) *Medium (5 to 10 Years)* *Long (10 to 15 Years)* *Very Long (> 15 Years)*	Medium	Medium	Long to Very Long	Very Long	Very Long	Very Long

Cost						
Capital Cost *Lowest (0 - $250M)* *High ($250M - $500M)* *Very High ($500M - $750M)* *Highest (>$750M)*	High	Lowest	High	Very High	High	Highest
Operation and Maintenance Cost *(based on Treatment and Pumping requirements)*	Lowest	Lowest	Low	High	High	Very High

implemented the most quickly of any of the alternatives under the existing regulatory framework.

Additional considerations are briefly identified below:

- Of the three alternatives that could be most readily permitted under the existing regulatory framework (Alternatives 1, 2 and 6), Alternative 2 is the least expensive and has the shortest construction duration, enabling the County to replace the deteriorating outfall most quickly.

- It is the less expensive of the two alternatives (Alternatives 1 and 2) with the least impact to area groundwater and surface water resources and has the shortest implementation duration, enabling the County to replace the deteriorating outfall most quickly.

- It has the shortest implementation schedule of any alternative; extending the schedule to a decade or more increases the possibility that the existing outfall could fail;

- Along with Alternatives 1 and 3, it has the lowest operating costs of the alternatives.

The primary disadvantage associated with Alternative 2 is the significant capital cost.

Alternative 1 is similar to Alternative 2, with the addition of carrier pipes within the outfall tunnel. The carrier pipes add additional cost to the project, and over a year to the schedule.

Alternative 3, replacement of the existing outfall via open cut, would cause significant impacts to the ecology and habitat within the construction zone along the tunnel alighment. Because outfall construction within the Bay could only proceed from October 1 through January 15, the cost for this alternative is increased along with the construction duration. The increased construction duration increases the possibility that the existing outfall could fail, resulting in an uncontrolled discharge to the Bay. Because this alternative has a higher capital cost, a longer implementation schedule, and would cause significantly more impact to the Great South Bay than Alternative 2.

Alternatives 4 and 5 cannot be permitted, as the USEPA has designated the Great South Bay as a no discharge zone.

Alternative 6, advanced treatment and upland recharge has the highest capital and operational cost of the five alternatives, and would also be the most complex to operate. It would be the most disruptive to local communities, both during construction and operation. While recharge of the treated effluent would return the groundwater removed from the aquifer for water supply, which would restore groundwater levels and stream baseflow to pre-sewering levels, it could also result in permanent impacts to the quality of the area's sole source aquifer, which is the only source of potable supply to area residents.

Section 4
Subsurface/Sub-marine Conditions in Project Area

4.1 Geological Setting

The Bergen Point WWTP and outfall is located within the Coastal Plain Province of New York at Long Island. The island generally slopes from the Harbor Hill and Ronkonkoma moraines to the south, and the Bergen Point WWTP site drains southward into Great South Bay, and ultimately to the Atlantic Ocean. The following information is based on four documents published between 1983 and 1999, (referenced in the Geotechnical Data Report) and the subsurface conditions encountered during the geotechnical investigation.

4.2 Regional Geology

Long Island is comprised of Cretaceous and Pleistocene unconsolidated deposits underlain by Early Paleozoic to Precambrian bedrock. A generalized regional cross section is shown by **Figure 4-1**.

Suffolk County is underlain by almost 2,000 feet of unconsolidated sediments of varying composition overlying metamorphic bedrock, as summarized below. The subsurface investigation was designed to determine the extent and consistency of the 20-foot thick clay deposit, if present, and other soil types within the upper 200 feet of the Upper Glacial aquifer.

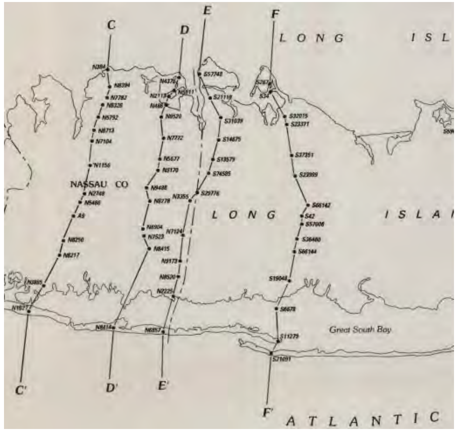
The following descriptions are using the hydrogeological unit names.

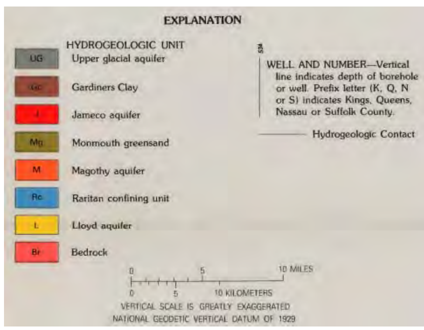
4.2.1 Bedrock

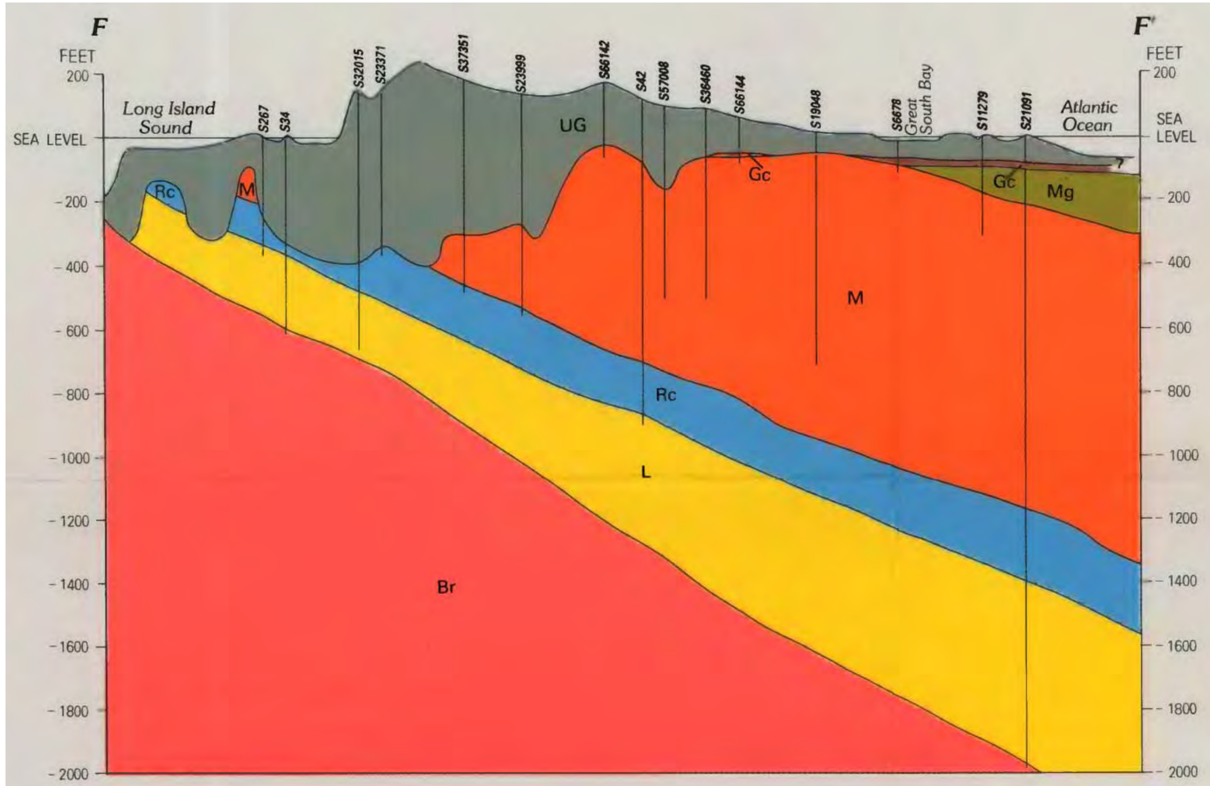
Generally, the base of the aquifer system is crystalline metamorphic and igneous rock of Early Paleozoic to Precambrian Age. The bedrock is relatively impermeable and does not transmit or store significant volumes of groundwater. Glacial scouring has left several buried valleys that have been subsequently filled by silt, clay and other unconsolidated deposits. The bedrock slopes steeply to the southeast, and the overlying unconsolidated deposits thicken to the south.

4.2.2 Lloyd Aquifer

The Lloyd Sand Member is part of the Raritan Formation. It overlies the bedrock surface and is Long Island's deepest and oldest aquifer. The Lloyd Sand was deposited as a series of braided streams and deltaic deposits consisting of white and pale yellow sand with inter-bedded lenses of gravel and clay. The aquifer does not outcrop on Long Island, and is assumed to extend to the north beneath Long Island Sound in eastern Nassau County and Suffolk County, and offshore to the south, beyond the barrier beaches. The thickness of the Lloyd Aquifer varies from just a few feet in northern portions of Long Island, to more than 500 feet to the south.







Source: modified from Smolensky, D.A., Buxton, H.T., and Shernoff, P.K. 1989. Hydrogeologic Framework of Long Island, New York. U.S. Geological Survey Hydrologic Investigations Atlas HA-709.

Figure 4-1

North-South Cross Section through Suffolk County

4.2.3 Raritan Clay

Overlying the Lloyd Aquifer is the Raritan Clay. This Cretaceous Age member of the Raritan Formation is the major confining unit on Long Island, ranging between 150 and 250 feet in thickness. The Raritan Clay is assumed to be present north of the Island beneath Long Island Sound, and south of the Island, beneath the barrier islands. This confining unit consists of solid, multicolored, compact clay (gray, white, red, or tan) with inter-bedded lenses of sand.

4.2.4 Magothy Aquifer

The Magothy Aquifer is an upward fining sequence of the Cretaceous Age Matawan Group consisting of fine to medium grained quartz sand, silt, clay, and gravel, and is up to 1,100 feet thick. The base of the Magothy Aquifer is very coarse, having been deposited in a high-energy environment involving stream and deltaic deposition. This high-energy deposition abruptly ended as fine sands, silts, and clays form the majority of the unit.

4.2.5 Monmouth/Greensand

The Monmouth greensand is a dark-greenish gray, greenish-black, greenish, black inter-bedded marine deposit of clay, silt and sand that ranges in thickness from just a few feet at its northern limit to 200 feet at the south shore barrier islands.

4.2.6 Gardiners Clay / "20-Foot" Clay

The Gardiners Clay, known locally as the "20-foot Clay", is a grayish green and brown clay of Pleistocene Age that extends eastward in a band along the south shore. The clay ranges in thickness from just a few feet at its northern limit, to approximately 100 feet at the southern barrier islands.

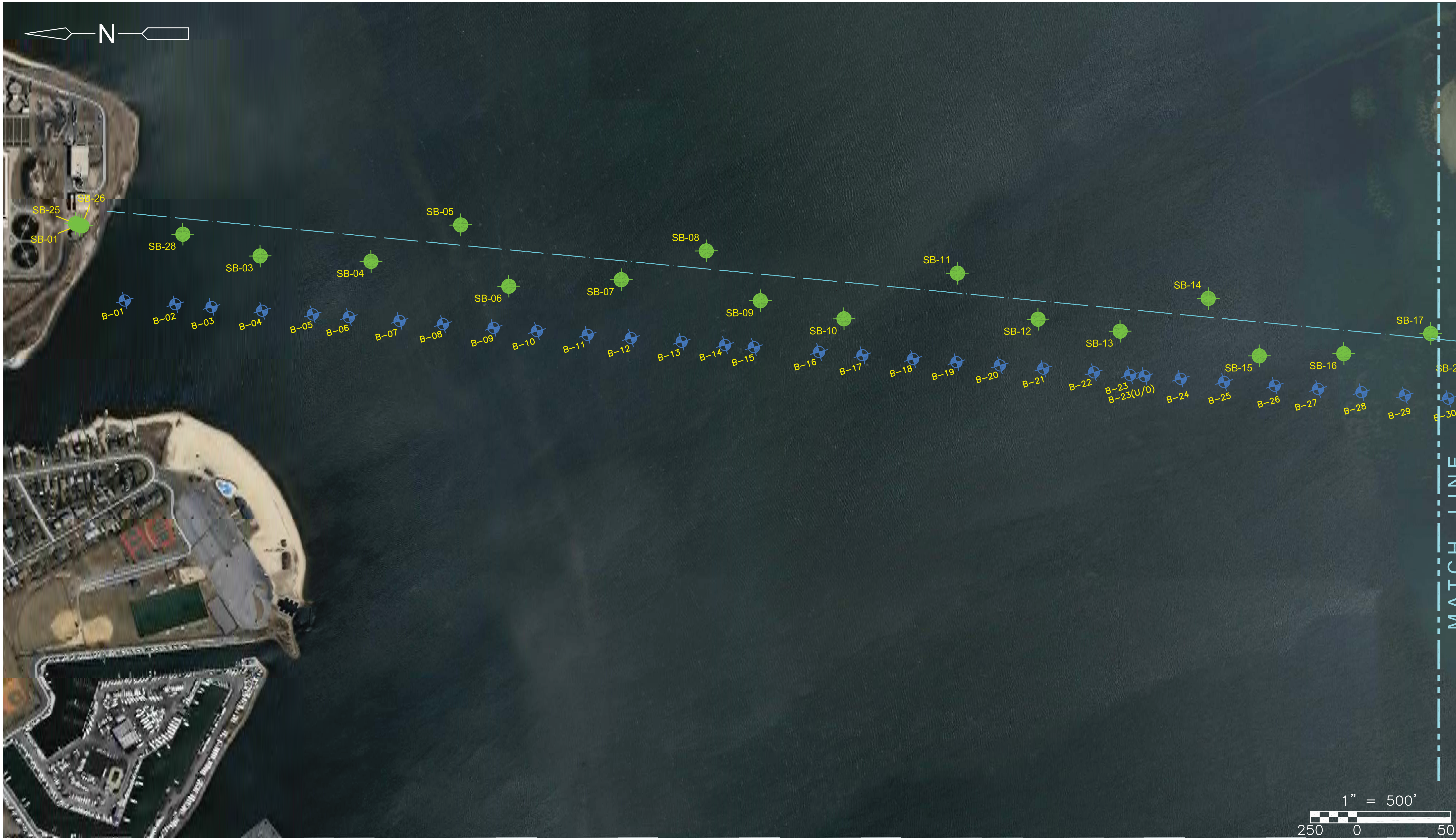
4.2.7 Upper Glacial Aquifer

The Upper Glacial Aquifer is the uppermost unit throughout the area. Along the terminal moraine and parts of the north shore, the unit is comprised of till consisting of poorly sorted outwash deposits composed of clay, sand, gravel, and boulders. These outwash deposits are moderately to highly permeable, consisting of gray, brown, and yellow fine to very coarse sand and gravel. The Upper Glacial Aquifer ranges up to 600 feet thick; however, the saturated thickness is often much lower.

4.3 Subsurface Investigation Program

4.3.1 Geotechnical Investigation

The geotechnical investigation program consisted of a total of 27 borings conducted along the 14,200 foot proposed tunnel alignment within the existing outfall easement between February and May 2009 as shown on **Figure 4-2**. Eight borings were conducted on land and 19 marine borings were conducted using a jack up barge. The

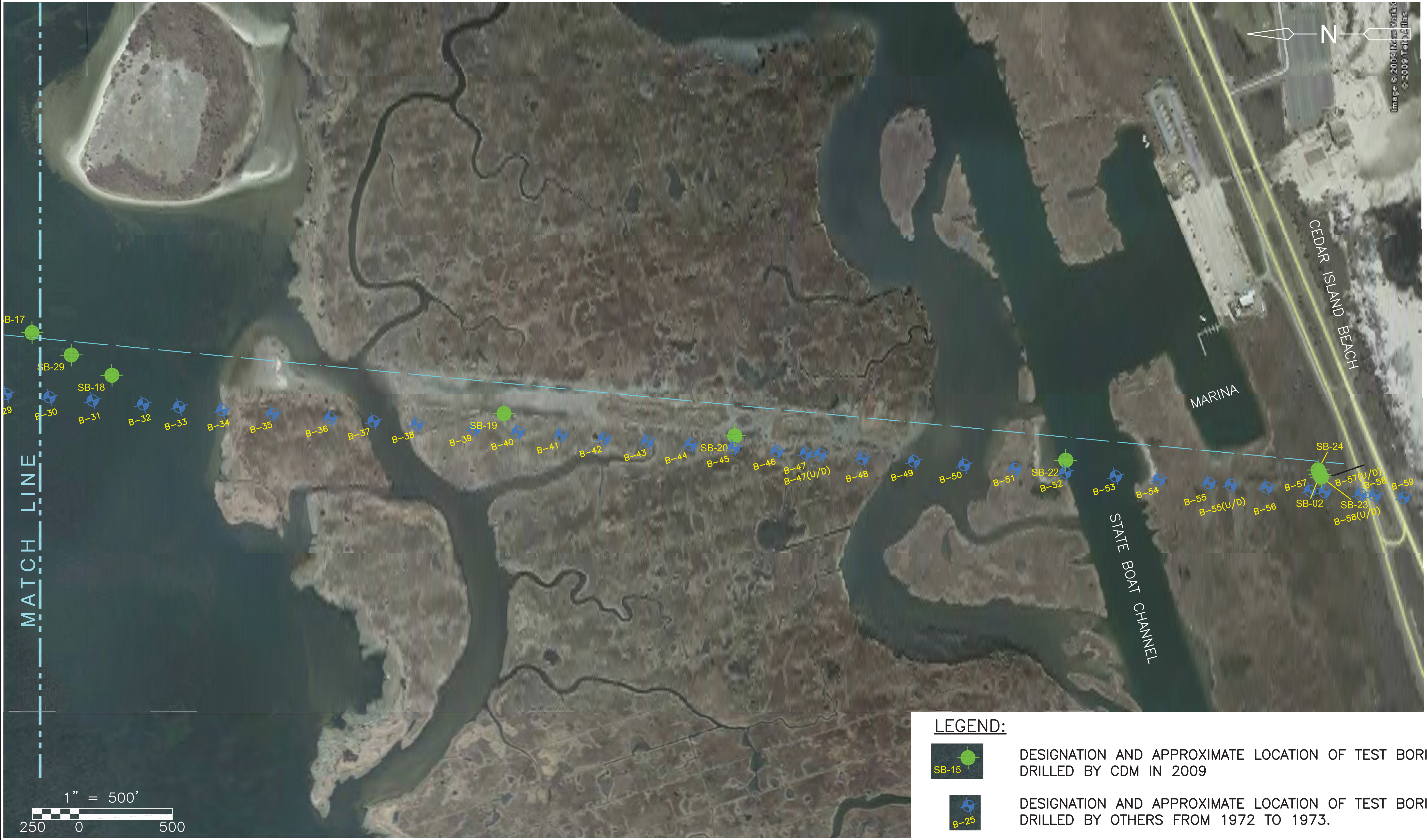


CDM
consulting • engineering • construction • operations

SUFFOLK COUNTY SEWER DISTRICT NO. 3
SOUTHWEST OUTFALL REPLACEMENT PROGRAM

BORING LOCATION PLAN
(SHEET 1 OF 2)

Figure 4-2a



LEGEND:

SB-15 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORINGS DRILLED BY CDM IN 2009

B-25 — DESIGNATION AND APPROXIMATE LOCATION OF TEST BORINGS DRILLED BY OTHERS FROM 1972 TO 1973.

GEOTECHNICAL PROFILE BERGEN POINT.dwg

CDM
consulting • engineering • construction • operations

SUFFOLK COUNTY SEWER DISTRICT NO. 3
SOUTHWEST OUTFALL REPLACEMENT PROGRAM

BORING LOCATION PLAN
(SHEET 2 OF 2)

Figure 4-2b

borings ranged in depth between 100 and 200 feet below existing grade. Split spoon sample tests (SPT) were taken at 10-foot intervals at depths above 80 feet, and 5-foot intervals at depths below 80 feet, except at boring locations SB-23 and SB-26. Sampling intervals at those locations were conducted continuously to a depth of 150 feet. Sampling was not conducted at SB-21 and SB-27 due to the consistent data of adjacent borings and schedule constraints from environmental permits. Undisturbed Shelby tubes were attempted as part of the program, but only one undisturbed sample was obtained. The consistency of the clay materials near the proposed tunnel elevations were very stiff to hard, and resulted in either no penetration of the tube into the soil and no recovery, or crushed tubes. Therefore, to obtain engineering properties for design, *in-situ* pressuremeter tests were conducted at three boreholes (SB-25, SB-26, and SB-07).

Three monitoring wells were installed within pervious strata at SB-01, SB-26 (launch shaft) and SB-02 (exit shaft). *In-situ* hydraulic conductivity and salinity measurements were conducted at each of the monitoring wells. The boring logs that show the sample interval are presented in Appendix 2A.1 of the Geotechnical Data Report (GDR), Appendix D to this document. Monitoring well logs are presented in Appendix 2A.3 in the Geotechnical Data Report. A summary of the water levels encountered in the land test borings at the time of drilling is shown in **Table 4-1.**

4.3.2 Geotechnical Laboratory Testing Program

Index tests were conducted on selected samples obtained from each of the borings. A total of 165 water content, 165 sieve, 165 hydrometer, 66 Atterberg, 9 organic content, 4 specific gravity, 12 triaxial, and 4 consolidation (constant rate of strain) tests were performed on the samples obtained. Test results of the samples are presented in the GDR.

4.3.3 Geotechnical Frozen Soil Laboratory Testing Program

Frozen soil laboratory testing was performed to assist in the evaluation of shaft construction using ground freezing techniques. Five representative samples were sent to a laboratory in Germany for index testing. The index tests including uniaxial compression, uniaxial creep, and triaxial compression tests, were generally conducted at -10 °C and -20 °C. One salinity test was conducted on the soils. The laboratory tests results are presented in Section 7 of the GDR.

4.4 Geotechnical Conditions

4.4.1 Subsurface Soil Conditions – Tunneling Options

The upper 60 feet of overburden below Great South Bay between the existing effluent pump station and Fox Creek Boat Channel consists of 10 feet of clay, overlaying a 10 to 20 foot thick layer of gravelly sand, overlying approximately 40 feet of clean sand. The remaining portions of the alignment consist of clayey silts and sands overlying clean sands; the clean sands contain discontinuous layers or pockets of gravelly sands

Table 4-1 Summary of Observation Well Water-Level Data

Boring No.	Date	Time	Static Water Level (ft)
SB-01	4/21/2009	11:39	8.4
SB-01	4/21/2009	12:50	8.5
SB-01	4/21/2009	17:14	8.4
SB-01	4/22/2009	14:01	8.5
SB-01	4/22/2009	14:15	8.6
SB-01	4/22/2009	15:01	8.7
SB-01	4/22/2009	16:19	8.6
SB-01	4/23/2009	7:15	8.5
SB-02	4/23/2009	8:05	artesian
SB-02	4/23/2009	11:00	artesian
SB-02	4/23/2009	14:15	artesian
SB-26	4/21/2009	15:30	10.6
SB-26	4/21/2009	17:34	10.6
SB-26	4/22/2009	7:58	10.5
SB-26	4/22/2009	9:25	10.8
SB-26	4/22/2009	10:20	10.5
SB-26	4/22/2009	12:25	11.2
SB-26	4/22/2009	15:00	-

that are 5 to 10 feet thick. The sand layer is also interrupted approximately every 2,000 feet by hummocky, clayey sands that protrude into the clean sand.

Below the clean sand layer are 10 to 20 foot thick layers of clay and clayey sand, with pockets of clean sand. The 20-foot thick, continuous layer of Gardiners Clay was not observed within the upper 200 feet along the alignment.

Based on the results of the lab data obtained, an interpretative profile was developed to differentiate soils encountered into five groups:

- Gravelly sand (group A)
- Clean sand (group B)
- Silty -clayey gravel (group C)
- Silt/silty- clayey sand (group D)
- Silty- clays and clays (group E)

These soil groups were defined primarily in accordance with their tunneling behavior. As such, the engineering parameters that are evaluated are the gradation, consistency, mineral content of the soil and permeability. The engineering properties of the soils in the proposed tunnel horizon are of importance to both the design and construction issues that will affect the tunnel.

4.4.1.1 Engineering Properties

The soil gradation is important in the evaluation of the permeability and the type of soil conditioner that the contractor will use: to mitigate abrasion wear on the equipment during tunneling; to help reduce torque on the cutter head and also to help provide a consistent muck composition which makes handling the material more efficient. The group B soils will consist of 15.7 to 89.3 % of sand and gravel, sieve size of 0.42 mm (#40). No gradations were performed on the group A soils because of the limited length of tunnel that is expected to encounter this soil grouping. The group D and E soils are fine grained and will consist of material with 5.0 to 97.6 % passing the #200 sieve. Group C material is not expected to be encountered within the vertical tunnel corridor based on the results of the subsurface investigation program.

Consistency is defined as the *in-situ* strength of the soil. This value is estimated by N values and also the pressuremeter testing and evaluated in terms of the Modulus of Elasticity, E. The expected modulus range of values by soil group is:

Group A - 600,000 to 4,200,200 psf

Group B - 600,000 to 3,000,000 psf

Group D - 100,000 to 410,000 psf

Group E - 50,000 to 104,000 psf.

No testing was performed in the group C soils which are not anticipated to be encountered at the tunnel horizon.

The permeability of the group A and group B soils is expected to be high, in the range of $1x10^{-2}$ to $5x10^{-4}$ cm/sec. The permeability of the group D and E soils is expected to be significantly lower in the range of $5x10^{-4}$ cm/sec or less. The permeability parameter will be used in evaluation of locations for interventions. Intervention is the term used when tunneling is stopped so that the face of the tunnel boring machine can be inspected by miners that access the front of the machine. These interventions are planned at locations that are favorable for this effort with regards to hydrostatic pressure, free flow of water and the ability to modify the ground to provide a stable condition for the miners.

Mineralogy is the composition of the soil elements and is a factor in evaluating the abrasion nature of the soil. To date there is no established standard to define soil abrasion similar to that used for rock. The minerals that are of importance are the hard material such as quartz and the shape of the minerals. Because of the grain shape of clay, these soils are typically low in abrasion and therefore this evaluation is only performed on the granular soils, in this case soil group B and D. The expected ranges in quartz content of these groups are between 35 and 45 percent by weight.

4.4.2 Subsurface Soil Conditions – Open Cut & Dredging Options

For the purposes of alternative generation and development of construction approaches for each alternative, the upper 50 feet along the alignment is discussed below. As a general trend, a very soft layer of silts is overlaying predominantly sandy material with various amounts of gravel. A summary of the subsurface conditions encountered along the outfall alignment is presented in Section 7 of the GDR.

Soft Surficial Deposit

In general, the upper 5 to 10 feet consist of a very soft to soft silts and clays with organic material. SPT N-values within this stratum range between weight of rod (WOR) and weight of hammer (WOH).

Sand and Gravel Deposits

In general, an approximately 10 to 15 feet thick layer of loose, fine to medium sand stratum was encountered below the soft surficial deposits. Limited amounts of fines or gravel were encountered within the stratum. A layer of medium dense, medium to coarse sands with varying amounts of gravel was encountered below the loose sand layer. SPT N-values within this stratum range between 10 and 20 blows per foot. Isolated pockets of dense to very dense material were encountered within this layer.

4.4.2.1 Engineering Properties

The following evaluation is based on a general interpretation of the anticipated engineering properties of the subsurface soils based on the data collected during the subsurface investigation.

The hydraulic conductivity for silt and clay deposit is anticipated to be less than 1 x 10^{-6} cm/sec due to the high fines content. Saturated unit weights for silt and clay are anticipated to range between 90 to 105 pcf. Cohesion values within the silt and clay are anticipated to be less than 200 pounds per square foot (psf).

The hydraulic conductivity for the sand and gravel deposit is anticipated to range between 1 x 10^{-2} cm/sec to 5 x 10^{-3} cm/sec. Saturated unit weights for the sand and gravel are anticipated to range between 125 to 130 pcf. Friction angles for the sand and gravel deposits are estimated to range between 28 to 30 degrees for the loose material and 32 to 34 degrees for the medium dense material. The pockets of dense to very dense material may have higher internal angles of friction.

Section 5
Conceptual Design of Preferred Alternative

5.1 Description of Preferred Alternative

As described in Section 3, the preferred alternative for replacement of the deteriorating section of the Bergen Point WWTP outfall beneath Great South Bay is Alternative 2, a tunnel. Alternative 2 has been selected as the preferred alternative because:

- It is one of the three alternatives that avoids construction within Great South Bay and/or discharge to Great South Bay, which significantly reduces the potential for impact to the environment.

- It is one of the two alternatives with the lowest (albeit still significant) capital cost, and is one of the three alternatives with the lowest operational cost.

- Its implementation schedule is significantly shorter than any of the other alternatives, thus reducing any potential impact to the Bay resulting from future failure of the existing outfall.

- It is one of the alternatives with the least impact to the surrounding community.

All alternatives, including Alternative 2 also require renovation of the existing effluent pump station. The conceptual design of the effluent pump station and the outfall tunnel are summarized in the following pages.

5.1.1 Rehabilitation of Effluent Pump Station

The existing effluent pump station will be rehabilitated to address the following three concerns:

- The effluent pump station is over 30 years old and the pumps, controls and mechanical systems are nearing the end of their useful life. In addition, due to the age of the pump station, parts for major components are currently difficult to procure making maintenance or repair difficult to perform.

- Currently SCDPW is in the design phase of an expansion of the Bergen Point WWTP from an average daily flow of 30.5 MGD to 40.5 MGD and an upgrade, which includes the addition of an ultraviolet (UV) disinfection system. The future peak flow of the plant associated with this expansion is 110 mgd which exceeds the capacity of the existing pumps. In addition, the head loss through the UV disinfection system will reduce the hydraulic grade line just prior to the effluent pump station. The increased flow and reduced hydraulic grade will reduce the ability to discharge plant effluent by gravity and will increase the frequency of effluent pumping required.

- Rehabilitation of the effluent pump station will address the change in hydraulic conditions associated with the new 10-foot diameter tunnel. However, since the pump station will operate for several years utilizing the existing outfall, it will be designed to address the headloss conditions of both pipelines. Additionally, the need to maintain pump station operation during outfall construction of the outfall will require a phased approach.

The current and projected ranges of flows associated with the effluent pump station are presented in **Table 5-1** below.

Table 5-1
Effluent Pump Station Flows

	Average Daily	Minimum	Peak
Existing Design, MGD	30.5	25	90
Current Flow, MGD	25.6	18	110
Upgraded Design, MGD	40.5	20	110

The effluent pump station rehabilitation will consist of the following items:

- Installation of one new effluent pump in existing location No.1
- Replacement of existing effluent pumps No. 2, 3 and 4with new pumps
- Replacement of existing interior pump station suction and discharge piping
- Replacement of existing interior check valves and isolation valves
- Reconfiguration of interior discharge piping to convey effluent to the west side of the existing building, to the replacement outfall tunnel
- Construction of exterior piping and valving from the reconfigured pump station to allow continued use of the existing 72-inch outfall during construction
- Construction of exterior piping and valving to connect the effluent pump station to the replacement outfall tunnel

The components of pump station rehabilitation are illustrated on **Figure 5-1.**

\\Wbysvr01\cad3\5175\39512\ FIG5-1 05/05/11 14:04 gencorellirj

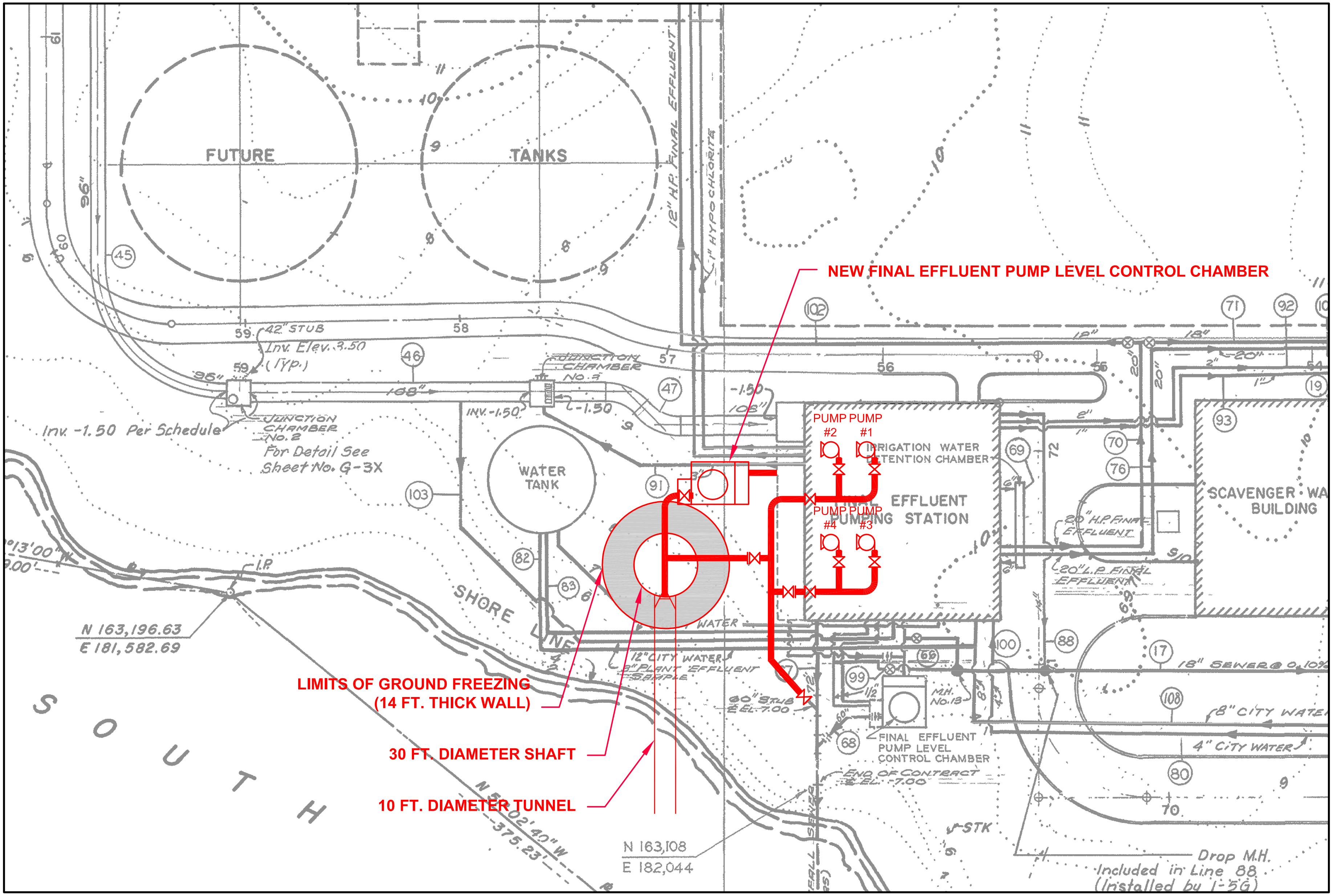


Figure No. 5-1
Final Effluent Pump Station Rehabilitation
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

5.1.1.1 Constraints

Pump Station Operation

Pump station operation will need to be maintained during construction. Due to the existing arrangement of the pump suction conduits and suction piping, two pumps will be installed or replaced at a time. This will require the pump station to operate with two pumps in service while the two other pumps are being replaced.

Initially, while pumps 1 and 2 are being installed, the pump station will operate with existing pumps 3 and 4 in service. While new pumps 3 and 4 are installed, the pump station will operate with new pumps No.1 and 2.

During construction, the pump station will continue to pump effluent through the existing bay portion of the 72-inch PCCP outfall. Initially, the existing discharge piping from pumps 3 and 4 will be utilized. After construction is complete, new pumps 1 and 2 will be connected to the existing outfall through new discharge piping. This will be accomplished by connecting the discharge piping from all four new pumps to a 60-inch stub located on the existing 72-inch PCCP approximately 40 feet south of the pump station building. Upon replacement of pumps 3 and 4 they will also discharge through the new discharge piping to the existing outfall.

Due to the substantial difference in size between the existing outfall and the proposed new outfall tunnel, the hydraulic conditions to be met by the new pumps prior to and after the outfall tunnel is placed into service will also vary significantly. The proposed 10-foot outfall tunnel will have a reduced friction loss component and lower head requirements than the existing 72-inch outfall. The new pumps will need to meet the range of flows and hydraulic conditions expected under both scenarios.

Pipe and Conduit Isolation

In order to complete the rehabilitation, sections of piping and conduit will need to be isolated. The outfall section containing the 60-inch stub will need to be isolated to allow for the connection of the new discharge piping. The 60-inch stub to be used for routing discharge from the new pumps to the existing outfall is currently blind flanged. To be able to connect to the 60-inch stub, the blind flange will need to be removed and a gate valve installed on the stub. To work on the 60-inch stub, flow through that section of the outfall will need to be isolated. The 60-inch stub is upstream of the existing connection for gravity flow from the effluent control structure. The location of the stub will allow work on the stub while the plant is discharging effluent by gravity flow. A limited window will exist for conducting this work.

Yard Piping Layout

New yard piping for the rehabilitated pump station will be constructed to the west of the pump station building. The yard piping layout will need to provide both an interim connection to the existing 72-inch PCCP outfall, and eventual connection to the outfall tunnel while not intruding on the area required for construction of the entry shaft and beginning of the tunnel. The space required for construction of the entry shaft and beginning of the tunnel is estimated to require greater than fifty percent of the available space between the west face of the pump station building and the on-site water tank. The yard piping up to the point of eventual connection to the outfall tunnel will therefore have to be constructed as close as practical to the pump station building.

Existing Structures, Utilities and Conduits

The discharge piping from pumps No. 3 and 4 will exit the pump station building to the west and will pass through the location of an existing west channel access manhole installed on top of the west pump suction conduit. The manhole will need to be relocated.

City water lines, disinfection lines and plant effluent sample lines of varying sizes, as well as an electrical conduit that run along the south of the pump station building will have to be relocated. The yard piping to connect the upgraded pump station to the existing outfall will be routed through this area.

5.1.1.2 Phased Approach

Rehabilitation of the Effluent Pump Station and connection to the replacement outfall will be conducted in four phases. The phased approach will maintain the effluent pump station operation during rehabilitation of the pump station and subsequent construction of the new outfall tunnel. During each phase of the rehabilitation, the effluent pump station will operate under a different discharge condition. The four phases of the rehabilitation are described below:

Phase 1

Existing pumps No. 3 and 4 will remain in operation, pumping through the existing 72-inch outfall while new pump No. 1 and replacement pump No.2 are installed, and new suction and discharge piping and yard piping are constructed. Yard piping will include a stub and valve for connection of pump No. 3 and 4 discharge piping in phase 2, and stub and valve for connection of yard piping to the proposed tunnel outfall.

Phase 2

Once new pumps No.1 and 2 are operational, the replacement of pumps No. 3 and 4 will occur including new suction and discharge piping and yard piping.

Phase 3

All four new pumps are in place prior to construction of the outfall tunnel and pumping out of the existing outfall. The rehabilitated pump station will operate under this condition until the new outfall tunnel is constructed.

Phase 4

All four new pumps are in place and operational and are connected to the new outfall tunnel. The connection to the 72-inch PCCP bay portion of the outfall made in Phase 1 remains in place as a potential back up.

5.1.1.3 Operating Conditions

The four operating conditions that the pump station will operate under are described below:

1. Existing Pumps No. 3 and 4 will pump through the existing 72-inch outfall.
2. New pump No.1 and replacement pump No.2 will pump through new yard piping connected to the existing 72-inch outfall.
3. New pump No.1 and replacement pumps No.2 through 4 will pump through new yard piping connected to the existing 72-inch outfall.
4. New pump No.1 and replacement pumps No.2 through 4 will pump through the new outfall tunnel.

To select pumps that would meet the requirements for the range of operating conditions (pumping through the existing 72-inch PCCP outfall and pumping through the new 10-foot outfall tunnel), two options were considered. The first option considered use of a single pump type and size to meet the operating requirements for both the existing outfall and the new tunnel. The range of discharge head and flow conditions that need to be met however, make selection of such a pump difficult due to trying to match the variable head and flow conditions and an efficient operating point on the curve throughout the variable speeds of the pump. The second option considered two different size pumps to meet the requirements of each of the two operating conditions. Option two was determined to be more practical and to provide flexibility in operation for the rehabilitated pump station.

The design/operating criteria of the effluent pump station through each of the four phases of rehabilitation are presented in **Table 5-2**.

Table 5-2
Effluent Pump Station – Design Criteria by Phase

Component	Phase 1	Phase 2	Phase 3	Phase 4
Number of Pumps	2 (existing)	2 (new)	4 (new)	4 (new)
Pump Type	Vertical Centrifugal	Vertical Centrifugal	Vertical Centrifugal	Vertical Centrifugal
Pump Capacity, mgd	45 (each)	55 (each)	60 (each)	60 (each)
Drive Type	VFD	VFD	VFD	VFD
Drive Size, hp	2 @ 500	2 @ 1,000	2 @ 700 & 2 @ 1,000	2 @ 700 & 2 @ 1,000
Minimum Flow, mgd	20	20	20	20
Maximum Flow, mgd	110	110	110	110
Gravity Flow [1]	Yes	Yes	No	Yes

1. Flow rate by gravity flow will be dependent upon tidal cycles.

For operating the pump station with new pumps No. 1 and 2 and discharging to the existing 72-inch outfall, the maximum flow and head requirements will be 110 mgd at approximately 85 feet TDH. The total water horsepower required for maximum flow will be 1,641 Hp. This condition will need to be met using only two pumps. The pumps selected for this condition are the 1,000 Hp pumps included in the Phase 2 column in **Table 5-2**. For operating the upgraded pump station with discharge to the 10-foot tunnel outfall, the maximum flow and head requirements will be 110 mgd at approximately 49 feet TDH. The total water horsepower required for maximum flow will be 946 Hp. This condition will be met using two 700 Hp pumps. The pumps selected for this condition are included in the Phase 3 and 4 columns in **Table 5-2**.

5.1.1.4 Pump Station Layout

The pump station layout will remain the same for the suction and discharge piping on either side of the pumps as shown in **Figure 5-2**. New pumps will be installed at the existing pump locations. The layout of the common discharge headers for each pair of pumps will be rerouted to exit at two locations through the west wall of the pump station building.

The suction and discharge piping sizes will be maintained the same as the existing piping. Cone check valves will be used at the discharge of each of the four pumps. The suction piping from the suction conduit to pump inlets will be 66-inch diameter. The discharge piping and cone check valves will be 30-inch diameter. The two discharge headers for the two pairs of pumps will be 60-inch diameter. An isolation gate valve will be installed on each of the two pump common discharge headers on the interior side of the building. Surge relief valves will also be provided.

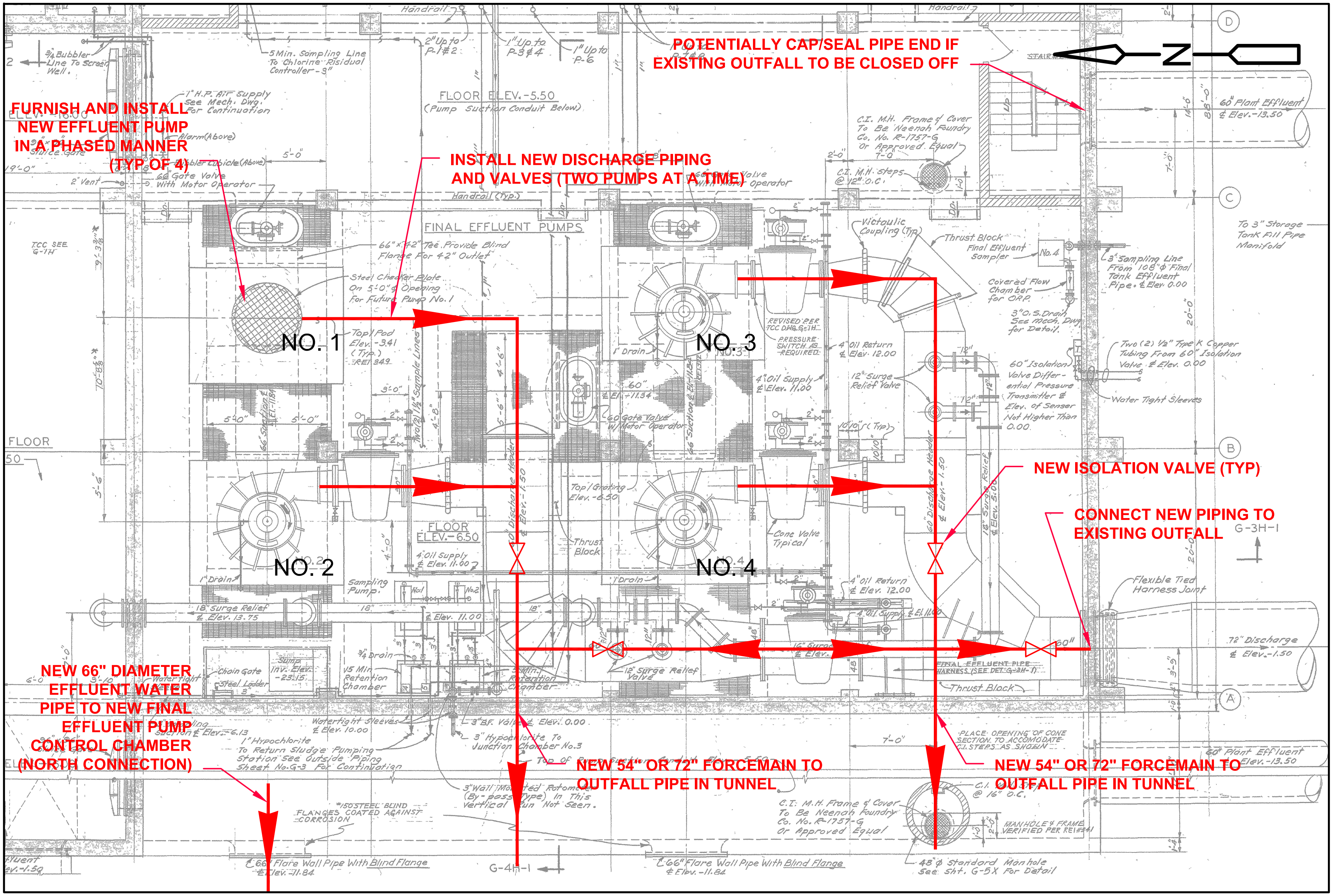


Figure No. 5-2
Revised Effluent Pump Station Piping
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

Installation of the new interior piping will require use of steel piping and fittings that can be fabricated to fit into the existing building space. Thrust blocking will be provided at pipe bends and other appropriate locations as required.

5.1.1.5 Yard Piping Layout

Yard piping will begin at the west wall of the pump station building at two locations with the continuation of the two common discharge headers for each pair of pumps. The two headers will be joined into a single 60-inch common header west of the exterior face of the west pump suction conduit. The common header will be provided with a tee and gate valve to allow for future connection to the outfall tunnel. The new header will also make a connection to the 60-inch wye to allow discharge from the new pumps to the existing 72-inch outfall. This branch will have a 60-inch gate valve at the point of connection to the wye, which will be closed to isolate the existing outfall after the outfall tunnel is in service.

5.1.1.6 Sequence of Construction

To allow operation of the upgraded effluent pump station with the existing 72-inch PCCP outfall, the new yard piping receiving the pump discharge will be connected to the existing outfall at an existing connection stub consisting of a 60"x 72"x 72" wye located approximately 40 feet from the south face of the pump station building. The location of the wye will have to be verified prior to construction of the yard piping. The 60-inch stub was included in the original outfall design to provide a connection point for a second pump station originally envisioned for a future expansion of plant capacity.

The first item of construction for the pump station rehabilitation will be installation of a gate valve at this location for later connection of the new yard piping for discharge from the upgraded pump station. In order to install a valve on the 60" stub, this section of pipe will need to be isolated. To accomplish this either plugs, as used in a linestop, or insert valves will be used on either side of the 60"x 72"x 72"wye, but upstream of the gravity connection from the effluent level control chamber. While the wye is isolated, a 60-inch gate valve will be installed on the end of the stub and will remain closed. The linestop plugs or insert valves will then be opened to resume normal operation of the outfall.

Pumps No.1 and 2 can then be replaced with new pump No.1 and replacement pump No. 2. New discharge piping and the new common discharge header for pumps 1 and 2 will be installed, including the tee and valve for connection of pumps No. 3 and 4.

Once new pumps 1 and 2 are operational and can pump flow into the existing 72-inch outfall, the plug or insert valve previously installed on the upstream side of the 60-inch stub will be closed to allow dismantling of the discharge piping for pumps No.s 3 and 4. This plug or insert valve will remain closed from this point on. Next the 66-

inch inlet valve for pumps No. 3 and 4 will be closed and the pumps will be replaced. The remaining existing interior piping will be dismantled. New discharge piping and the new common discharge header for pumps 3 and 4 will then be constructed and will be connected to the common pump station header at the 60-inch gate valve installed at the exterior of the building.

5.1.2 Outfall Tunnel

A 10-foot inner diameter outfall tunnel will be constructed to replace the existing 72-inch diameter PCCP outfall from the Bergen Point WWTP south beneath Great South Bay to the barrier island, as shown in plan and profile by **Figure 5-3**. The 14,200 linear foot tunnel would be constructed using a tunnel boring machine lowered into position through a thirty-foot diameter working shaft located at the southwest side of the Bergen Point WWTP site. The tunnel would be advanced to a new south exit shaft, located at Gilgo State Park on the barrier island just north of Ocean Parkway. On the barrier island, the new outfall would be connected to the existing ocean outfall to convey treated effluent to discharge. The tunnel would be lined and the lined tunnel would become the replacement outfall.

5.1.2.1 Tunnel and Shaft Construction

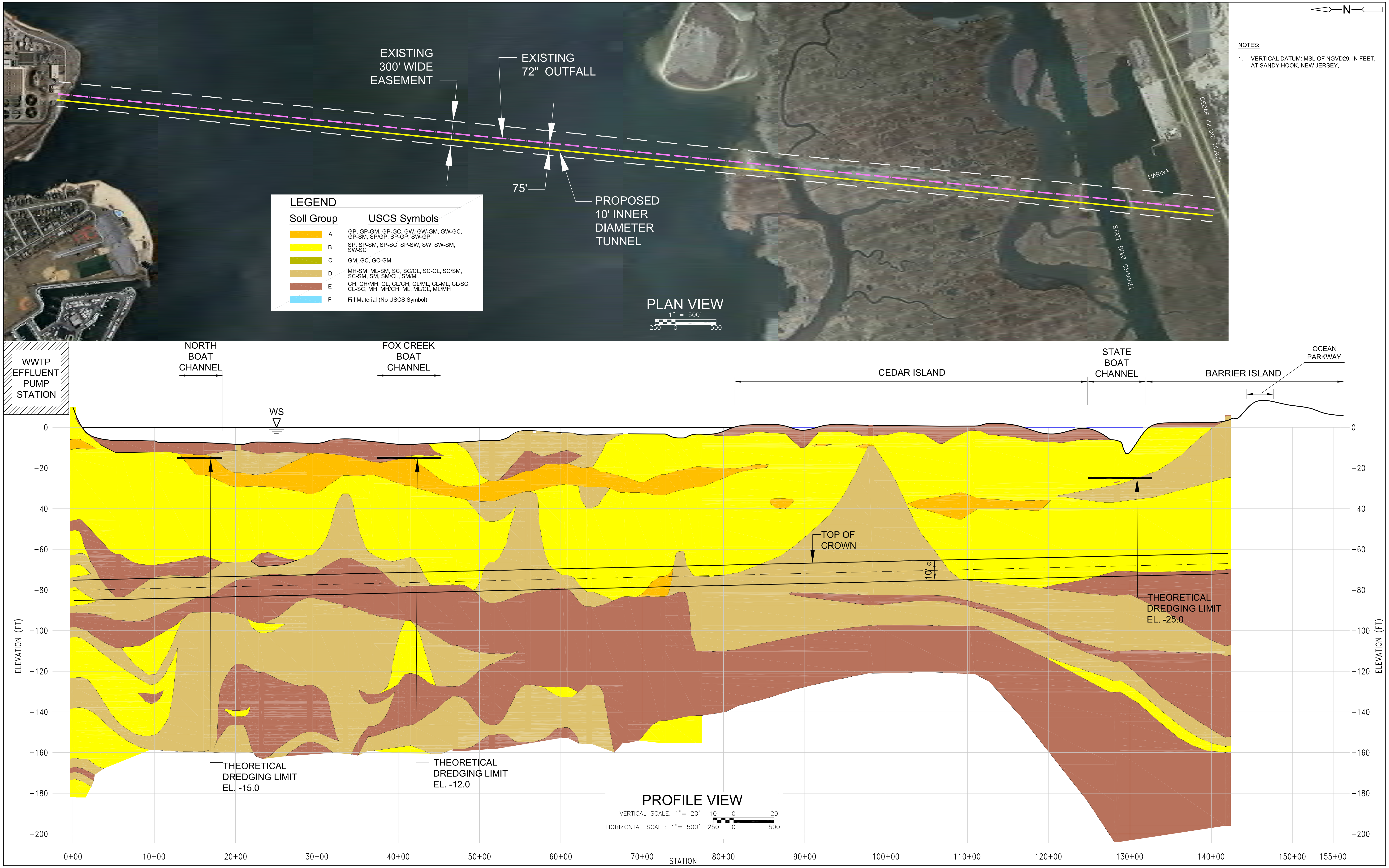
Shaft Construction

The initial construction activity for the tunnel would be construction of a working tunnel shaft that will serve to set up the TBM and also to support the tunnel construction activities by providing a means of transporting personnel and materials to the tunnel heading and a means of removing excavated soil or muck during the tunnel excavation. The shaft diameter is usually in the range of 2.5 to 3 times the outside diameter of the tunnel, or in this case approximately 30 feet. There are several methods of making these excavations and supporting the walls of the excavation which are described in more detail in Appendix A; it is assumed that ground freezing will be selected to construct the shaft.

The depth of the working shaft subgrade is from the ground surface to the bottom of the tunnel lining is estimated to be approximately 70 feet. After the working shaft is completed, the contractor would likely hand mine a tail tunnel in the opposite direction of the tunnel drive. This tunnel would be used to extend the working area of the shaft at the bottom and would provide the room necessary to more efficiently move materials to the tunnel heading. A similar process of excavating and supporting a second or exit shaft would be required to remove the TBM. Because there is less work associated with tunnel construction at the exit shaft, the diameter of this shaft is usually smaller than the working shaft diameter.

The staging area adjacent to the working shaft must be sited to

- Allow the TBM to be lowered into the shaft;



U:\5175\39512\ FIG 5-3 05/26/11 10:19 garveydj

Figure 5-3
Recommended Alternative - Horizontal and Vertical Alignment of 10' Tunnel
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

CDM
consulting • engineering • construction • operations

- Provide space for the shafts' equipment, tunnel lining material and excavated spoil removal;
- Provide space for construction equipment (e.g., cranes) and workshops;
- Provide adequate power supply for the TBM and temporary utility connections for potable water, storm drainage, electricity;
- Access to the site for materials delivery.

It is anticipated that the staging area at the plant would be approximately 3 acres, and the staging area on the barrier island would be between 1 and 3 acres.

Tunnel Construction

A ten-foot inner diameter tunnel would be constructed moving south from the working shaft to the exit shaft on the barrier island. The vertical profile of the tunnel was established based upon maintenance of a depth of 2.5 tunnel bored diameters between the dredge depths of the two boating channels and the tunnel crown. The preferred direction of a tunnel drive is up gradient. Tunneling in this direction provides the ability to drain the outfall pipe(s) back to the launch shaft at the treatment plant after the outfall pipe(s) is completed and in service. A slight up slope of 0.1% was selected as the gradient, since it is adequate for the long term function of draining the carrier pipe(s) within the tunnel and because it also provides the necessary slope for drainage during construction.

The bored tunnel diameter of ten feet was selected as the minimum economical bored diameter to drive the tunnel and transport crew and materials (lighting, ventilation and lining segments) to the tunnel heading and remove tunnel muck. Space within a tunnel is limited and haul times and related costs will need to be weighed against the TBM size, and the increased cost for a larger diameter tunnel. As a result of these considerations, the minimum feasible inside diameter is 10 feet. The tunnel will be constructed using a TBM, as was described in more detail in Section 3. The soil is excavated at the front of the TBM through a cased auger screw, deposited onto a conveyor belt, and then transferred to muck carts which transport the muck to the working or launch shaft and then out of the tunnel to the surface. The screw helps to reduce the pressure of the material from the higher pressures encountered at the tunnel face, to normal atmospheric pressure conditions existing within the tunnel. Limiting the screw rotation enables a pressure to be built up in the forward chamber that helps to support the tunnel face; providing the name "Earth Pressure Balance."

By careful and continual monitoring of the face pressure to balance the resisting force to maintain a stable heading and without applying excess pressure that can cause the soil to fail and result in disturbance to the Bay bottom, this tunnel can be driven without causing disturbance to the Bay. Today's tunneling machines are built to monitor these face conditions primarily because it means the safety to the workers in the tunnel and results in optimal economics to the contractor.

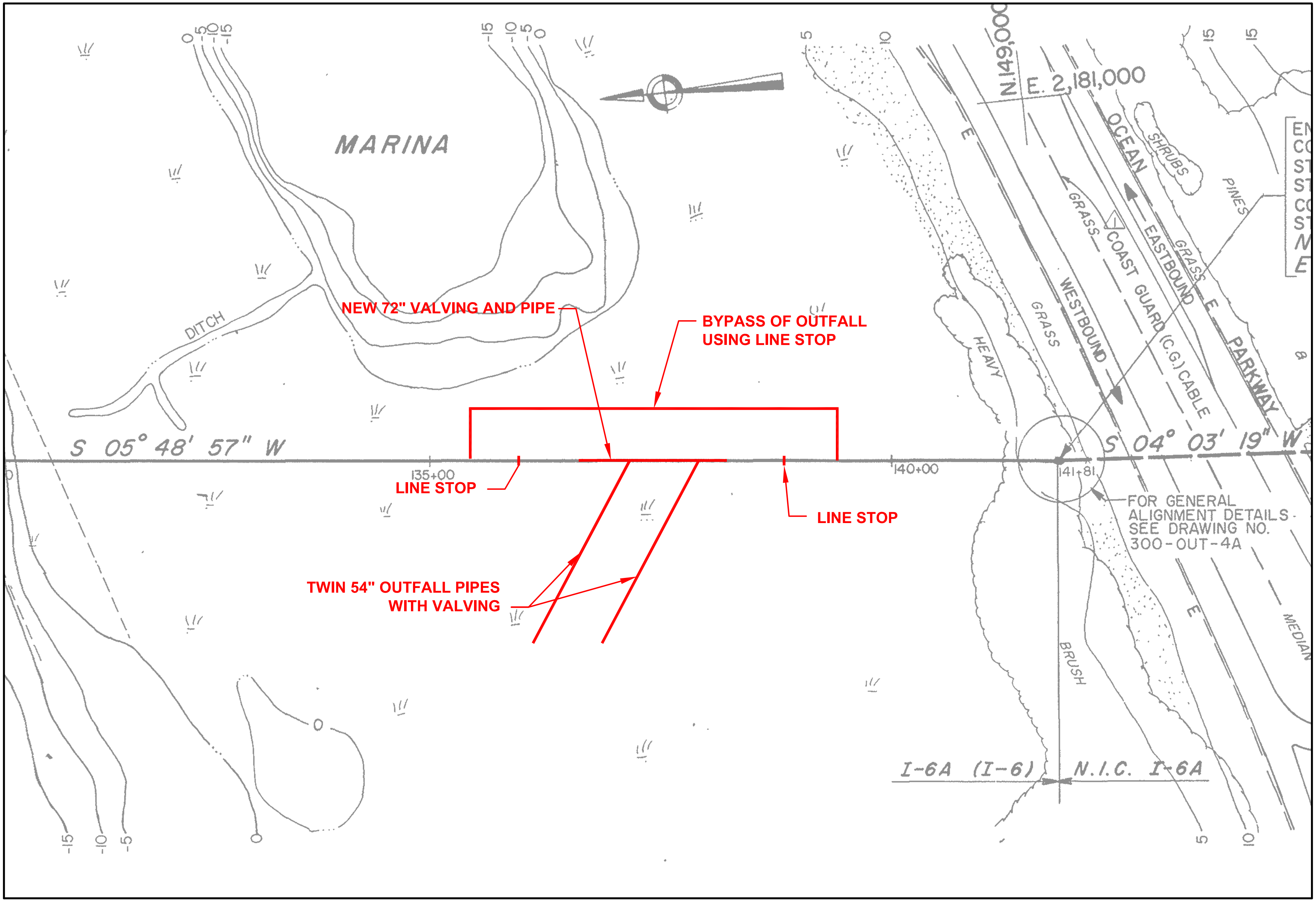
As this work is proceeding at the front of the TBM, a tunnel lining is installed within the tail of the machine by a team working in atmospheric conditions. The subaqueous tunnel lining system consists of precast concrete ring segments with gaskets that are assembled into a ring **(Figure 5-4).** The TBM then extends jacks against the newly assembled ring, exposing

Figure 5-4
Stacked Precast Concrete Segments (left) and The Assembled Ring during Construction with Lighting, Yellow Ventilation, Utility Pipes and Railroad Tracks in the Tunnel (right)

the ring to the soil outside of the tunnel bore. As the tunnel is advanced in this manner, a cement grout is simultaneously injected through grout ports to fill the space between the outside of the ring and the soil to keep soil and water out of the tunnel. This process is repeated until the tunnel has been driven from the working shaft on the plant site south to the exit shaft on the barrier island.

5.1.2.2 Connection to Existing Outfall

The outfall will connect to the existing ocean portion of the outfall near the existing sample chamber on the barrier island just north of the Ocean Parkway. The connection to the existing outfall must be made while it remains in operation. To connect to the existing outfall, a bypass system with line stops will be installed as shown on **Figure 5-5**. The existing outfall would be tapped upstream and downstream of the area of the new tunnelled outfall connection. The taps on each side of the work area are for a bypass connection and for a line stop. The bypass piping is installed followed by the line stops to direct the flow through the bypass piping and around the existing outfall piping to be removed and replaced. New piping with fittings and valving to isolate the new and existing outfalls would be installed and then the line stops and bypass piping removed and the exising outfall put back into



CDM
consulting • engineering • construction • operations

Figure 5-5
New Outfall Connection at Barrier Island
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project
Engineering Report

normal operation. The tunnel outfall would then be connected to the existing outfall but the isolation valves will remain closed until the new outfall is ready for operation.

5.1.2.3 Disposal of Excavated Materials

Construction of the tunnel will generate a significant quantity of spoils that must be removed, managed and disposed. For the ten-foot inner diameter upgradient driven tunnel, it is estimated that approximately 90,000 cubic yards of material will require disposal. It is anticipated that the materials removed from the sub-surface tunnel alignment would not be contaminated and could either be stock-piled on-site in the spoils area for future use by the County, or transported off-site for disposal by the contractor.

5.2 Permit Requirements

Permit requirements are summarized on **Table 5-3**.

5.3 Project Schedule

A preliminary schedule for project implementation is shown on **Figure 5-6**.

5.4 Project Costs

Estimated total project costs are summarized on **Table 5-4**.

Table 5-4
Preliminary Cost Estimate for the Recommended Tunnel Alternative

Project Component	10-foot Diameter Tunnel
	($)
Pump Station	**19,300,000**
Launch and Receiving Shafts	**7,255,000**
Tunnel Boring Machine	**20,000,000**
Tunnel Drive	**110,000,000**
Site Restoration	**255,000**
Effluent Pump Station Connection	**3,300,000**
Barrier Island Connection	**850,000**
Subtotal	**161,131,000**
Contingency @ 20%	**32,226,000**
Total	**193,356,000**
Escalation (2% for four years)	**209,295,000**
Engineering (7%)	**$14,650,633**
Total Estimated Project Cost	**224,000,000**

Table 5-3

Potential Permits and Approvals for the Recommended Alternative, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. Nationwide Permit 7 covers the construction/repair of an outfall while NWP 12 covers the installation of utility lines. Pre-construction notification is required to obtain coverage under these existing permits.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)

Table 5-3

Potential Permits and Approvals for the Recommended Alternative, Construct Replacement Outfall by Tunneling

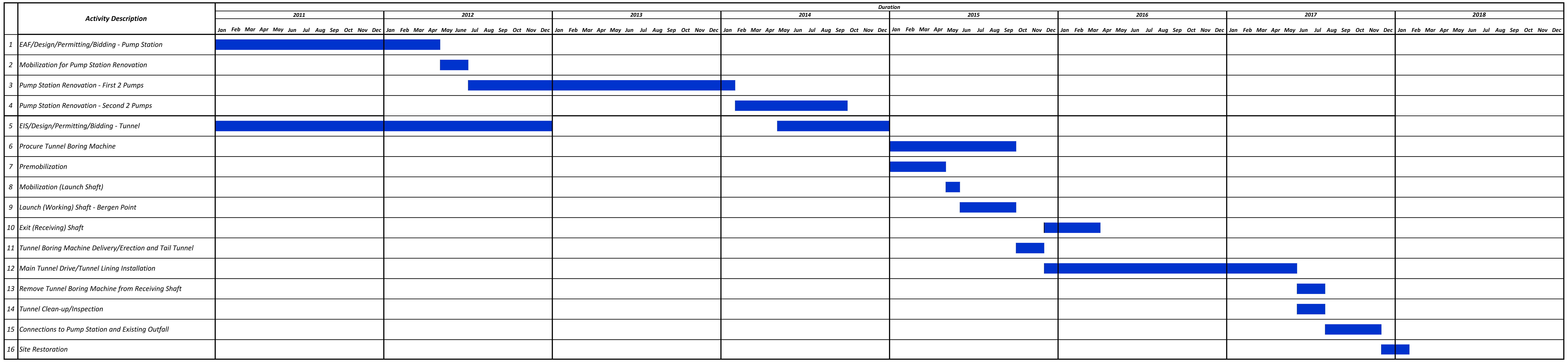
PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
STATE				
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters. NYSDEC has issued/agreed to standard conditions associated with many of the NWP issued by ACOE.	Roger Evans, Regional Permit Administrator 631-444-0361
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
Air Registration	NYS Department of Environmental Conservation	Environmental Conservation Law Article 19 New York Code of Rules and Regulations Title 6, Part 200-203	Contractor maybe required to obtain permit for onsite generators required for ground freezing event on barrier island.	Roger Evans, Regional Permit Administrator 631-444-0361
Approval	NYS Parks – LI State	N.A.	Regulates access of parkland, including use	Scott Fish 631-669-1000

Table 5-3

Potential Permits and Approvals for the Recommended Alternative, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
	Park Region		of commercial vehicles.	Michelle Somma Land Management and Regulatory Affairs Coordinator 631-321-3580
Divisible Load Permit Highway Work Permit for Utility Work	NYSDOT – Region 10	NYCRR Title 17, Part 126 – NYS Vehicle & Traffic Law Section 385 NY Highway Law Article 52	NYSDOT regulates the use of NYS roadways. Permit required by vehicles that exceed the road weight. Permit required to work within a NYS ROW &/or install MPTs	Gene Smith, Regional HWP Contact 631-952-6028
LOCAL				
Consultation	SCDPW		Approval of Plans and Specifications	John Donovan, Acting Chief Engineer 631-852-4204
Review and comment	SCDHS			Walter Hilbert, Chief, Office of Wastewater Management 631-852-5700 Walter Dawydiak, Chief Engineer Division of Environmental Quality 631-852-5800
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

Figure 5-6 Preliminary Schedule for Recommended Alternative, Construct Replacement Outfall by Tunneling



Memorandum

To: *Ben Wright, P.E.*

From: *Keith Kelly, P.E.; Juan C. Vilca, P.E.*

Date: *8/12/2009*

Subject: *Suffolk County DPW – Bergen Point WWTP Outfall*
Hydraulic Analysis of Outfall Replacement Alternatives

In order to determine the size of the tunnel, the number and size of outfall pipes needs to be determined. Redundancy is a key issue in the replacement of the existing single 72 inch outfall pipe. Therefore, a hydraulic analysis was conducted using various pipe sizes and numbers of pipes to determine the flow capacity of each pipe alternative and associated headloss and horsepower requirement. The analysis was conducted using the proposed tunnel layout as shown in **Appendix A** on **Figures 1 and 2,** which are schematics that depict the potential outfall alternatives crossing the bay between the treatment plant and the Barrier Island. The following are the three potential alternatives considered.

- Single 72-inch pipe
- Dual 54-inch pipes
- Dual 48-inch pipes

The lengths of the proposed pipes and locations of fittings and valves shown in Figures 1 and 2 are conceptual and used here for the purpose of comparative analysis of the alternatives. The designed pipe lengths and locations of fittings and valves may differ from that shown.

Flow conditions used in this analysis ranged from 30 mgd to 160 mgd to cover current and potential future pumped flows from the treatment plant.

The following criteria were considered in the analysis:

- Flow velocities
- Total headloss
- Power requirement

The hydraulic analysis conducted for the various alternatives encompassed the length of pipe from the effluent pump station discharge point just prior to the 72-inch x 60-inch reducer through to the diffuser discharge at the end of the outfall. Analysis of the dual pipe alternatives included two scenarios, operation of the outfall with both branches of the pipes in service and operation of the outfall with one branch out of service. Flow velocities, headloss and water horsepower were calculated for each of the alternatives and both scenarios of the dual pipe alternatives and tabulated for comparison. Additionally, the maximum operating pressure for the pipes under various flow conditions was calculated. The maximum operating pressure was calculated at the point of lowest elevation of the pipelines, which for all alternatives would be the bottom of the entry shaft to the proposed pipe tunnel. The springline at the lowest elevation of the pipes as currently proposed is estimated to be at elevation -67.0.

In addition to the hydraulic analysis of the system using the three potential alternatives, an analysis was conducted to determine the effect of closing a number of diffuser ports on the headlosses for each alternative. This additional analysis was conducted to assess the resulting impact should diffuser ports be rendered non-operational due to being covered with bottom sediment.

The pipe material for the proposed replacement lines was assumed to be epoxy lined steel. Calculation of headloss in the pipes was performed using the Hazen-Williams equation. For the proposed pipe material, a Hazen-Williams C factor of 140 was used. For the existing concrete pipe, a C factor of 100 was used. A summary of the analysis results is presented in **Appendix B Table 1**. A summary of preliminary pumping sizing required for future flows up to 120 MGD is presented in **Appendix B Table 2**. The table includes conceptual level estimates of pump horsepower requirements for three selected flows based on the analysis results presented in table 1, and presents the number of operating pumps that would be required to meet each flow condition with pumps rated at 500 Hp, 600 Hp and 700 Hp.

System curves for the various analyzed alternatives are presented in **Appendix B, Figures 3 through 7**.

For calculation of headloss in the diffuser, an iterative method addressing the conditions at each port sequentially was used. The headloss calculated for the diffuser was added to the headloss calculated for the pipeline to obtain the total system headloss. Closing of diffuser ports was simulated by setting individual port discharges to zero in the headloss calculations.

Flow Velocities

A typical desired operating range of velocities for a force main carrying wastewater is 2 to 10 feet per second (fps). A minimum velocity of 2 fps is typically desired for flushing of any sediments that may settle out of the wastewater during low flows. A maximum of 10 fps is typically recommended to minimize scour and potential deterioration of the pipe lining. These minimum and maximum velocities are more of a concern with untreated wastewaters carrying a larger amount of settleable material, particularly grit, than typical final effluents. For comparison purposes, the range above was used, though likely the flow velocities can go slightly beyond the range on either end for limited periods without much detriment to the system.

All three alternatives, with both branches of the dual pipe alternatives operating, had minimum velocities in the range of 1.5 to 2 fps at 30 mgd, the lowest flow analyzed. Effluent pumping operations at the facility typically begin at approximately 30 MGD. Below 30 MGD the effluent will typically be discharged under gravity flow. At a flow of 40 mgd, all three alternatives had flow velocities in the vicinity of 2 fps, within the desired range for minimum flow conditions. Under all three of the alternatives, the maximum velocity through the highest flow condition of 160 mgd was maintained below 10 fps. The lowest velocity was 7.8 fps for the dual 54-inch alternative and the highest was 9.8 fps for the double 48-inch alternative. The flow velocities for all three alternatives, with both branches of the dual pipe alternatives operating, are considered to be acceptable throughout the range of flow conditions analyzed.

The flow velocities for the dual pipe alternatives with only one branch operating are, as would be expected, substantially higher than with both branches operating. With only one branch operating, both alternatives reach the maximum velocity in the recommended range at much lower flows. The dual 54-inch alternative with one branch operating approaches 10 fps at 100 mgd. The dual 48-inch alternative approaches 10 fps at 80 mgd and has a flow velocity of 11 fps at 90 mgd, the current peak flow. Both dual pipe alternatives with one branch operating appear to be acceptable with respect to flow velocities through the current peak flow of 90 mgd. Single branch operation would be limited beyond that.

Headloss

The total headloss for the single 72-inch pipe was found to be the lowest of the three alternatives under all flow conditions. For comparison of the three alternatives, the total headlosses in the system with a single 72-inch pipe were used as the baselines for each flow condition. The headlosses for dual 54-inch and dual 48-inch pipes are compared to the baseline. Results for three flow conditions, 40 mgd, 90 mgd and 160 mgd, were selected for simplification of the comparison. Results for the full range of flows analyzed are presented in Table 1. The three flows selected represent the current average flow, current peak flow and potential future peak flow, respectively.

The baseline headlosses for the single 72-inch pipe alternative, presented in table 1, were 5.7 ft at 40 mgd, 35.2 ft at 90 mgd and 108.1 ft at 160 mgd.

The use of dual 54-inch pipes with both branches operating resulted in increases in headlosses from the baselines at the three selected flows by, respectively, 0.5 ft (9.0%), 2.4 ft (6.8%) and 7.2 ft (6.6%). Operation with a single 54-inch branch increased the headlosses from the baselines respectively by 8.7 ft (153.5%), 39.8 ft (113.3%) and 117 ft (108.2%).

The use of dual 48-inch pipes with both branches operating resulted in increases in headlosses from the baselines at the three selected flows by respectively 2.9 ft (50.2%), 13.0 ft (37.1%) and 38.3 ft (35.4%). Operation with a single 48-inch branch increased the system headlosses from the baselines respectively by 17.3 ft (303.2%), 78.5 ft (223.3%) and 230 ft (212.7%).

Moderately higher head losses were obtained for the dual 54-inch alternative as compared to the single 72-inch alternative. Substantially higher headlosses were obtained for the dual 48-inch alternative. The practical implication of these increases in headloss is naturally a proportionate increase in the operating power required for effluent pumping.

Power Requirement

The power required for effluent pumping is directly proportional to the total headloss experienced in the piping system. The percent increases in power requirements will therefore be equivalent to the increases in headloss for each alternative.

Of the three alternatives, the single 72-inch line was the most efficient of the three with respect to power requirement. The power requirements were calculated in terms of water horsepower. Again for comparison, the power requirements for the single 72-inch pipe alternative at each flow rate were used as the baselines. The power requirements for use of dual 54-inch and double 48-inch pipes are compared to the baselines.

The baseline total water horsepower requirements for the single 72-inch pipe alternative, presented in table 1, were 40 Hp at 40 mgd, 555 Hp at 90 mgd and 3,037 Hp at 160 mgd.

The total water horsepower required for the dual 54-inch alternative with both branches operating increased from the baselines for the three selected flows by respectively 3.6 Hp (9.0%), 37.8 Hp (6.8%) and 201.8 Hp (6.6%).

The total water horse power required with a single 54 inch branch operating increased from the baselines at the three selected flows respectively by 61.4 Hp (153.5%), 629.3 Hp (113.3%) and 3,285 Hp (108.2%). Based on this, the system would be very limited in either the amount of flow pumped through the outfall or the duration of operation with a single branch.

The total water horsepower required with the dual 48-inch alternative with both branches operating increased from the baselines at the three selected flows by respectively 20.1 Hp (50.2%), 205.9 Hp (37.1%) and 1,075 Hp (35.4%). These increases are considerably higher than the increases seen with the dual 54-inch pipe alternative. Use of the dual 48-inch pipes with both branches operating results in an approximately fivefold increase in required water horsepower over the 54-inch alternative through the current range of operating flows and up to the potential future peak flow.

The headlosses with a single 48 inch branch operating increased over the baselines respectively by 121.3 Hp (303.2%), 1,239.8 Hp (223.3%) and 6,458 Hp (212.7%). These are considered unacceptable increases in required power even for temporary operation of this alternative with a single branch.

Diffuser Headloss with Non-Operating Ports

An analysis of the diffuser section of the outfall line was conducted by simulating conditions in which a number of the diffusers ports are covered. The objective of this analysis was to determine the effect of non-operating diffuser ports on the overall headloss for the outfall. The analysis was conducted for scenarios in which 10%, 20%, 30% and 50% of the diffuser ports were non-operating. The headloss for the diffuser section of the outfall is calculated separately from the headloss for the pipeline. The headloss calculated for the diffuser under each of the scenarios described above was added to the headloss calculated for the pipeline for each of the three alternatives for the range of flows analyzed. The results of the analysis are presented in **Tables 3 through 6**, included here as **Appendix C**.

The first concern related to loss of operating diffuser ports is the hindrance of gravity flow. The higher headloss due to non-operating ports could result in limiting gravity flow and triggering the effluent pumping operation at lower flows than with 100% operating ports. The consequence of this is additional costs for longer pump operating times. The results shown in the tables indicate a minimal effect on headloss at the typically lowest pumped flow of 30 MGD, with an approximate 2-inch increase in headloss due to 30% loss of ports. Below 30 MGD, the effect on headloss is expected to be less than 2 inches. Therefore, the effect of loss of operating diffuser ports up to 30%, would not be expected to have a significant effect at flows at which the outfall is discharging by gravity.

A more significant effect is seen for flows from 40 mgd to 160 mgd, where the additional headlosses attributable to loss of diffuser ports range from just below 4 inches to just above 5 feet. Since the headloss contribution from the diffuser section is affected only by the flow through the diffuser and the number of operating ports, and not by the pipeline configuration upstream, the headloss contribution by the diffuser will be the same for each of the alternatives. To simplify discussion of the effects, the headlosses for 40 mgd, 90 mgd and 160 mgd will be highlighted here. The added headloss due to port loss corresponding to 90% operating ports ranged from less than one tenth of a foot at 40 mgd to slightly over one foot at 160 mgd. With 80% operating diffusers, the additional headloss ranges from 0.17 ft at 40 mgd to 2.67 at 160 mgd. With 70% operating diffusers, the additional headloss ranges from 0.31 ft at 40 mgd to 5.01 ft at 160 mgd. The added headlosses at 40 mgd, the average flow condition for the outfall, were 0.07 ft at 90% operating ports, 0.33 ft with 80% operating and 1.06 ft with 70% operating. Over an extended period of operation, these additional headlosses could result in significant additional operating costs.

The effect of closed diffuser ports on overall system headloss diminishes with the two dual pipe alternatives, with the effect being less significant for the dual 48-inch alternative. The reason for this is the progressively higher friction headloss in the pipelines for each of these alternatives. In each of these two alternatives the friction headloss is more significant than the headloss contribution from the diffuser. For these alternatives, other considerations determine their viability. However, the added headloss from loss of operating diffuser ports is evident, along with the consequent conclusion of higher operating costs resulting from loss of the ports.

Conclusions

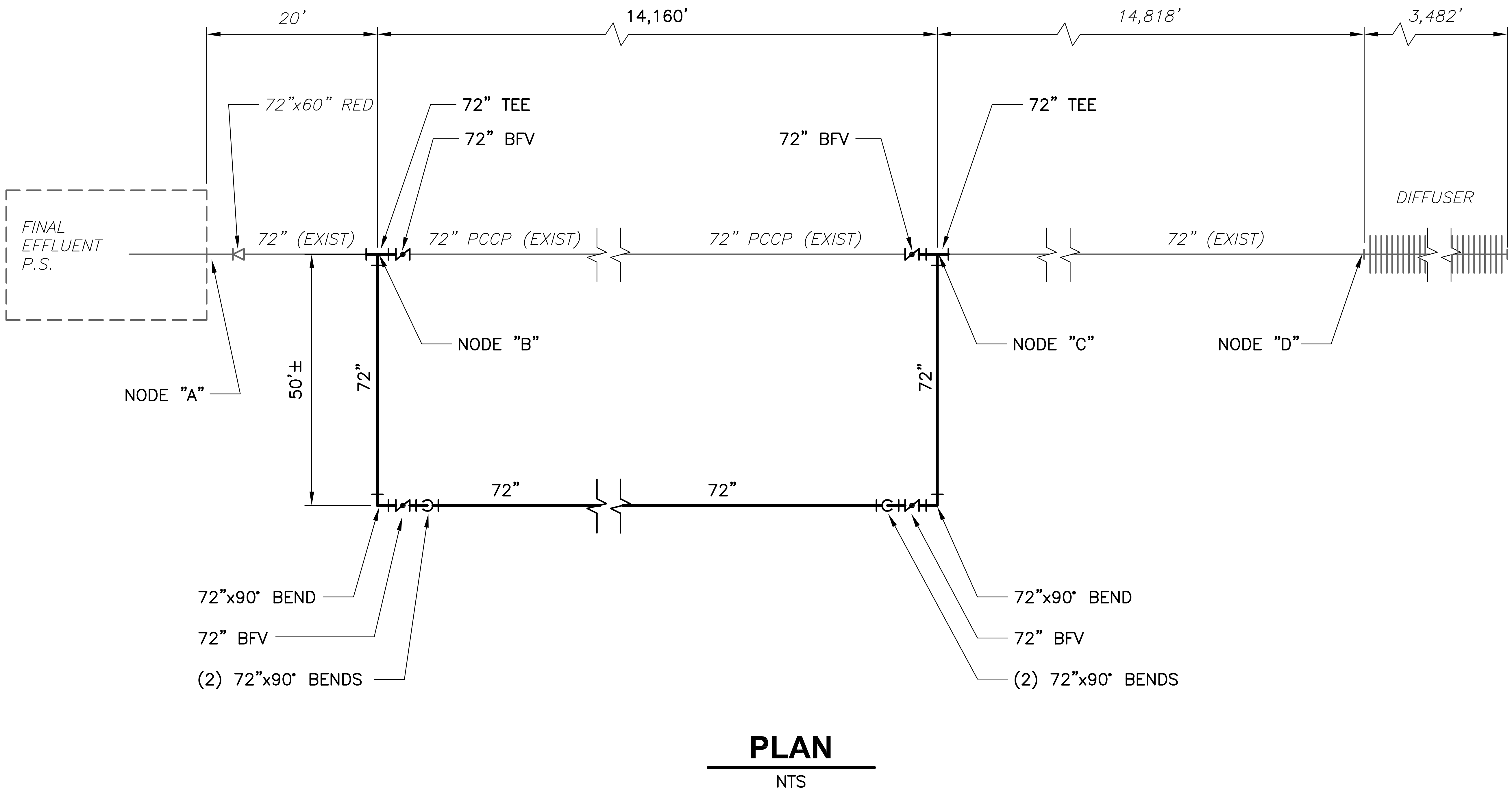
The hydraulic analysis of the Bergen Point outfall replacement alternatives indicated the following:

- The single 72 inch pipe alternative provides the lowest headlosses and thus the lowest heads to pump against. However, the single pipe alternative does not provide the County with any redundancy.
- Of the two dual pipe alternatives, the 54-inch dual pipe with moderate increases in headloss and power requirements will provide the County with redundant effluent pipes under the bay that can handle future flows.
- Operation of the single 54 inch branch would be limited to the current operating flow range without an increase in horsepower to overcome the increased headloss.
- Loss of operating diffuser ports down to 70% operating ports is not expected to significantly affect gravity flow in the outfall.
- Loss of operating diffuser ports down to 70% operating ports results in significant increases in headlosses and consequent increases in required power in the system, which could add significant operating cost over an extended period of operation.

cc: M Taylor
D Krol
J Donovan

Appendix A

Outfall Alternatives Conceptual Layouts

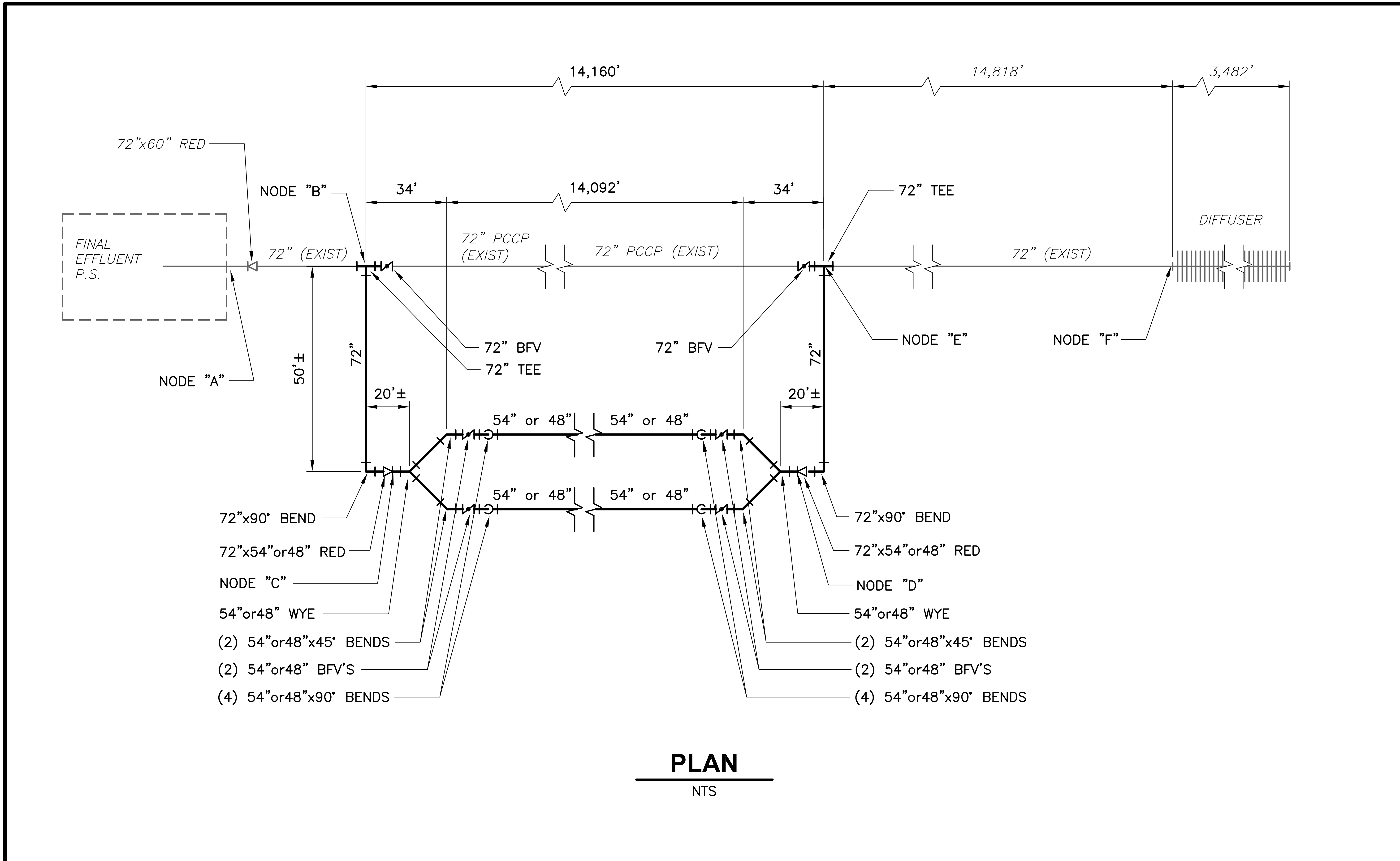


P:\5175\39512\30p\Report\ Figure1 08/11/09 13:36 sanciminoja

CDM

Figure 1
Bergen Point WWTP Outfall
Proposed Single 72-inch Replacement Line

P:\5175\39512\30p\Report\ Figure2 08/11/09 13:41 sanciminoja



CDM

Figure 2
Bergen Point WWTP Outfall
Proposed Dual 54-inch or 48-inch Replacement Line

Appendix B

Bergen Point Outfall Alternatives Hydraulic Analysis Summary
And System Curves

Table 1 Bergen Point Outfall Alternatives Hydraulic Analysis Summary 1

	Single 72-inch Line				Dual 54-inch Line (2 Branches Operating)				Dual 54-inch Line (1 Branch Operating)				Dual 48-inch Line (2 Branches Operating)				Dual 48-inch Line (1 Branch Operating)			
Q	Total Headloss	Max Operating Pressure [2]	Velocity 72" line	Total Water Horsepower	Total Headloss	Max Operating Pressure [2]	Velocity 54" line	Total Water Horsepower	Total Headloss	Max Operating Pressure [2]	Velocity 54" line	Total Water Horsepower	Total Headloss	Max Operating Pressure [2]	Velocity 48" line	Total Water Horsepower	Total Headloss	Max Operating Pressure [2]	Velocity 48" line	Total Water Horsepower
(mgd)	(ft)	(psi)	(fps)	(HP)	(ft)	(psi)	(fps)	(HP)	(ft)	(psi)	(fps)	(HP)	(ft)	(psi)	(fps)	(HP)	(ft)	(psi)	(fps)	(HP)
30	2.2	31	1.6	12	2.5	31	1.5	13	7.4	33	2.9	39	3.9	32	1.8	-	12.3	35	3.7	65
40	5.7	33	2.2	40	6.2	33	1.9	44	14.4	36	3.9	101	8.6	34	2.5	60	23.0	40	4.9	161
60	15.1	37	3.3	159	16.2	37	2.9	171	33.8	44	5.8	355	21.2	39	3.7	223	51.9	51	7.4	547
80	27.7	42	4.4	389	29.6	43	3.9	416	59.6	55	7.8	838	38.1	46	4.9	536	90.7	67	9.8	1273
90	35.2	45	4.9	555	37.5	46	4.4	593	75.0	61	8.8	1185	48.2	50	5.5	761	113.6	76	11.1	1795
100	43.4	49	5.5	761	46.3	50	4.9	813	91.9	68	9.7	1613	59.3	55	6.2	1040	138.9	87	12.3	2438
120	62.0	57	6.6	1307	66.2	58	5.8	1394	130.3	83	11.7	2744	84.4	65	7.4	1777	196.4	110	14.8	4136
140	83.7	66	7.7	2056	89.2	67	6.8	2192	174.8	101	13.6	4294	113.5	77	8.6	2788	262.8	136	17.2	6459
160	108.1	76	8.8	3037	115.3	78	7.8	3238	225.1	121	15.6	6322	146.4	91	9.8	4112	338.1	166	19.7	9495

1. Analysis conducted for highest static head condition based on min water Elevation +8.0 at plant effluent and Mean High High Tide Elevation of +5.4.

2. Pressure at point of lowest elevation in proposed lines, at approximate pipe centerline elevation -67.0.

Table 2 Bergen Point Outfall Alternatives - Conceptual Pumping Arrangements

Q	Single 72-inch Line					Double 54-inch Lines (2 Branches Operating)					Double 48-inch Lines (2 Branches Operating)				
	Q/ Operating Pump	Hp/ Operating Pump	Total Water Hp Required [1]	Total Pump Hp Required [2]	No. Operating Pumps	Q/ Operating Pump	Hp/ Operating Pump	Total Water Hp Required [1]	Total Pump Hp Required [2]	No. Operating Pumps	Q/ Operating Pump	Hp/ Operating Pump	Total Water Hp Required [1]	Total Pump Hp Required [2]	No. Operating Pumps
(mgd)	(mgd)	(Hp)	(Hp)	(Hp)		(mgd)	(Hp)	(Hp)	(Hp)		(mgd)	(Hp)	(Hp)	(Hp)	
60	60	500	159	248	1	60	500	171	267	1	60	500	223	349	1
90	45	500	555	868	2	45	500	593	927	2	30	500	761	1189	3
120	30	500	1307	2042	4	24	500	1394	2178	5	20	500	1777	2777	6
60	60	600	159	248	1	60	600	171	267	1	60	600	223	349	1
90	45	600	555	868	2	45	600	593	927	2	45	600	761	1189	2
120	30	600	1307	2042	4	30	600	1394	2178	4	24	600	1777	2777	5
60	60	700	159	248	1	60	700	171	267	1	60	700	223	349	1
90	45	700	555	868	2	45	700	593	927	2	45	700	761	1189	2
120	40	700	1307	2042	3	40	700	1394	2178	3	30	700	1777	2777	4

1. Based on hydraulic analysis summarized in Table 1.

2. Based on 1.25 safety factor applied to water horsepower (equivalent to 64% pump efficiency)

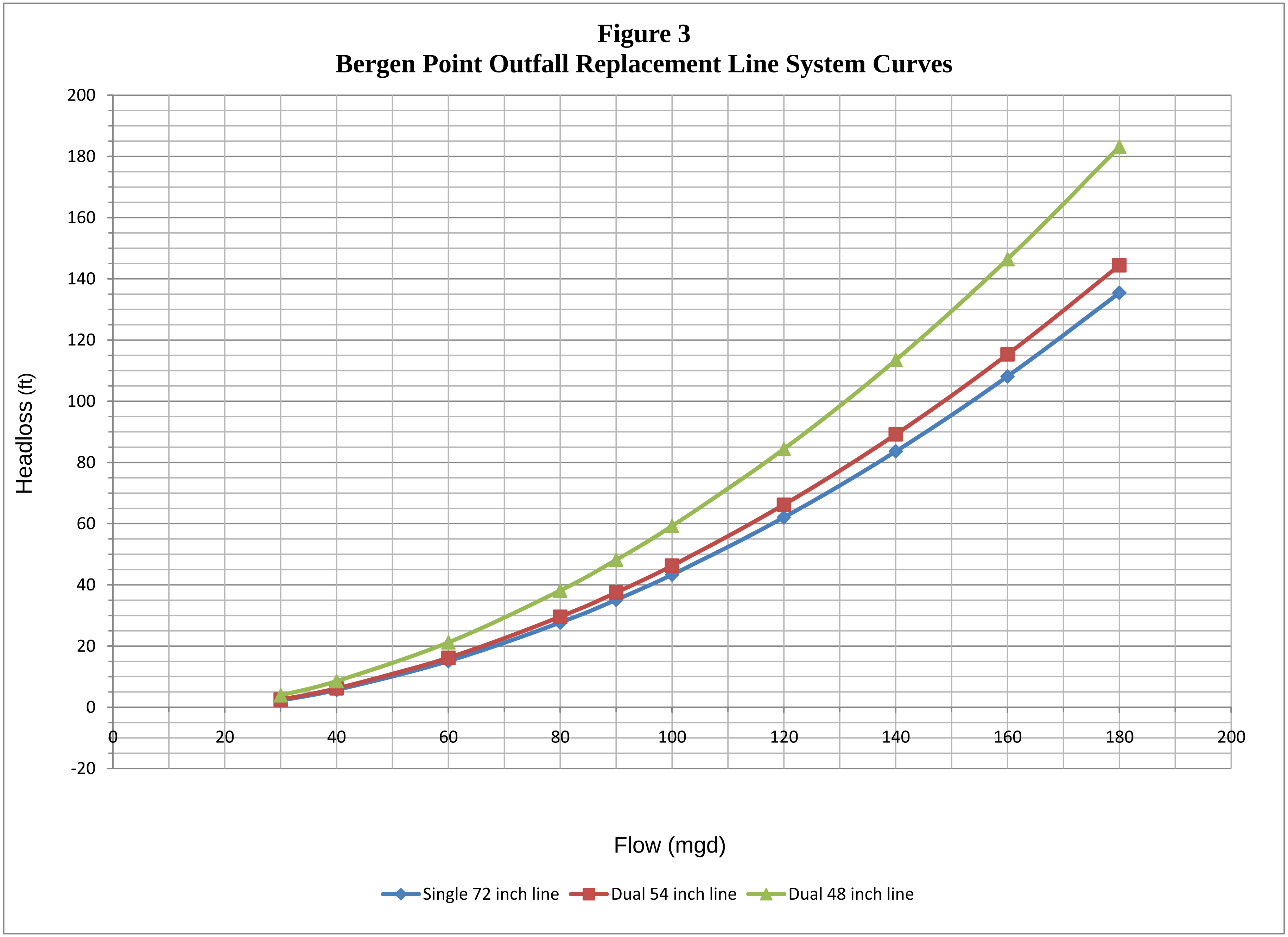


Figure 3
Bergen Point Outfall Replacement Line System Curves
Headloss (ft)
200
180
160
140
120
100
80
60
40
20
0
-20
0
20
40
60
80
100
120
140
160
180
200
Flow (mgd)
Single 72 inch line
Dual 54 inch line
Dual 48 inch line

CDM

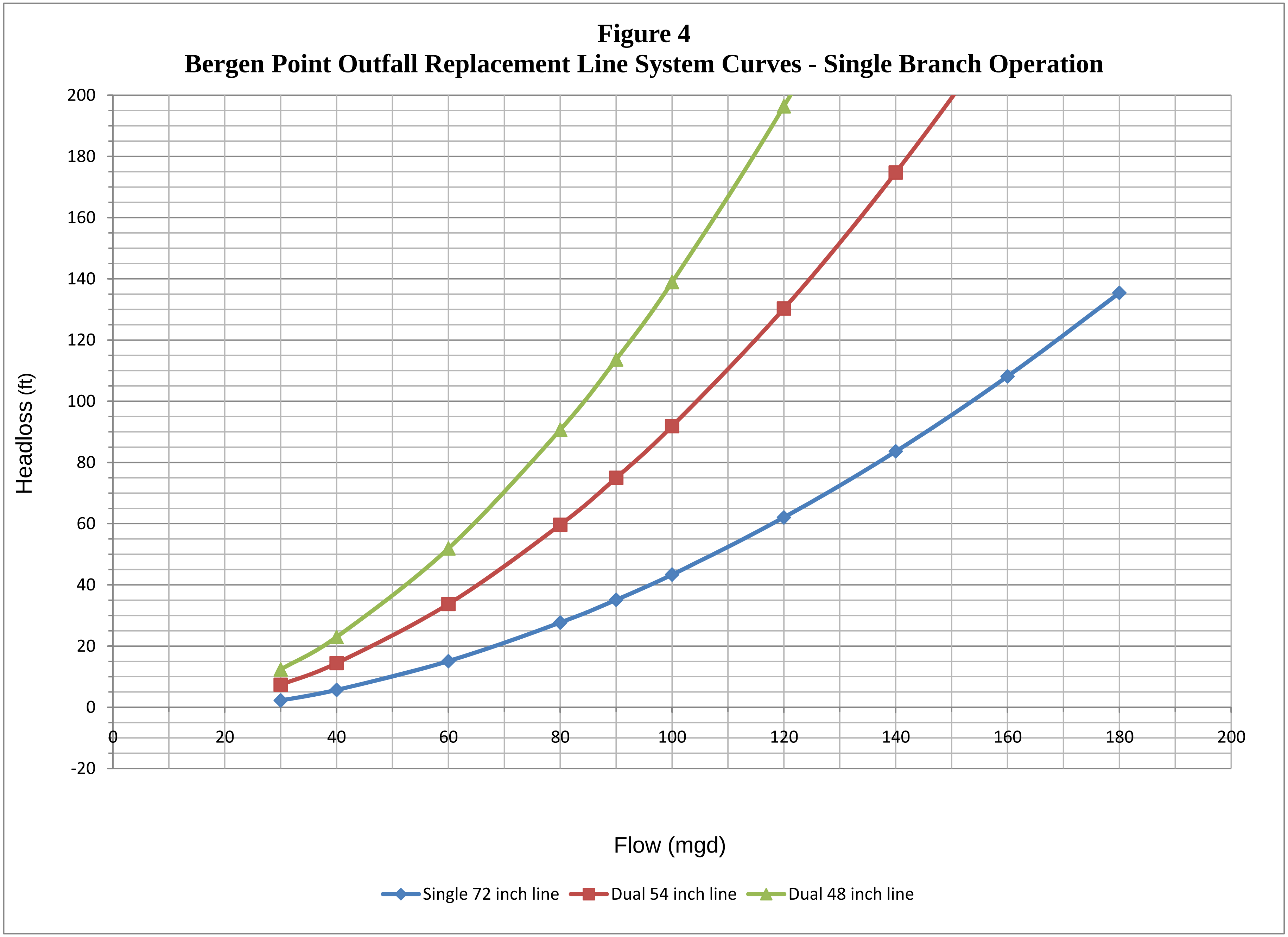
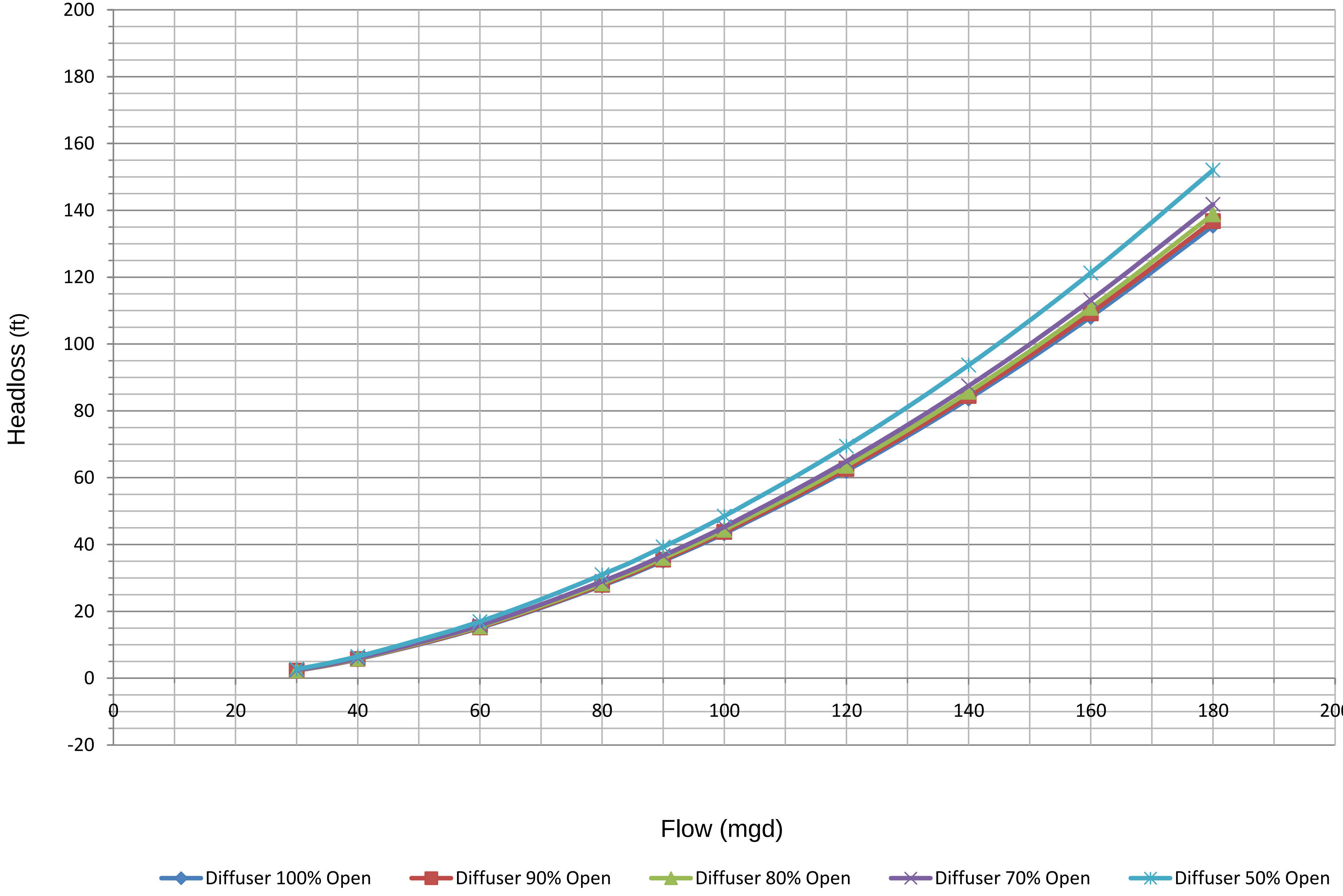


Figure 4
Bergen Point Outfall Replacement Line System Curves - Single Branch Operation
Headloss (ft)
200
180
160
140
120
100
80
60
40
20
0
-20
0
20
40
60
80
100
120
140
160
180
200
Flow (mgd)
Single 72 inch line
Dual 54 inch line
Dual 48 inch line

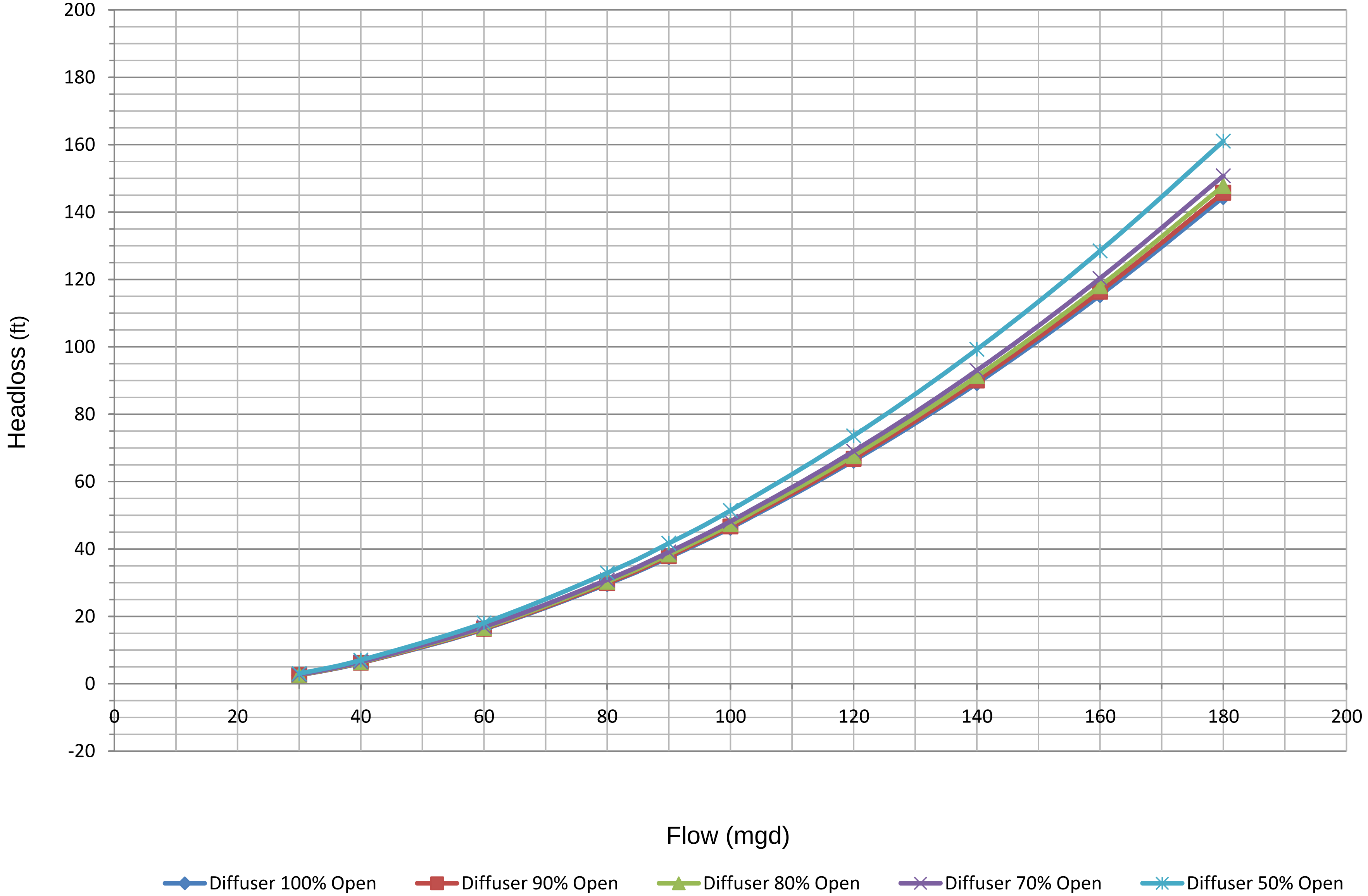
CDM

Figure 5
Bergen Point Outfall Closed Diffuser Ports System Curves - Single 72-inch Line



CDM

Figure 6
Bergen Point Outfall Closed Diffuser Ports System Curves - Dual 54-inch Line



CDM

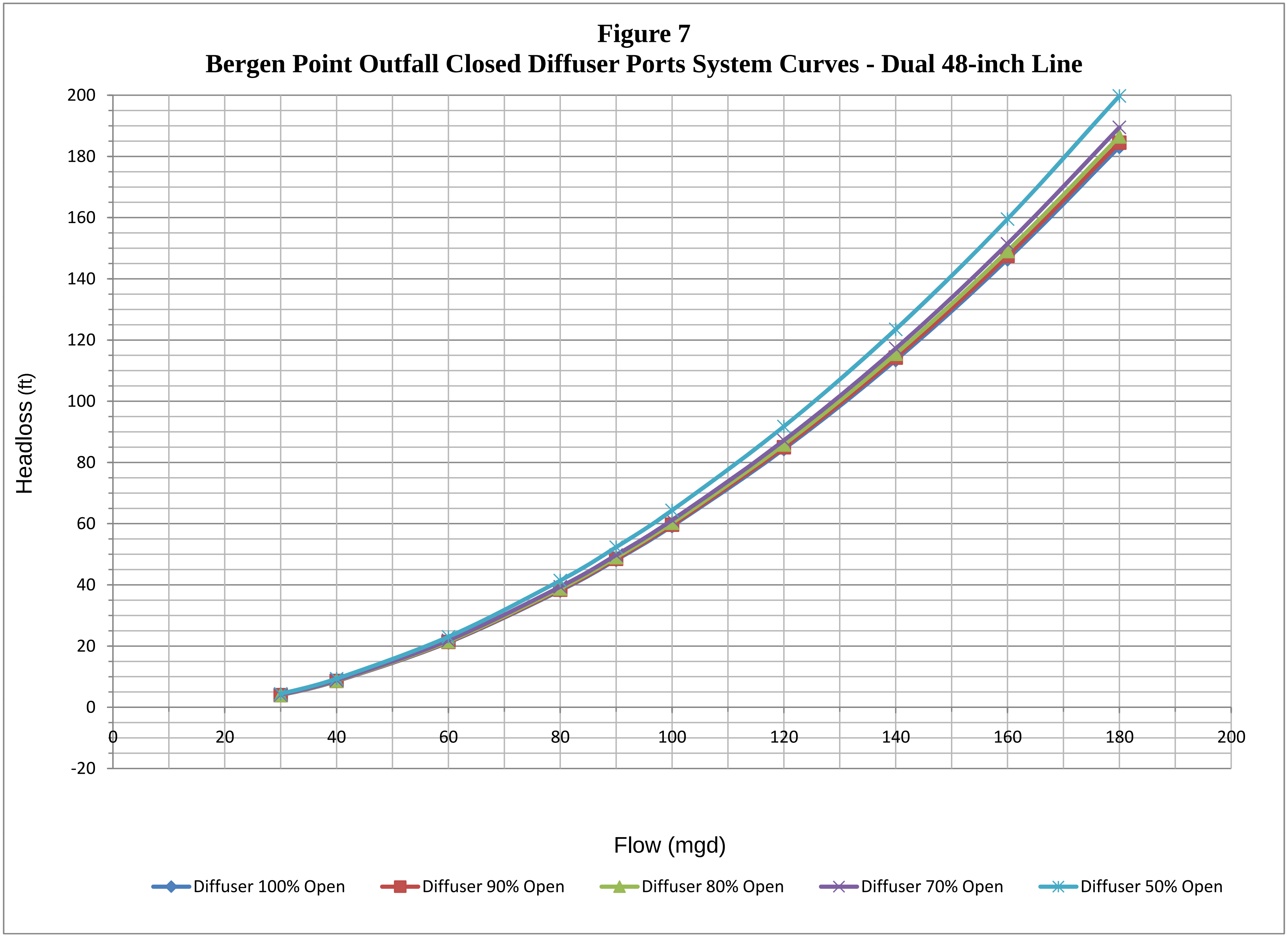


Figure 7
Bergen Point Outfall Closed Diffuser Ports System Curves - Dual 48-inch Line
Headloss (ft)
Flow (mgd)
200
180
160
140
120
100
80
60
40
20
0
-20
0
20
40
60
80
100
120
140
160
180
200
Diffuser 100% Open
Diffuser 90% Open
Diffuser 80% Open
Diffuser 70% Open
Diffuser 50% Open

CDM

Appendix C

Diffuser Headloss Summary Tables

Table 3 Single 72-inch Line Closed Diffuser Ports Headloss Summary

Flow (mgd)	Outfall Headloss (ft)						
	Diffuser 100% Open	Diffuser 90% Open		Diffuser 80% Open		Diffuser 70% Open	
	headloss	headloss	increase	headloss	increase	headloss	increase
30	2.2	2.3	0.04	2.3	0.09	2.4	0.18
40	5.7	5.8	0.07	5.9	0.17	6.0	0.31
60	15.1	15.2	0.15	15.5	0.37	15.8	0.71
80	27.7	28.0	0.26	28.4	0.67	28.9	1.25
90	35.2	35.5	0.33	36.0	0.84	36.7	1.59
100	43.4	43.8	0.41	44.4	1.04	45.3	1.96
120	62.0	62.6	0.60	63.5	1.50	64.9	2.82
140	83.7	84.5	0.81	85.7	2.04	87.5	3.84
160	108.1	109.2	1.06	110.8	2.67	113.1	5.01

Table 4 Dual 54-inch Line Closed Diffuser Ports Headloss Summary

Flow (mgd)	Outfall Headloss (ft)						
	Diffuser 100% Open	Diffuser 90% Open		Diffuser 80% Open		Diffuser 70% Open	
	headloss	headloss	increase	headloss	increase	headloss	increase
30	2.5	2.6	0.0	2.6	0.1	2.7	0.2
40	6.2	6.3	0.1	6.4	0.2	6.5	0.3
60	16.2	16.3	0.1	16.6	0.4	16.9	0.7
80	29.6	29.9	0.3	30.3	0.7	30.9	1.3
90	37.5	37.9	0.3	38.4	0.8	39.1	1.6
100	46.3	46.7	0.4	47.3	1.0	48.3	2.0
120	66.2	66.8	0.6	67.7	1.5	69.0	2.8
140	89.2	90.0	0.8	91.3	2.0	93.1	3.8
160	115.3	116.4	1.1	118.0	2.7	120.3	5.0

Table 5 Dual 48-inch Line Closed Diffuser Ports Headloss Summary

Flow (mgd)	Outfall Headloss (ft)						
	Diffuser 100% Open	Diffuser 90% Open		Diffuser 80% Open		Diffuser 70% Open	
	headloss	headloss	increase	headloss	increase	headloss	increase
30	3.9	4.0	0.0	4.0	0.1	4.1	0.2
40	8.6	8.6	0.1	8.7	0.2	8.9	0.3
60	21.2	21.3	0.1	21.6	0.4	21.9	0.7
80	38.1	38.4	0.3	38.8	0.7	39.4	1.3
90	48.2	48.5	0.3	49.0	0.8	49.8	1.6
100	59.3	59.7	0.4	60.3	1.0	61.2	2.0
120	84.4	85.0	0.6	85.9	1.5	87.2	2.8
140	113.5	114.3	0.8	115.5	2.0	117.3	3.8
160	146.4	147.5	1.1	149.1	2.7	151.4	5.0

Table 6 Headloss Increases Due to Closed Diffuser Ports

Flow (mgd)	Headloss Increase (ft)					
	Diffuser 90% Open		Diffuser 80% Open		Diffuser 70% Open	
	ft	in	ft	in	ft	in
30	0.04	0.4	0.09	1.1	0.18	2.1
40	0.07	0.8	0.17	2.0	0.31	3.8
60	0.15	1.8	0.37	4.5	0.71	8.5
80	0.26	3.2	0.67	8.0	1.25	15.0
90	0.33	4.0	0.84	10.1	1.59	19.0
100	0.41	5.0	1.04	12.5	1.96	23.5
120	0.60	7.1	1.50	18.0	2.82	33.9
140	0.81	9.7	2.04	24.5	3.84	46.1
160	1.06	12.7	2.67	32.0	5.01	60.2

Memorandum

To: *Mike Gilbert*

From: *Rick Ponti*

Date: *June 8, 2009*

Subject: Shaft Excavation and Support Method Selection for the Suffolk County Outfall Replacement

This memorandum provides alternative methods of shaft support and excavation for the Bergen Point Wastewater Treatment Plant Outfall replacement tunnel project in Suffolk County, New York. The tunnel is planned to be approximately 14,200 ft long from launch shaft to receiving shaft, connecting Suffolk County's Sewer District No .3 - Southwest Bergen Point Wastewater Treatment Plant (WWTP) at the end Bergen Avenue under the Great South Bay, south to an open area north of Ocean Parkway on the Barrier Island. The tunnel is planned to be constructed on the west side of the existing pipeline, advancing from north to south starting at a working shaft at the WWTP. The tunnel exit shaft is located on the barrier island just south of Cedar Island, north of Ocean Parkway.

The purpose of this white paper is to identify potential shaft construction methods considered for the Suffolk County Outfall Tunnel replacement project and to evaluate the issues and potential risks related to each of the shaft construction methods. Although the size of the tunnel is not finalized, it is anticipated the minimum tunnel envelope or the inner diameter (ID) needed for installation of the proper size pipe to be 10 feet. Discussion for this paper assumes that the bored tunnel diameter will be 12 to 14 feet and the working shaft diameter will be 30 to 40 feet.

In general, the required work area for shaft construction ranges between 1 and 3 acres, and is a function of the construction methods used. A 30-foot diameter shaft is the minimum preferred launch shaft size to accommodate tunnel construction. The exit shaft is primarily designed to remove the TBM, support lines, and to connect the existing outfall pipe, and may be designed smaller than the launch shaft. The final design shaft size is based on the existing ground conditions, the size of tunnel, method of shaft/tunnel excavation, and long term use.

The vertical alignment of the tunnel is described in the TBM white paper for this project. Based on the criteria presented in that paper, the proposed bottom slab at the launch (working) shaft is at elevation -76 (NGVD), and the proposed surface of the bottom slab at the exit (receiving) shaft slab elevation is at elevation -62(NGVD). To address bottom stability and groundwater inflow issues during the excavation for a shaft in soil it is common to extend the lateral support walls below the shaft bottom subgrade. The extension depends upon the subsurface profile. For these two shafts there is a clay stratum at each site than could serve to mitigate upward flow if the excavation walls extend into the clay to form an open-ended cylinder that terminates in the low permeable soil.

Common to any construction method at the site are the environmental issues. Environmental permitting, extensive mitigation measures and environmental monitoring are likely to be required to protect the existing vegetation and wildlife habitat during the shaft construction.

Some of the most common methods of lateral support of the shafts include sheet pile/tieback, soldier pile lagging, deep mix method, secant pile wall, slurry wall, jet grout, and ground freezing. Because of the high groundwater table and highly transmissible subsurface conditions, for groundwater control reasons, some of these methods such as sheet piles or soldier pile and lagging that allow too much seepage through the lateral support system are not feasible. Methods that address the issue of seepage through the support and thereby reduce the magnitude of groundwater pumping warrant a closer evaluation. These shaft support methods are presented in the following text. For design efficiency, the footprint shape of the shaft will be circular.

Site Descriptions

The project involves two shafts. The north shaft, which will serve as the launch shaft, will be located at the southwest side of the WWTP. The south or exit shaft will be located at Gilgo State Park.

North Shaft – Surface Conditions

The site of the proposed launch shaft (north shaft) consists of a relatively flat, unpaved, 0.3-acre area bounded by an existing effluent pump station to the east, Great South Bay shoreline (rip-rap) to the south, a water storage tank to the west, and undeveloped parcel across the access road to the north. According to the available information to date, there are water lines, electrical conduit and wire and hypochlorite lines between the existing water storage tank and effluent pump station. Normal traffic is typically light, restricted to authorized personnel, and limited to occasional supply deliveries and/or maintenance visits by site personnel. However, the WWTP is undergoing numerous up-grades and the coordination of this project with others that will be ongoing is critical to allow the plant to maintain operations and complete the projects.

North Shaft – Subsurface Conditions

The subsurface conditions consist of shallow, tidally influenced and brackish groundwater. The soil conditions at the north (working) shaft at the WWTP site generally consists of sandy soils (with a gravel layer) to a depth of about 100 feet, underlain by a 10 foot thick layer of fine grained soil, underlain by sandy soil to at least 200 feet below the existing ground surface.

There is a low risk of boulders being encountered. Refer to Figure 1 for a preliminary description of the subsurface conditions at this location.

South Shaft – Surface Conditions

The proposed exit shaft (south shaft) is located just south of Cedar Island, within Gilgo State Park, approximately 2,000 feet west of the existing marina, and approximately 700 feet west of the marina bay. The site is a tidal flat/tidal marsh bounded only on the south side by Ocean Parkway. The parkway is a two lane divided highway. Traffic is seasonal, and heavily traveled in the summer months. The site is an environmentally sensitive area within the zone of fluctuating tidal influence, and is a nesting area for migratory birds. The site is currently undeveloped with no known or published underground utilities, except the existing outfall pipe and shaft within the outfall easement.

South Shaft – Subsurface Conditions

The receiving shaft sits adjacent to Ocean Parkway, the upper 80 feet of soil is sandy, to about elevation -75 and below that depth the soil consists of very stiff to hard clay to at least 200 feet. Refer to Figure 2 for a preliminary description of the subsurface conditions at this location (also no key, so only clay is identified).

Viable Construction Methods

With the limited construction space, environmental considerations and subsurface conditions encountered in the boring, the most feasible shaft construction methods include secant pile wall, slurry wall, jet grouting, and ground freezing approaches. The following is a general description of these methods.

Secant Pile Wall Method

The secant pile wall method consists of using consecutive, overlapping, primary and secondary, augured, concrete (secant) piles in a circular pattern to form the perimeter wall of the shaft. The wall is created by a series of overlapping piles as primary and secondary piles. All of the piles are the same diameter. A typical pile diameter is 30-inches. The secondary piles overlap the primary piles by about 5 to 10 inches depending on the wall thickness required and pile diameter. Only the secondary piles will have steel reinforcement.

The installation of a primary secant pile consists of drilled using an auger to advance a hole to a specified depth. The pile-hole stability, during the drilling process, is maintained by using either temporary casing or maintaining a bentonite slurry in the hole to counter the groundwater level in the ground. Once the pile is drilled to design length the slurry is displace with a tremie concrete. The primary piles are spaced so as to allow for the secondary piles to overlap the primary piles. The secondary piles are drilled through soil and the "green" or fresh concrete of the two new existing primary piles. Once this secondary pile is drilled, steel reinforcement H-beam or rebar cage is placed the full length of the secondary pile and then the slurry is displaced by a tremie concrete.

The displaced slurry is collected and recycled for subsequent piles. The secondary hole, between the two primary piles is drilled within 1 or 2 days after the primary holes have been allowed to set. The primary-secondary pile sequence is repeated in a circular pattern to form the shaft. After the pattern of the secant piles has been connected, the primary shaft wall is complete. For the depth and diameter of these shafts circular secant pile shafts will require ring beams equally spaced at about 10 to 12 feet vertically for structural support. All internal structural support systems are installed sequentially as the shaft excavation is advanced toward the bottom.

Excavation within the shaft support is performed with a small excavator and clamshell, with removed material loaded into haul trucks, and transported to a storage location.

Bottom stability of the shaft during excavation is maintained by either lowering the groundwater using deep wells located inside/outside of the shaft until a base slab is poured in place, or using an *in-situ* jet grout technique. Both the secant pile wall and the slurry wall method may utilize these techniques to help maintain bottom stability and limit the amount of dewatering required. A jet grout base plug may be constructed prior to the shaft excavation to counter the uplift hydrostatic pressure and seepage into the shaft from the exposed subgrade. A jet grout base is constructed by injecting a grout mix under high pressure below the bottom of the secant pile shaft wall to the design thickness. The soil materials are mixed in place with a high strength grout by a rotating drill rod equipped with side jetports that displaces the soil in a jetting manner. The limit of the lateral extent or diameter of the grout is a function of the injection pressure and the composition and density of the soil being mixed. The jet grout method as a method of lateral support of a shaft wall is described latter in this paper.

Dewatering requires continuous supervision (24/7), environmental permits and monitoring, power source with back-up, (portable diesel generator) pump maintenance, and the pumped water sometimes requires processing through a treatment system prior to discharge. The groundwater is currently fresh to brackish, and continuous pumping over an extended period of time will generally increase the salinity, and may also increase pump maintenance.

As shown in Figure 1, there is a low permeability stratum at about elevation -100 that could help to mitigate inflow into the shaft excavation if the lateral support system is embedded into this stratum. Figure 2 shows a significantly thicker stratum of finer grained soils at the exit shaft than what was encountered at the launch shaft site. At the launch shaft, if the fine grained soil stratum at elevation -100 is continuous, the magnitude of the dewatering effort could be dramatically reduced. The same would hold true regarding the fine grained soils at elevation -75 at the exit shaft site.

Construction Issues for Secant Pile Method

Construction issues associated with this shaft construction method that need to be addressed are:

Land requirement – the equipment used for this construction primarily consists of a large crane to drill the piles and install the reinforcement into the piles. Also area to mix bentonite slurry and cement (approximately 20 x 40 feet) and treat for disposal of bentonite slurry (tanks approximately 60 x 14 feet). The land required for the shaft construction is approximately 1.5 acres.

Vertical Alignment – The ability of this method of wall support to provide a dry excavation through the walls is a function how well the contractor can maintain a vertical alignment for each pile. The more individual elements that compose the perimeter of the shaft support result in more seams and subsequently increase the potential areas for leakage. The industry standard for tolerance of a secant pile is 1.5% of the total vertical length of the pile.

Bottom Stability - Any excavation, especially in soil has to be concerned with the resulting unbalanced loads caused by the excavation. The driving forces causing instability are the gravitation effect of the soil mass adjacent to the excavation and the difference in hydrostatic pressure due to elevation change in the groundwater. These driving forces have to be resisted by the soil strength along a potential failure line.

As long as that resistance is greater than the driving force the excavation is stable. If the force exceeds the resistance the result is the exposed subgrade of the excavation is moved upward. The deeper an excavation advances the greater the unbalanced loading acting on the exposed subgrade becomes. An overall design objective of the excavation support system is to utilize the wall and soil strength parameter values to balance the driving forces of the soil and groundwater outside of the excavation that are acting on the subgrade. A part of the solution is to counter the unbalance forces at the shaft subgrade by extending the lateral support walls into a stratum that has sufficient strength to resist the upward forces. That can be done by either extending the wall into rock or by modifying the soil to increase its strength to resist the forces.

The effect of the groundwater hydrostatic pressure imbalance can be countered by either dewatering to remove the uplift forces or the entire excavation for the shaft can be performed in the wet by maintaining a high groundwater level in the shaft.

At the two shaft sites for this project, the option of extending the support system into rock is not feasible because of the excessive depth to rock. Thus this leaves only the second alternative, extending the wall to a stratum with sufficient strength or modifying the soil strength, as feasible solutions. The soil can be modified by over excavating and replacing the *in-situ* soil with a tremie concrete mat or plug or modify the *in-situ* soil by increasing its strength by the jet grouting method.

The dewatering will require an extensive dewatering system and a large volume of water would have to be pumped. Maintaining the high groundwater level inside the limits of the shaft or excavating "in the blind". Such an excavation is difficult, messy and time consuming for a shaft of this depth.

Secant Pile Wall Risk With secant piles the risks involved are generally concerned with maintaining both hole stability and vertical tolerance of the hole during the drilling process.

Maintaining positive head on the slurry relative to the hydrostatic head imposed by the groundwater during the pile installation process is critical to the successful installation of each pile. This head will in cohesive soils usually be sufficient to allow the hole to stay open during drilling. If cohesionless soils (sand and gravel) are encountered the risk of hole collapse increases. Thick gravel deposits (3 feet or greater) will also potentially cause delays and also increase grout consumption. The slurry supporting the hole is not pressurized and does not add sufficient strength to prevent the gravel from collapsing into the hole to its angle of repose. For gravels this angle is typically in the range of 32° to 38°. Grout will fill this displaced gravel outside the theoretical limits of the pile. The volume of excess grout is a function of the angle and the thickness of the stratum.

Seepage through a secant wall occurs along the vertical joints between two piles. The seepage is a function of the total footage of vertical joints and the quality of the overlapping joints between piles. Pile diameter and spacing overlap can be designed to reduce this footage. However, the ability to maintain a vertical tolerance for each pile is also critical. A boulder or large cobble, if encountered, may cause the auger to deviate, and affect the verticality of the pile. Encountered boulders must be either removed or broken up in place so they can be displaced. Either option could significantly impede progress. If this impediment is not addressed, a boulder could adversely affect leakage issues by causing the pile to deviate from the design vertical alignment and reducing the overlap interface between adjacent piles.

Reliance on the fine-grained soil stratum at elevation -100 at the launch shaft as a continuous stratum across the entire footprint of the shaft is a significant risk. It appears more likely that the fine-grained soil stratum at elevation -75 at the exit shaft is continuous, although the risk that it is not continuous does exist. If present then the need for ground modification of the subgrade soils would not be necessary at this shaft. This approach assumes that the secant pile wall is extended so to be sufficiently embedded into this very stiff to hard clay thus forcing the failure plane through this stratum which has sufficient strength to prevent bottom stability.

Slurry Wall Method

The slurry wall method consists of linking, vertical primary and secondary, steel reinforced rectangular panels, to form a shaft as excavation proceeds. The various stages of the panel construction are shown on Figure 3.

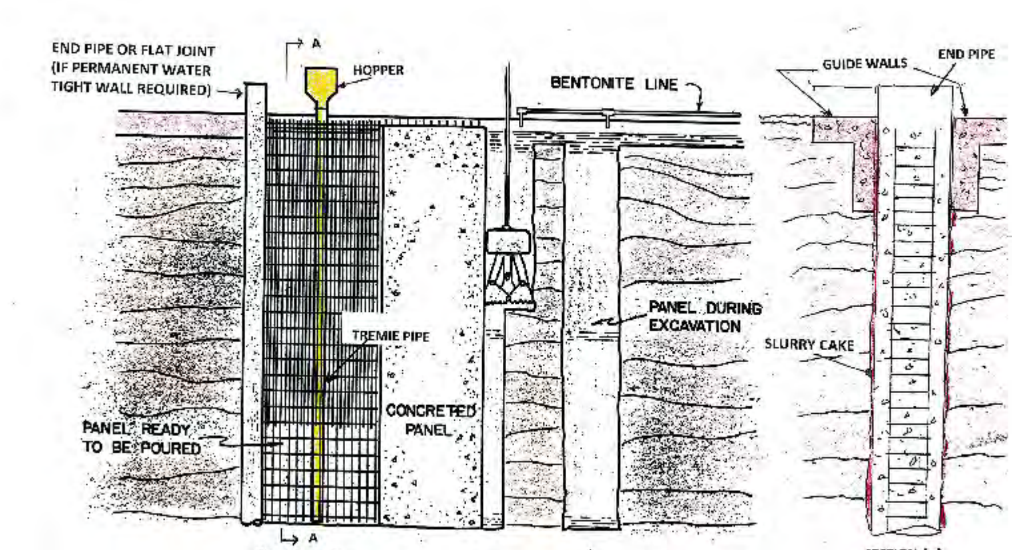


Figure 3 Different Phases of Slurry Wall Construction

The panels are linked together with a semi-circular or triangular joint at the intersections to form watertight joints. The sequence of panel installation is by first excavating for the primary panels and placing concrete into them. The process installs alternate panels as primary and secondary. Once the concrete in two primary panels has reached sufficient curing (1-2 days), the secondary panel (in between two adjacent primary panels) is then excavated and tremie concrete pumped into the panel. The panels are generally excavated with a mechanically activated cable clamshell, a cable or Kelly-bar, hydraulic activated clamshell, or a hydromill (a vertical milling machine). Bentonite slurry is used during the excavation process to maintain the stability of the panel excavation. The excavated panel remains stable by maintaining a positive outward hydrostatic pressure from the slurry in the panel (usually 3 to 5 feet above water table) that counterbalances

the combination of the groundwater and surrounding lateral soil pressure. The bentonite forms a thin cake layer on the wall of the panel that prevents slurry from exfiltrating into the adjoining soil and allowing a sidewall collapse.

After the primary panels are excavated, reinforcing steel is installed by a crane inside the slurry-filled panel, prior to the concrete placement. After the rebar cage is lowered in place, the slurry is displaced with tremie concrete. Tremie concrete uses a pipe that maintains about 5 feet of concrete above the discharge point to displace the lighter weight slurry. By maintaining a positive head the risk of a leaving a void or “window” in the panel is reduced. As the concrete rises, the fluid or slurry is displaced at the top of the panel and removed from the panel to be re-used in another panel. As shown in Figure 3 an end pipe is used at each panel. If a water tight joint is required for a permanent installation this pipe is replaced with a flat joint at each end of a primary panel. This flat joint creates the pressure joint between panels that is water tight.

The soil material within the shaft area, formed by the slurry wall, can then be excavated using a small excavator inside the shaft with a mechanical clamshell, as previously mentioned with the secant wall shaft method. Similar to the secant piles, the wall joint between panels controls the water-tightness of the shaft. Industry standard for vertical deviation is about 1.5% of the wall height. For the launch shaft this is a length of about 95 feet including embedment depth below subgrade and the expected maximum deviation would be about 15 to 18 inches. Depending on the length of the panel, generally, slurry walls have about three to five times fewer joints than a secant pile wall. Therefore, fewer joints reduce the chance of leakage through a joint.

The construction of a shaft by the slurry wall method requires sufficient space and support equipment similar to the secant wall method, area to provide access for the handling of end joints, the excavation machine used to excavate the panel, and for handling reinforcing steel cages. The space required to assemble the rebar cage for the launch shaft will be approximately 30 feet x 120 feet and at the exit shaft the cage assembly area will be about 28 feet x 95 feet. These lengths assume the fine-grained soils are continuous at the depths shown on Figures 1 and 2, and that the walls extend about 5 to 10 feet into these impermeable strata. In addition to this cage assembly area space is also required to mix and process bentonite slurry.

Slurry Wall Risk Difficulties with excavating the slurry walls are similar to those previously mentioned with the secant wall method if gravel or boulders are encountered during the excavation operation. The ability to install the wall within the vertical tolerances to ensure a water tight joint is a risk. However, for the depth of the shafts for this project the ability to maintain these tolerances are well within the current state of the practice of slurry wall installation and therefore this risk can be considered acceptable.

The same issue with reliance on the fine-grained soils being contiguous across the entire shaft footprints to be used as a seepage cut-off is a major risk at the launch shaft site. The risk of the fine-grained soil stratum not be contiguous at the exit shaft is significantly lower because of the thickness of the stratum.

Jet Grouting

The jet grout method consists of pumping grout, air, and drilling fluid from a rotating drill string equipped with side ports into the soil to create an in-situ soilcrete column mixture, generally ranging between 2 and 15 feet in diameter. Figure 4 shows the construction sequence of the jet grouting procedure.

A rotating drill string is advanced to the desired depth, and then high velocity air and grout slurry is pumped into opposing nozzles and continuously rotated, thus mixing the soil and grout in place. Compared to the secant pile method, the jet grout columns are twice as fast to install in similar soil conditions.

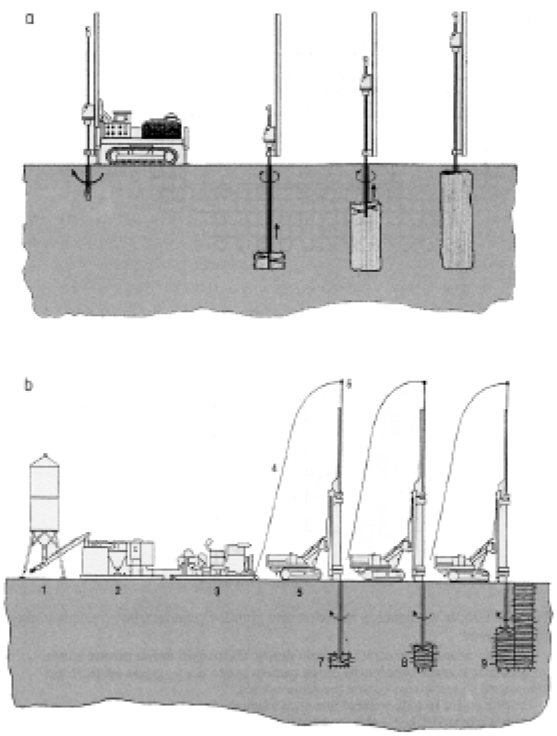


Figure 4 Fig. 14. Stages of conducting jet-grouting method (a) as well as set of the equipment used (b): 1 – cement silo, 2 – cement-inject plant, 3 – high-pressure pump, 4 – high-pressure conduit, 5 – rotary drilling rig, 6 – casing head, 7 – beginning of the jet injection after having driven a drilling rod until the designed depth, 8 – jet petrification of the first pile, 9 – next pile forming

The method is effective when samples of the soil material can be tested by the manufacturer and the soil strata depths and thicknesses are known as is the case for this project. Because of the high reliance on the ability of the operator to adjust nozzle pressure during the jetting process as a function of the changes in the soil consistency the more uniform the ground condition the more reliable this method is. Jet grouting is most effective in fine-grained to gravelly sand types of soil. The soilcrete columns can be reinforced by several design techniques prior to the soilcrete hardening, similar to the secant pile method. The jet grouting can provide a fast way to establish a shaft wall, provided few soil strata and density changes occur within the jet grout column.

Jet Grout Column Risk Jet grout column joints are similar to the number of joints in a secant pile wall, except for these two shaft and the anticipated ground conditions the jet grouting method has a very high reliance on the operator to control the nozzle jet pressure to develop a column of uniform diameter throughout the entire length. Without this uniformity may adversely affect the wall watertightness due to variation in the overlap thickness and also wall strength by limiting continuity of the wall at a design thickness. The effectiveness of the joint seals and wall strength, as with the secant and slurry wall methods, can only be ascertained after the staged excavation. Therefore, the jet grout shafts are generally constructed with a double wall configuration with redundant overlap.

If gravel pockets or boulders are encountered, the risk for deviation is high, and another piece of heavy equipment (clamshell) is required to remove the obstructions. Because the jet grout column uses a small drill column, in comparison to the secant pile column diameter it is less likely that a boulder would be encountered during the drilling. Such a boulder would still adversely affect the placement of the jet grout.

Ground Freezing Method

The Ground Freezing Method involves drilling vertical freeze pipes to circulate a brine solution in a closed system to freeze the ground. The freeze pipes consist of two concentric pipes and an outer freeze pipe with an inner return line. The system circulates in a closed loop that includes a freeze plant. Brine is cooled to a temperature of about -20º C at the plant. The piping control system is designed to control the coolant flow and power requirements for both the freeze up phase and the maintenance phase of the operation. Once the freeze system attains closure, the system energy requirements can be reduced to maintain the freeze elements to stabilize the freeze zone. An instrumentation program is required to monitor and control growth of the freeze wall and control energy consumption.

Advantages of ground freezing include: shaft wall verticality is more controlled than the other excavation methods addressed in this paper. The ability to monitor and control the excavation to maintain a plumb vertical shaft is very high. This control allows for the concrete wall thickness to be reduced to the required thickness to accommodate the lateral loading without adding wall thickness to account for out of plumb wall elements such as a slurry wall panel. Because of the circular shape all the earth loading is acting radial to the center of the shaft thus all loads and resulting stresses on the wall are compressive or hoop stress. This loading condition goes to the strength of concrete.

There is minimal surface area disturbance (compared to any other methods discussed in this paper); eliminates the need for dewatering and the associated permitting. The most significant advantage is that the groundwater that is to be frozen forms a continuum of frozen ground as a support system, not discrete elements like the other systems that have joints that are weak points in the integrated system.

The disadvantage is the limited number of contractors with experience in this type of excavation support in the US. Presently there are only 3 or 4 firms with significant experience. In the last few years these firms have been averaging about 2 to 5 groundfreezing project per year. In Europe and especially Germany where there are very restrictive laws regarding groundwater lowering groundfreezing is much more widely used for support and groundwater control of deep excavations in urban areas. CDM averages about 10 groundfreeze projects per year in Germany and Western Europe. Typically these projects are performed under a contract arrangement that is similar to a design/build contract here in the USA.

Ground Freeze Risk- The major risk issues with groundfreezing are encountering a soil stratum that has significantly different thermal properties such as a layer of shells, or a very high permeable layer of gravel that results in a high groundwater velocity. Encountering boulders or cobbles that cause a deviation in the planned location of any freeze element would potentially increase the distance between elements and thereby increase the freeze time substantially. There are methods of mitigating these risks by ensuring that continuous samples are taken during the geotechnical exploration phase as was done under our program for this project and by surveying the as-installed location of each freeze element to confirm its location.

Other concerns are uncontrolled growth of the freeze wall resulting in excavation of excessive amounts of frozen soil that will have the consistency of a soft rock and thus slow the excavation rate.

A summary of the major shaft construction issues and shaft construction methods are presented in Table-1 below.

Recommendations

Based on the results of the explorations as presented in the subsurface profiles in Figures 1 and 2 and in consideration of the various risk elements associated with environmental concerns and land restrictions it is our recommendation to consider the ground freezing method as the primary method of shaft excavation and support. If during detailed design, a fatal flaw in this method is encountered, and then another alternative will be considered. The risk items, probability of occurrence and effects of an occurrence should be evaluated in an initial risk work shop. A continuation of the management and mitigation of risk should be followed through design and construction.

Table 1: Construction Issues and Methods Summary

Construction Issues	Shaft Construction Methods			
	Secant Pile	**Slurry**	**Jet Grout**	**Ground Freezing**
Site				
Working space required at the surface (lay-down area)	1.5 Acres	2.0 Acres	1.5 Acres	0.5 Acres
Power requirements source – temporary lighting and temporary 2000 kV line for North shaft (TBM machine)	Diesel fuel for equipment	Diesel fuel for equipment	Diesel fuel for equipment	Redundant power supplies are required one electrical and portable diesel generator as backup
Construction easements	North Shaft: None South Shaft: 300′ x 100′	North Shaft: None South Shaft: 300′ x 100′	North Shaft: None South Shaft: 300′ x 100′	North Shaft: None South Shaft: 300′ x 100′
Noise – common equipment: 1. Crane 2. Excavator 3. Loader 4. Haul trucks 5. Batch plant 6. Diesel generators	Augur/jet grout rig- Typical construction site noise level can be expected.	Augur/jet grout rig- Typical construction site noise level can be expected.	Augur/jet grout rig - Typical construction site noise level can be expected.	Freeze plant – Relatively low noise level generated from this equipment which is housed.
Subsurface				
Subsurface conditions as presented in Figures 1 and 2	North Shaft: Possible cobbles/thick gravel layer may require thick grout mix and grouting of layer and allowing to set before advance of pile, slowing production. South Shaft: No apparent limitation	North Shaft: Possible cobbles/thick gravel layer limitation, may require thick grout mix and grouting of layer and allowing to set before advance of panel, slowing production South Shaft: No apparent limitation	North Shaft: Possible cobble/thick gravel layer limitation may require thick grout mix and grouting of the layer, and set time before advance of pile, around the shaft perimeter slowing production. Soil density and soil layer variation may require multiple mix ratios and advance rates, thus reducing production South Shaft: Soil density and soil layer variation may require multiple mix ratios and advance rates, thus reducing production	North Shaft: No apparent limitation South Shaft: No apparent limitation

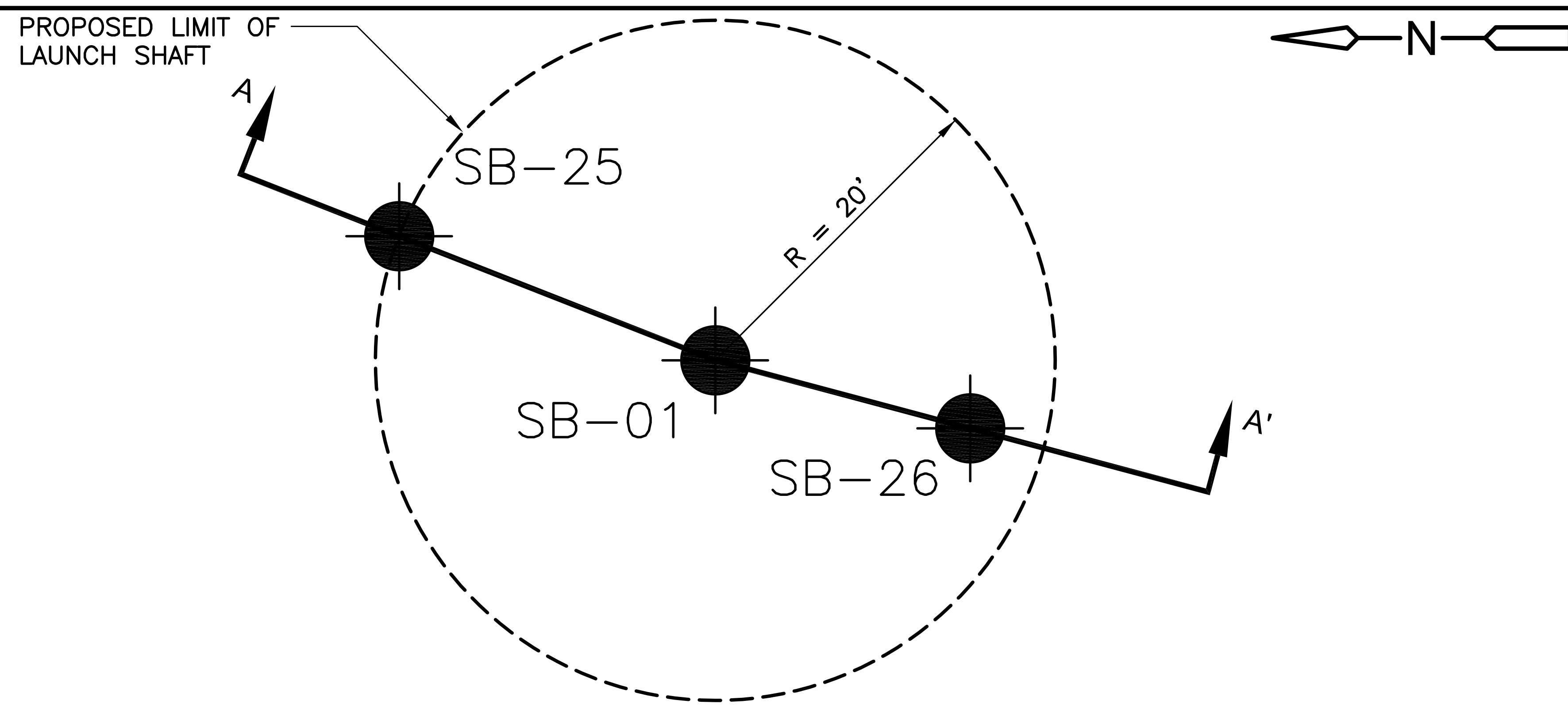
Construction Issues	Shaft Construction Methods			
	Secant Pile	**Slurry**	**Jet Grout**	**Ground Freezing**
Groundwater pressure that will cause lateral collapse of the excavation.	Maintain slurry level above groundwater table to provide positive pressure hydrostatic pressure against the groundwater pressure.	Maintain slurry level above groundwater table to provide positive pressure hydrostatic pressure against the groundwater pressure.	No issue.	No issue – due to existing saturated soil conditions
Groundwater issues with salinity	Need design mix for brackish water (slurry and concrete)	Need design mix for brackish water (slurry and concrete)	Need design mix for brackish water (slurry and concrete)	Salt water increases freeze time and reduces frozen ground strength. Therefore, it will require a thicker wall than non-saline water; (approximately 1-2 feet)
Groundwater issues with velocity	Need to supply excavation area with water or slurry mix	Need to supply excavation area with water or slurry mix	Need to supply excavation area with water or slurry mix	No issue

Construction Issues	Shaft Construction Methods			
	Secant Pile	**Slurry**	**Jet Grout**	**Ground Freezing**
Groundwater control during shaft excavation (Dewatering)	North Shaft: • Probable mitigation measures required for nearby structures and underground utilities if dewatering used during construction of shaft. • Reliance on 10 ft of fine-grained soil stratum to be contiguous under the shaft footprint to reduce dewatering effort. • Water quality discharge will require filtration of the effluent. South Shaft: • Reliance on fine grained soil below elevation -75 to be contiguous across shaft footprint. • Water quality discharge will require filtration of the effluent.	North Shaft: • Probable mitigation measures required for nearby structures and underground utilities if dewatering used during construction of shaft. • Reliance on 10 ft of fine-grained soil stratum to be contiguous under the shaft footprint to reduce dewatering effort. • Water quality discharge will require filtration of the effluent. South Shaft: • Reliance on fine grained soil below elevation -75 to be contiguous across shaft footprint. • Water quality discharge will require filtration of the effluent.	North Shaft: • Probable mitigation measures required for nearby structures and underground utilities if dewatering used during construction of shaft. • Reliance on 10 ft of fine-grained soil stratum to be contiguous under the shaft footprint to reduce dewatering effort. • Water quality discharge will require filtration of the effluent. South Shaft: • Reliance on fine grained soil below elevation -75 to be contiguous across shaft footprint. • Water quality discharge will require filtration of the effluent.	North Shaft: Minimal dewatering required during shaft excavation South Shaft: Minimal dewatering required during shaft excavation
Salt water intrusion if prolonged dewatering is required	Requires the design slurry and grout mix to withstand saline exposure	Requires the design slurry and grout mix to withstand saline exposure	Requires the design slurry and grout mix to withstand saline exposure	Freeze time may be lengthened due to salinity. Reduced strength of the frozen ground could result due to brackish water.
Boulders/Gravel layers >3' thick	Schedule constraint if encountered	Schedule constraint if encountered	Schedule constraint if encountered	May require longer freeze time, or an additional freeze element(s) to be installed if as-installed alignment is affected by presence of boulder
Changes in soil strata	Not an issue	Not an issue	Limiting factor; if changes are numerous, the method may not be practical due to grout mix changes	Can affect the rate of freeze and strength of the frozen strata

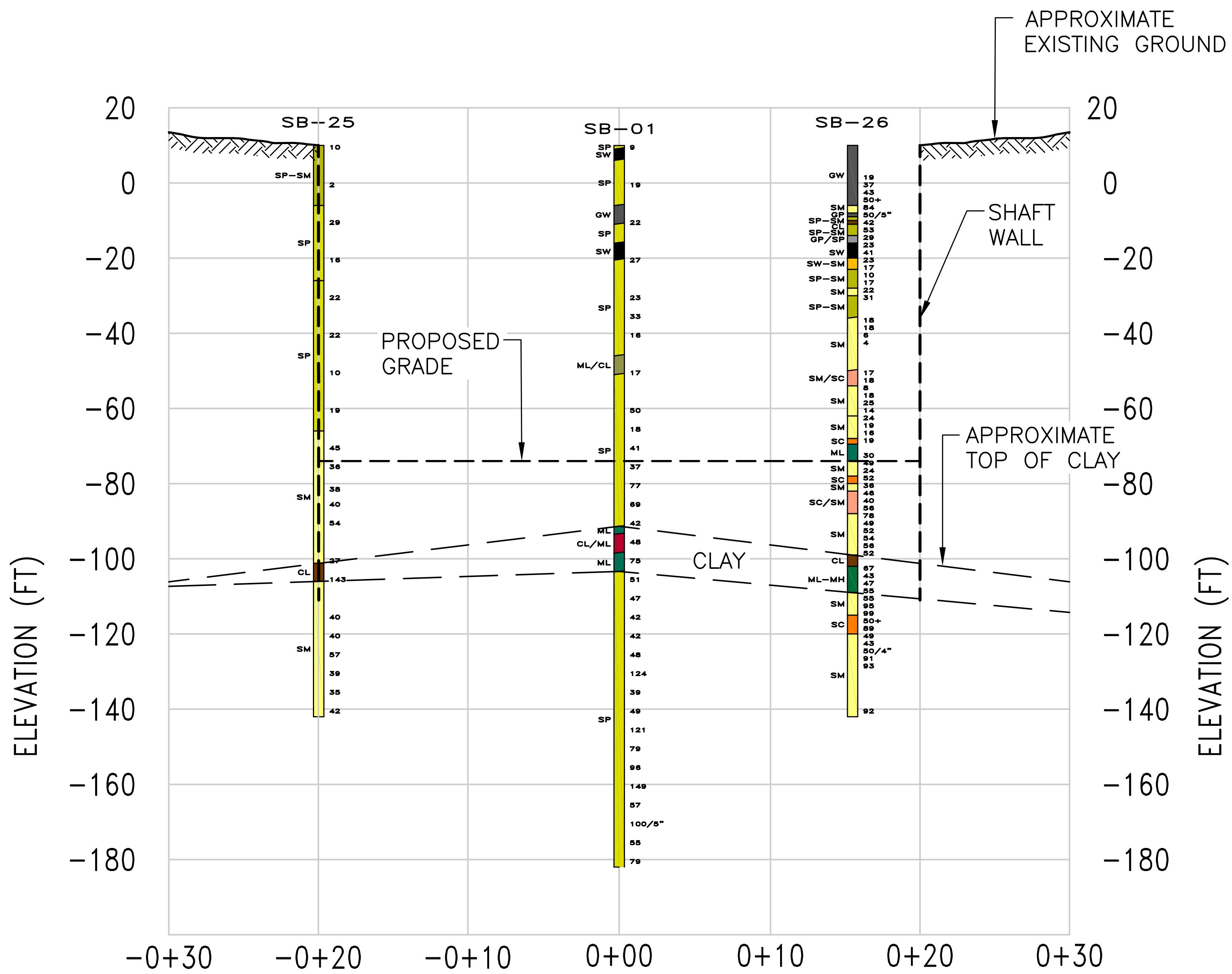
Construction Issues	Shaft Construction Methods			
	Secant Pile	Slurry	Jet Grout	Ground Freezing
			and soil density changes	

Structure				
Temporary and permanent effects on the environment at north and south sites	North Shaft: None South Shaft: Wetland vegetation destroyed over an area slightly larger than the shaft footprint and no replication possible in the area where the secant pile wall was installed without costly removal of the upper portion of the wall; sound abatement during migratory bird season.	North Shaft: None South Shaft: Wetland vegetation destroyed over area of shaft footprint plus the rebar cage assembly areas. Replication only possible in cage assemble areas; sound abatement during migratory bird season	North Shaft: None South Shaft: Wetland vegetation destroyed in area similar to the secant pile method; sound abatement during migratory bird season	North Shaft: None South Shaft: Wetland vegetation loss confined to footprint of freezewall during construction; replication up to the limits of the final shaft footprint are possible; sound abatement during migratory bird season
Experience	Requires specialty sub-contractor Available in NYC area	Requires specialty sub-contractor Available in NYC area	Requires specialty sub-contractor Available in NYC area	Only 3 major specialized firms in the U.S.
Construction tolerances Vertical joints are a leakage issue	Verticality 1.5% Joint seals	Verticality, slurry 1.5% Joint seals	Verticality 1.5% Joint seals	Have the ability to survey vertical alignment of shaft as excavation progresses No vertical joints to seal
Leakage through the wall	Approximately 40 joints (30 foot diameter), high leakage potential	Approximately 8 joints, low leakage potential	Approximately 80 joints (double wall), high leakage potential	Not an issue once closure is confirmed by instrumentation
Bottom stability	Tremie concrete plug required and reliance on fine grained soil stratum being present at both sites. Higher risk issue at launch site.	Tremie concrete plug required and reliance on fine grained soil stratum being present at both sites. Higher risk issue at launch site.	Tremie concrete plug required and reliance on fine grained soil stratum being present at both sites. Higher risk issue at launch site.	Freeze system can be designed to plug the bottom.
Leakage through the base	Requires jet grouting and embedment of walls into the fine-grained soil stratum. Potential high risk at the launch shaft where the fine grained stratum is only 10 ft thick.	Requires jet grouting and embedment of walls into the fine-grained soil stratum. Potential high risk at the launch shaft where the fine grained stratum is only 10 ft thick.	Requires jet grouting and embedment of walls into the fine-grained soil stratum. Potential high risk at the launch shaft where the fine grained stratum is only 10 ft thick. Probably has the least risk of the slurry wall, secant wall and this method because specialty contractor	Shaft wall and base plug are frozen continuously; if power source fails, the frozen ground is self-sustaining for several months.

Construction Issues	Shaft Construction Methods			
	Secant Pile	**Slurry**	**Jet Grout**	**Ground Freezing**
			will be the same as the shaft wall contractor	



PLAN VIEW



CROSS-SECTION A-A'

LEGEND

Soil	Description
GM	
GP	Poorly Graded Gravel
GP/GC	
GP/SP	
GW	Well Graded Gravel
SC	Clayey Sand
SC/CL	
SC-SM	
SM	Silty Sand
SM/CL	
SM-SC	
SM/ML	
SP	Poorly Graded Sand
SP/GP	Poorly Graded Sand/Gravel
SP/SC	
SP-SM	Poorly Graded Silty Sand
SP/SW	
SW	Well Graded Sand

CROSS-SECTION B-B'

SW-SC	
SW/GP	
SW-SM	Well Graded Sand/Silty Sand
MH	
MH/CH	
MH/SM	
ML	Silt
ML/CL	Silt/Clay
ML/MH	
ML/SM	
CH/MH	
CH	Highly Plastic Clay/Silty Clay
CL	Lean Clay
CL/ML	Lean Clay/Silt
CL-CH	
CL-ML	
CL-SC	
CL-SM	
FILL	
OH	
OL	Organic Clay

NOTES:

a. VERTICAL DATUM: MSL OF NGVD29, IN FEET, AT SANDY HOOK, NEW JERSEY.

b. THE SERIES OF BORINGS ARE SHOWN – B–XX SERIES WAS COMPLETED BETWEEN YEAR 1972 AND 1973. SB–XX SERIES IS THE CURRENT PHASE OF BORINGS.

VERTICAL SCALE: 1"= 40' 20 0 40

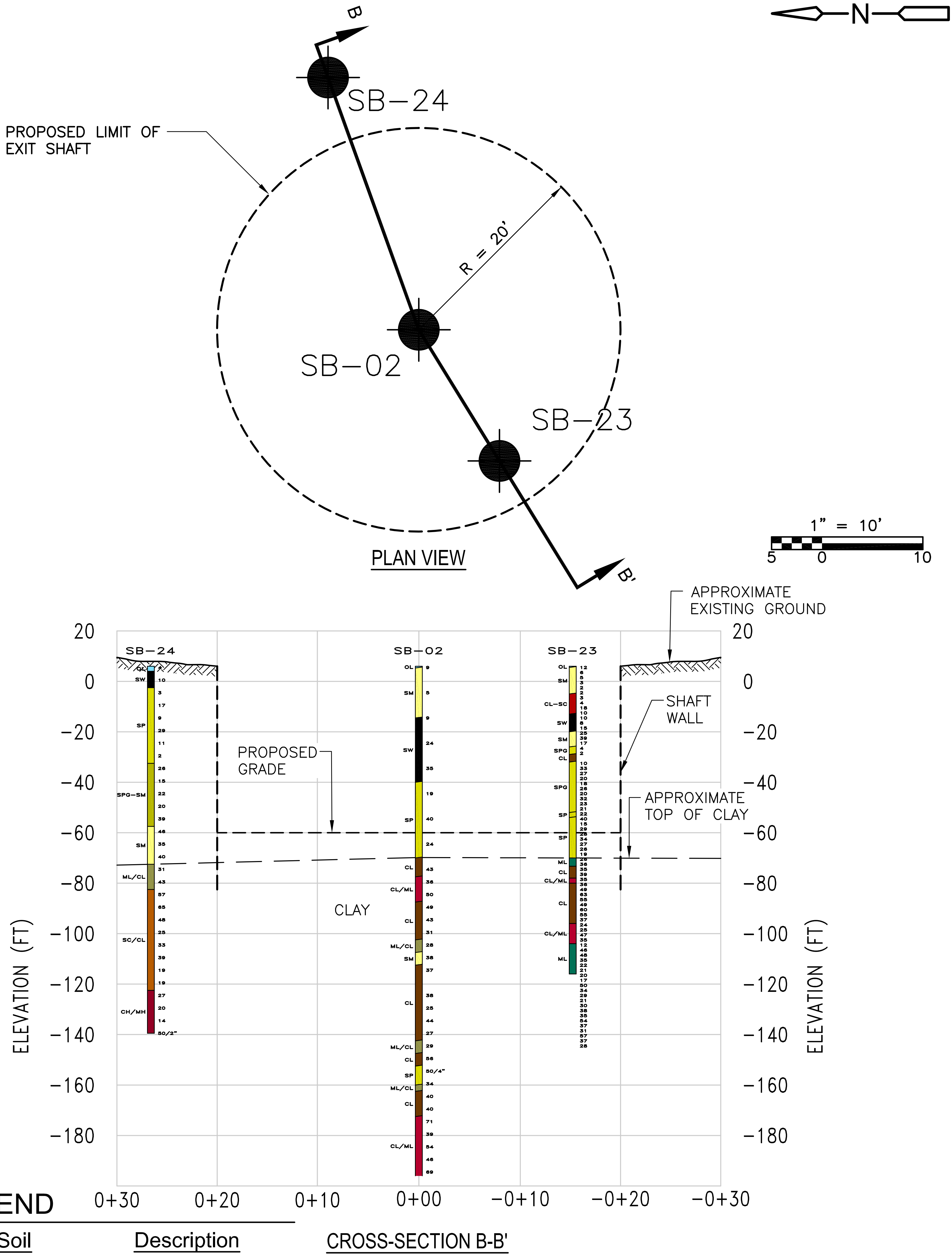
HORIZONTAL SCALE: 1"= 10' 5 0 10

CDM

consulting • engineering • construction • operations

SUFFOLK COUNTY OUTFALL REPLACEMENT
LAUNCH SHAFT PLAN AND PROFILE

FIGURE 1



LEGEND

Soil	Description
GM	
GP	Poorly Graded Gravel
GP/GC	
GP/SP	
GW	Well Graded Gravel
SC	Clayey Sand
SC/CL	
SC-SM	
SM	Silty Sand
SM/CL	
SM-SC	
SM/ML	
SP	Poorly Graded Sand
SP/GP	Poorly Graded Sand/Gravel
SP/SC	
SP-SM	Poorly Graded Silty Sand
SP/SW	
SW	Well Graded Sand
SW-SC	
SW/GP	
SW-SM	Well Graded Sand/Silty Sand
MH	
MH/CH	
MH/SM	
ML	Silt
ML/CL	Silt/Clay
ML/MH	
ML/SM	
CH/MH	
CH	Highly Plastic Clay/Silty Clay
CL	Lean Clay
CL/ML	Lean Clay/Silt
CL-CH	
CL-ML	
CL-SC	
CL-SM	
FILL	
OH	
OL	Organic Clay

NOTES:

a. VERTICAL DATUM: MSL OF NGVD29, IN FEET, AT SANDY HOOK, NEW JERSEY.

b. THE SERIES OF BORINGS ARE SHOWN – B–XX SERIES WAS COMPLETED BETWEEN YEAR 1972 AND 1973. SB–XX SERIES IS THE CURRENT PHASE OF BORINGS.

VERTICAL SCALE: 1"= 40' 20 0 40

HORIZONTAL SCALE: 1"= 10' 5 0 10

CDM
consulting • engineering • construction • operations

SUFFOLK COUNTY OUTFALL REPLACEMENT
EXIT SHAFT PLAN AND PROFILE

FIGURE 2

Appendix C

Table C.1 Suffolk County DHS Sewage Collection Systems and Treatment Works Design Criteria

Design Parameter	Value	Units
Total Flow	1	MGD
Maximum allowable design flow rate (unfiltered effluent)	10	gpd/sf
Maximum allowable design flow rate (filtered effluent)	5	gpd/sf
Minimum buffer	100	ft
Minimum distance to structure or building setback	400	ft
Minimum distance to property line	300	ft
Maximum bed depth	4	ft
Expansion Area (% redundancy)	100	%

(Values from SCDHS Division of Environmental Quality Appendix B "Standards for Approval and Construction of Sewage Collection Systems and Treatment Works")

Table C.2 Upland Recharge Basin Locations (2 pages)

Count	Parcel ID	Town/Region	Total Acreage	Land Use	30ft to GW	10 acres
1	400273000300001000	Dix Hills	51.43	Institutional - Madonna Heights Private School/partially wooded	Y	Y
2	400282000200043000	Dix Hills	57.96	Institutional - Otsego Park	Y	Y
3	400272000200006000	Dix Hills	7.21	Institutional - Lutheran Church/partially wooded	Y	N
4	500071000100010000	Brentwood	372.17	Institutional - Pilgrim Psychiatric Hospital	Y	Y
5	500071000100010000	Brentwood	115.71	Institutional - Pilgrim Psychiatric Hospital	Y	Y
6	500092000200002000	Brentwood	8.14	Institutional - St. Luke's Religious Ed Facility	Y	N
7	500071000100012000	Brentwood	202.46	Institutional - Suffolk County Community College	Y	Y
8	400266000100016000	Farmingdale	323.58	Institutional - SUNY Farmingdale	Y	Y
9	100001000100006000	Farmingdale	38.25	Institutional- Evening College/recreational fields	Y	Y
10	500211000100002000	Bohemia	150.73	Recreation/Open Space - Bohemia County Park	Y	Y
11	400273000100063000	Brentwood	22.86	Recreation/Open Space - Butterfly Park	Y	Y
12	400273000100065000	Brentwood	16.70	Recreation/Open Space - Butterfly Park	Y	Y
13	400262000300016000	Deer Park	12.27	Recreation/Open Space - Highland Park	Y	Y
14	400254000200043000	Melville	14.98	Recreation/Open Space - Kenwal Day Camp	Y	Y
15	400285000100079000	Brentwood	239.89	Recreation/Open Space - L.I. Correctional Facility -wooded	Y	Y
16	100051000100001000	Farmingdale	9.11	Recreation/Open Space - mostly flat/grassy	Y	N
17	400285000100077000	Dix Hills	43.73	Recreation/Open Space - mostly wooded area	Y	Y
18	100029000100002000	Deer Park	530.42	Recreation/Open Space - NYS Conservation Area	Y	Y
19	400264000300001000	Dix Hills	24.99	Recreation/Open Space - partially cleared out/partially wooded	Y	Y
20	400285000200017000	Brentwood	15.67	Recreation/Open Space - residential/wooded	Y	Y
21	400269000100029000	Melville	34.95	Recreation/Open Space - Roundtree Park	Y	Y
22	400274000100026000	Dix Hills	6.17	Recreation/Open Space - Strathmore Park	Y	N
23	400274000100026000	Dix Hills	7.94	Recreation/Open Space - wooded area	Y	N
24	100051000100003000	Wyandanch	7.10	Recreation/Open Space - wooded area	Y	N
25	100051000100004000	Farmingdale	5.86	Recreation/Open Space - partially wooded area	Y	N
26	100029000100002000	Deer Park	32.87	Recreation/Open Space - wooded area	Y	Y
27	100029000100002000	Deer Park	31.49	Recreation/Open Space - wooded area	Y	Y
28	400254000100007000	Melville	23.31	Recreation/Open Space - wooded area	Y	Y

29	400254000200005000	Melville	9.67	Recreation/Open Space - wooded area	Y	N
30	400254000200046000	Melville	52.19	Recreation/Open Space - wooded area	Y	Y
31	400254000200046000	Melville	5.78	Recreation/Open Space - wooded area	Y	N
32	400254000200046000	Melville	30.81	Recreation/Open Space - wooded area	Y	Y
33	400254000200046000	Melville	8.12	Recreation/Open Space - wooded area	Y	N
34	400271000100062000	Wyandanch	98.47	Recreation/Open Space - wooded area	Y	Y
35	400284000200001000	Dix Hills	5.06	Recreation/Open Space - wooded area	Y	N
36	400285000100079000	Deer Park	14.38	Recreation/Open Space - wooded area	Y	Y
37	400285000100079000	Deer Park	16.40	Recreation/Open Space - wooded area	Y	Y
38	400254000200023000	Melville	9.00	Recreation/Open Space - wooded area	Y	N
39	500182000200061000	Islip	37.79	Recreation/Open Space - wooded area/park	Y	Y
40	100011000100002000	Wyandanch	230.19	Recreation/Open Space - wooded/Henry Kaufman campgrounds	Y	Y
41	400271000100030000	Wyandanch	142.97	Recreation/Open Space - wooded/partial residential	Y	Y
42	100083000400001000	Wyandanch	31.11	Recreation/Open Space - Wyandanch Park	Y	Y
44	400269000300080000	Wyandanch	5.19	Transportation - Recharge Basin - dry	Y	N
45	400262000300001000	Dix Hills	7.00	Transportation - Recharge Basin	Y	N
46	100098000100105000	Farmingdale	45.23	Transportation - Republic Airport - wooded section	Y	Y
47	400273000200144000	Deer Park	5.63	Utility - power lines	Y	N
48	400266000100007000	Melville	31.72	Utility - National Grid Training Facility + Recharge Basin - dry	Y	Y
49	400263000300051000	Dix Hills	7.94	Utility - power lines	Y	N
50	400271000100047000	Wyandanch	14.81	Utility - power lines	Y	Y
51	400274000100027000	Deer Park	8.05	Utility - power lines	Y	N
52	400281000200079000	Deer Park	9.05	Utility - power lines	Y	N
53	400282000100077000	Dix Hills	8.50	Utility - power lines	Y	N
54	400282000300062000	Dix Hills	5.57	Utility - power lines	Y	N
55	400283000200039000	Dix Hills	14.64	Utility - power lines	Y	Y
56	500184000100035000	Islip	7.68	Utility - Timberline Park	Y	N
57	500038000200020000	Islip	9.93	Vacant - flat, cleared out	Y	N
58	500038000200020000	Islip	6.63	Vacant - flat, cleared out	Y	N
59	400270000200014000	Wyandanch	5.10	Vacant - partial new construction	Y	N
60	400255000100036000	Melville	5.80	Vacant - partially wooded/partially new construction	Y	N
61	500181000200043000	Brentwood	11.93	Vacant - wooded area	Y	Y
62	400269000100019000	Melville	10.47	Vacant - wooded area	Y	Y
63	400269000100052000	Melville	12.09	Vacant - wooded lot	Y	Y
64	400254000200046000	Melville	8.01	Vacant - wooded lot	Y	N
65	400267000100013000	Melville	16.53	Vacant - wooded/partial new development	Y	Y

Table C.3 Available Space for Recharge Basins

Potential Number of Recharge Basins	
Greater than10 acres	38
Less than10 acres	27
Total	65

Table C.4 Upland Recharge – Injection Well Locations (7 pages)

Count	Parcel Number	Total Acreage	Land Use	30 ft to GW
1	500040000200016000	0.56	Vacant - wooded	Y
2	500040000200018000	0.21	Vacant - wooded	Y
3	500040000200044000	0.48	Vacant - wooded	Y
4	500054000100007000	0.78	Vacant - wooded near residential	Y
5	500054000100009000	0.84	Vacant - wooded	Y
6	500054000200020000	0.27	Vacant - wooded	Y
7	500056000200016000	0.87	Vacant - wooded	Y
8	500072000100006000	0.72	Vacant - narrow/near residential	Y
9	500074000100030000	0.23	Vacant - open space	Y
10	500077000100006000	0.87	Vacant - wooded	Y
11	500078000300064000	0.14	Vacant - wooded/near residential	Y
12	500097000100033000	0.52	Vacant - partially wooded/near residential	Y
13	500098000100032000	0.27	Vacant - open space	Y
14	500098000100053000	0.23	Vacant - partially wooded	Y
15	500099000200022000	0.26	Vacant - wooded/near residential	Y
16	500099000200053000	0.31	Vacant - wooded	Y
17	500099000200054000	0.35	Vacant - wooded	Y
18	500113000200047000	0.51	Vacant - wooded	Y
19	500115000200065000	0.23	Vacant - wooded	Y
20	500115000200066000	0.46	Vacant - wooded	Y
21	500115000200083000	0.21	Vacant - wooded/near residential	Y
22	500115000200084000	0.22	Vacant - wooded/near residential	Y
23	500115000200096000	0.23	Vacant - wooded/near residential	Y
24	500116000200030000	0.46	Vacant - wooded	Y
25	500117000100015000	0.17	Vacant - wooded	Y
26	500117000100041000	0.17	Vacant - wooded	Y
27	500117000200009000	0.46	Vacant - wooded/near residential	Y
28	500117000300077000	0.34	Vacant - wooded	Y
29	500118000300002000	0.21	Vacant - partially wooded/near residential	Y
30	500118000300003000	0.29	Vacant - partially wooded/near residential	Y
31	500118000300004000	0.21	Vacant - partially wooded/near residential	Y
32	500118000300008000	0.30	Vacant - partially wooded	Y
33	500118000300019000	2.15	Vacant - partially wooded	Y
34	500119000100029000	0.26	Vacant - open space	Y
35	500119000100089000	0.41	Vacant - wooded	Y
36	500119000100096000	0.30	Vacant - partially wooded	Y
37	500136000100099000	0.60	Vacant - open space/near residential	Y
38	500136000200048000	0.45	Vacant - partially wooded	Y
39	500136000200095000	1.01	Vacant - wooded	Y
40	500136000200113000	0.22	Vacant - wooded	Y
41	500136000200116000	0.77	Vacant - wooded	Y
42	500136000200117000	0.72	Vacant - partially wooded	Y
43	500137000400006000	0.39	Vacant - partially wooded	Y
44	500137000400009000	0.22	Vacant - wooded/near train station	Y

45	500140000100050000	0.34	Vacant - wooded	Y
46	500140000200002000	0.43	Vacant - wooded/near residential	Y
47	500140000200005000	0.29	Vacant - wooded/near residential	Y
48	500141000300008000	0.14	Vacant - near residential	Y
49	500157000200018000	0.38	Vacant - partially wooded/open space	Y
50	500157000200021000	0.38	Vacant - partially wooded/open space	Y
51	500157000200022000	0.37	Vacant - open space	Y
52	500157000200023000	0.37	Vacant - open space	Y
53	500157000200024000	0.42	Vacant - open space	Y
54	500157000200040000	1.80	Vacant - wooded	Y
55	500157000200041000	2.14	Vacant - wooded	Y
56	500158000200049000	0.61	Vacant - wooded	Y
57	500158000300011000	0.18	Vacant - wooded/near residential	Y
58	500158000300011000	0.18	Vacant - wooded/near residential	Y
59	500158000300014000	0.18	Vacant - wooded/near residential	Y
60	500158000300040000	0.23	Vacant - wooded/near residential *	Y
61	500158000300055000	0.23	Vacant - wooded/near residential *	Y
62	500158000300056000	0.18	Vacant - wooded/near residential *	Y
63	500158000300058000	0.23	Vacant - wooded/near residential *	Y
64	500158000300059000	0.23	Vacant - wooded/near residential *	Y
65	500158000300060000	0.37	Vacant - wooded/near residential *	Y
66	500158000300062000	0.18	Vacant - wooded/near residential *	Y
67	500158000300064000	0.23	Vacant - wooded/near residential *	Y
68	500158000300069000	0.23	Vacant - wooded/near residential *	Y
69	500158000300070000	0.18	Vacant - wooded/near residential *	Y
70	500158000300073000	0.18	Vacant - wooded/near residential *	Y
71	500158000300076000	0.18	Vacant - wooded/near residential *	Y
72	500158000300078000	0.28	Vacant - wooded/near residential *	Y
73	500158000300111000	0.17	Vacant - wooded/near residential *	Y
74	500158000300112000	0.45	Vacant - wooded/near residential *	Y
75	500179000200041000	0.40	Vacant - wooded/near commercial site	Y
76	500179000200053000	0.42	Vacant - wooded/near commercial site	Y
77	500180000400061000	0.33	Vacant - wooded/near residential	Y
78	500181000300028000	0.23	Vacant - wooded/near residential *	Y
79	500181000300030000	0.18	Vacant - wooded/near residential *	Y
80	500181000300031000	0.18	Vacant - wooded/near residential *	Y
81	500181000300034000	0.28	Vacant - wooded/near residential *	Y
82	500181000300054000	0.23	Vacant - wooded/near residential *	Y
83	500183000200002000	0.88	Vacant - wooded	Y
84	500183000200003000	0.44	Vacant - open space	Y
85	504006000100008000	0.73	Vacant - wooded	Y
86	504012000100026000	0.33	Vacant - partially wooded	Y
87	504012000200021000	0.41	Vacant - open space	Y
88	504013000200097000	0.34	Vacant - wooded/near residential	Y
89	504017000100029000	0.41	Vacant - partially wooded	Y
90	500054000200007000	0.31	Vacant - wooded	Y
91	500080000300068000	1.22	Vacant - wooded	Y
92	500099000200056000	0.28	Vacant - wooded	Y

93	500099000200058000	0.36	Vacant - wooded	Y
94	500157000200020000	0.37	Vacant - open space	Y
95	504017000100007000	3.24	Vacant - open space	Y
96	500050000300019000	0.16	Vacant - wooded	Y
97	500115000200004000	0.22	Vacant - wooded	Y
98	500137000400007000	0.39	Vacant - partially wooded	Y
99	500140000200004000	0.32	Vacant - wooded	Y
100	500157000200017000	0.39	Vacant - partially wooded	Y
101	500158000300067000	0.23	Vacant - wooded/near residential	Y
102	500181000300033000	0.23	Vacant - wooded/near residential	Y
103	500202000100063000	0.39	Vacant - partially wooded/open space	Y
104	500041000100030000	0.36	Vacant - wooded/near residential	Y
105	500054000100011000	0.49	Vacant - wooded/near residential	Y
106	500054000300043000	2.53	Vacant - wooded	Y
107	500078000300060000	0.18	Vacant - wooded/near residential	Y
108	500115000200018000	0.47	Vacant - wooded/near residential	Y
109	500118000100105000	0.46	Vacant - partially wooded	Y
110	500120000300073000	0.24	Vacant - open space	Y
111	500137000100096000	0.15	Vacant - open space	Y
112	500157000200039000	0.83	Vacant - wooded	Y
113	500052000300017000	0.29	Vacant - wooded/near residential	Y
114	500053000200022000	0.35	Vacant - wooded/near residential	Y
115	500078000100002000	1.08	Vacant - wooded/near residential	Y
116	500120000100089000	0.31	Vacant - wooded	Y
117	500158000300002000	0.23	Vacant - wooded/near residential	Y
118	500158000300013000	0.23	Vacant - wooded/near residential	Y
119	504017000100006000	3.19	Vacant - open space	Y
120	100017000100046000	0.23	Vacant - wooded	Y
121	100017000100046000	0.24	Vacant - wooded	Y
122	100017000100047000	0.22	Vacant - wooded	Y
123	100017000100047000	0.22	Vacant - wooded	Y
124	100017000100068000	0.23	Vacant - wooded	Y
125	100035000100018000	0.54	Vacant - near industrial park	Y
126	100036000200003000	1.60	Vacant - near industrial park	Y
127	100039000100126000	0.46	Vacant - partially wooded	Y
128	100039000200094000	0.15	Vacant - wooded/near residential	Y
129	100039000300063000	0.23	Vacant - wooded/near residential	Y
130	100040000100038000	0.17	Vacant - wooded/near residential	Y
131	100040000200045000	0.37	Vacant - wooded	Y
132	100040000300015000	0.17	Vacant - wooded	Y
133	100040000300018000	0.22	Vacant - wooded	Y
134	100040000300020000	0.98	Vacant - wooded	Y
135	100040000300024000	0.46	Vacant - wooded/near residential	Y
136	100040000300025000	0.46	Vacant - wooded/near residential	Y
137	100040000300039000	0.16	Vacant - wooded/near residential	Y
138	100040000300041000	4.52	Vacant - wooded	Y
139	100041000100008000	0.23	Vacant - wooded/near residential	Y
140	100044000200006000	1.03	Vacant - wooded	Y

141	100046000100016000	0.32	Vacant - wooded	Y
142	100053000100027000	0.23	Vacant - wooded	Y
143	100053000100062000	0.40	Vacant - wooded	Y
144	100053000100064000	0.23	Vacant - wooded	Y
145	100053000100065000	0.17	Vacant - wooded	Y
146	100053000100067000	0.34	Vacant - wooded	Y
147	100053000100073000	0.23	Vacant - wooded	Y
148	100053000100074000	0.23	Vacant - wooded	Y
149	100054000300013000	0.36	Vacant - wooded	Y
150	100054000300019000	0.56	Vacant - wooded	Y
151	100054000300027000	0.19	Vacant - wooded	Y
152	100055000300001000	0.36	Vacant - open space	Y
153	100055000300006000	0.58	Vacant - open space	Y
154	100055000300062000	0.31	Vacant - open space	Y
155	100056000200042000	0.46	Vacant - wooded	Y
156	100056000300022000	0.23	Vacant - open space/near residential	Y
157	100057000100037000	0.46	Vacant - open space	Y
158	100057000100042000	0.33	Vacant - open space	Y
159	100057000100044000	0.32	Vacant - wooded	Y
160	100057000100045000	1.16	Vacant - wooded	Y
161	100057000200062000	0.16	Vacant - near residential	Y
162	100057000300122000	0.17	Vacant - wooded/near residential	Y
163	100058000200035000	0.32	Vacant - wooded	Y
164	100058000400010000	0.17	Vacant - open space	Y
165	100058000400082000	0.14	Vacant - wooded	Y
166	100058000400084000	0.18	Vacant - wooded	Y
167	100058000500002000	0.23	Vacant - near residential/wooded	Y
168	100058000500003000	0.18	Vacant - wooded	Y
169	100058000500013000	0.18	Vacant - wooded	Y
170	100058000500034000	0.18	Vacant - near residential	Y
171	100058000600020000	0.18	Vacant - near residential	Y
172	100058000600045000	0.25	Vacant - near residential	Y
173	100058000600055000	0.25	Vacant - open space/near residential	Y
174	100058000600057000	0.27	Vacant - open space	Y
175	100058000600060000	0.18	Vacant - open space	Y
176	100059000400017000	0.16	Vacant - wooded	Y
177	100059000400018000	0.48	Vacant - wooded	Y
178	100070000100048000	0.67	Vacant - wooded	Y
179	100078000200004000	0.39	Vacant - open space/near residential	Y
180	100078000200035000	0.43	Vacant - wooded	Y
181	100078000200036000	0.18	Vacant - wooded	Y
182	100078000200037000	0.17	Vacant - wooded	Y
183	100078000200038000	0.18	Vacant - wooded	Y
184	100078000200039000	0.17	Vacant - wooded	Y
185	100078000200054000	0.17	Vacant - wooded	Y
186	100078000200055000	0.33	Vacant - wooded	Y
187	100079000100016000	0.99	Vacant - open space	Y
188	100079000200025000	0.18	Vacant - residential/wooded	Y

189	100079000300037000	0.36	Vacant - wooded	Y
190	100079000300038000	0.18	Vacant - wooded	Y
191	100079000300041000	0.27	Vacant - wooded	Y
192	100079000300043000	0.63	Vacant - wooded	Y
193	100079000300044000	0.28	Vacant - wooded	Y
194	100079000300075000	0.33	Vacant - near residential/wooded	Y
195	100080000100001000	0.25	Vacant - wooded	Y
196	100080000200024000	1.36	Vacant - wooded/open space	Y
197	100080000200118000	1.13	Vacant - open space	Y
198	100080000200154000	0.16	Vacant - open space	Y
199	100080000300099000	0.17	Vacant - open/near residential	Y
200	100081000100023000	0.23	Vacant - near residential	Y
201	100081000100098000	0.23	Vacant - near residential	Y
202	100081000200067000	0.14	Vacant - wooded/near residential	Y
203	100081000300013000	0.23	Vacant - near residential	Y
204	100082000200037000	0.28	Vacant - narrow	Y
205	100082000200045000	0.23	Vacant - near residential	Y
206	100082000300005000	0.73	Vacant - wooded	Y
207	100082000300008000	1.38	Vacant - mostly wooded	Y
208	100082000300009000	0.25	Vacant - wooded	Y
209	100083000100030000	0.17	Vacant - wooded	Y
210	100083000100038000	0.14	Vacant - wooded/near residential	Y
211	100083000100046000	0.22	Vacant - wooded/near residential	Y
212	100083000100057000	0.18	Vacant - wooded	Y
213	100083000100080000	0.89	Vacant - wooded	Y
214	100083000100081000	0.22	Vacant - wooded	Y
215	100083000100098000	0.18	Vacant - wooded	Y
216	100083000100104000	0.18	Vacant - wooded	Y
217	100083000100106000	0.18	Vacant - wooded/near residential	Y
218	100083000100117000	0.18	Vacant - wooded	Y
219	100083000100133000	0.18	Vacant - wooded	Y
220	100083000100152000	0.56	Vacant - wooded	Y
221	100083000100156000	0.18	Vacant - wooded	Y
222	100083000200008000	0.18	Vacant - wooded	Y
223	100083000200010000	0.49	Vacant - wooded	Y
224	100083000200011000	0.71	Vacant - wooded	Y
225	100083000200039000	0.22	Vacant - near residential	Y
226	100083000200069000	0.22	Vacant - near residential	Y
227	100083000200069000	0.22	Vacant - wooded	Y
228	100083000400070000	0.17	Vacant - open space	Y
229	100102000100001000	0.19	Vacant - wooded/near residential	Y
230	100015000200048000	0.25	Vacant - wooded	Y
231	100040000200046000	0.33	Vacant - wooded/near residential	Y
232	100053000100068000	0.17	Vacant - wooded	Y
233	100053000100075000	0.22	Vacant - wooded	Y
234	100056000200045000	0.23	Vacant - wooded/near residential	Y
235	100057000100046000	0.18	Vacant - wooded	Y
236	100058000300002000	0.18	Vacant - wooded/near residential	Y

237	100058000400085000	0.14	Vacant - wooded	Y
238	100023000100005000	0.54	Vacant - wooded	Y
239	100040000300016000	0.23	Vacant - wooded	Y
240	100053000100063000	0.39	Vacant - wooded	Y
241	100053000100072000	0.17	Vacant - wooded	Y
242	100055000200035000	0.18	Vacant - partially wooded	Y
243	100059000400016000	0.18	Vacant - wooded	Y
244	100083000100157000	0.18	Vacant - near residential/wooded	Y
245	100083000200012000	0.89	Vacant - wooded	Y
246	100083000300040000	0.18	Vacant - near residential	Y
247	100007000100041000	1.51	Vacant - partial open field/parking lot	Y
248	100079000400005000	0.18	Vacant - near residential	Y
249	100083000100027000	0.19	Vacant - near residential	Y
250	100017000100068000	0.23	Vacant - wooded	Y
251	100039000300113000	0.23	Vacant - wooded	Y
252	100040000300019000	0.23	Vacant - wooded	Y
253	100054000200009000	0.17	Vacant - open space/near residential	Y
254	100058000600056000	0.26	Vacant - open space	Y
255	100079000300033000	0.18	Vacant - narrow	Y
256	100082000300003000	0.47	Vacant - wooded	Y
257	100083000200135000	0.21	Vacant	Y
258	400254000100008000	0.46	Vacant - wooded	Y
259	400254000200024000	1.28	Vacant - wooded	Y
260	400254000200033000	0.49	Vacant - wooded/near residential	Y
261	400259000300022000	0.23	Vacant - partially wooded/park	Y
262	400262000300009000	0.72	Vacant - wooded	Y
263	400266000100008000	0.63	Vacant - wooded	Y
264	400267000200023000	0.90	Vacant - near industrial park	Y
265	400267000200030000	2.45	Vacant - open space	Y
266	400270000200014000	3.93	Vacant - narrow/wooded	Y
267	400273000100071000	0.34	Vacant - wooded	Y
268	400273000100072000	0.40	Vacant - wooded	Y
269	400273000200010000	0.42	Vacant - wooded	Y
270	400273000200019000	0.23	Vacant - wooded	Y
271	400273000200019000	0.24	Vacant - wooded	Y
272	400273000200096000	0.73	Vacant - wooded	Y
273	400273000200141000	0.24	Vacant - wooded/near residential	Y
274	400273000300027000	0.23	Vacant - near residential	Y
275	400273000300064000	1.38	Vacant - wooded	Y
276	400274000200029000	1.06	Vacant - wooded/near residential	Y
277	400278000200162000	1.94	Vacant - wooded	Y
278	400278000200177000	1.33	Vacant - wooded	Y
279	400279000200034000	0.32	Vacant - wooded/near residential	Y
280	400279000200038000	0.14	Vacant - wooded	Y
281	400281000100098000	0.14	Vacant - wooded	Y
282	400281000100098000	0.17	Vacant - wooded	Y
283	400281000200011000	0.89	Vacant - wooded	Y
284	400281000200022000	0.38	Vacant - wooded	Y

285	400281000200043000	1.10	Vacant - wooded	Y
286	400281000200081000	1.71	Vacant - partially wooded	Y
287	400282000200044000	2.86	Vacant - wooded	Y
288	400282000300149000	0.74	Vacant - narrow/wooded	Y
289	400282000300185000	0.29	Vacant - partially wooded	Y
290	400283000100033000	1.01	Vacant - wooded	Y
291	400254000100003000	0.33	Vacant - wooded	Y
292	400254000200049000	0.76	Vacant - partially wooded	Y
293	400262000300008000	1.03	Vacant - partially wooded	Y
294	400273000300099000	0.30	Vacant - wooded	Y
295	400268000100026000	0.53	Vacant - partially wooded	Y
296	400273000200088000	0.14	Vacant - wooded	Y
297	400283000200022000	1.02	Vacant - wooded/near residential	Y
298	400272000400012000	3.75	Vacant - narrow/wooded	Y
299	400273000100070000	0.36	Vacant - partially wooded	Y
300	400273000200107000	0.46	Vacant - wooded/near residential	Y
301	400281000100112000	0.22	Vacant - wooded	Y
302	500180000100084000	0.29	Vacant - wooded near construction/storage	Y
303	500158000300077000	0.18	Vacant - wooded/near residential	Y
304	500158000300010000	0.18	Vacant - wooded/near residential	Y
305	500115000100016000	0.45	Vacant - open space	Y
306	500115000100016000	0.34	Vacant - wooded/near residential	Y
307	500115000200126000	0.17	Vacant - wooded/near residential	Y
308	500136000200115000	0.47	Vacant - wooded	Y
309	500136000200114000	0.20	Vacant - wooded	Y
310	500118000300025000	0.82	Vacant - partially wooded	Y
311	500118000300007000	0.21	Vacant - partially wooded/near residential	Y
312	500120000200026000	0.37	Vacant - wooded/near residential	Y
313	500098000100060000	0.35	Vacant - open space	Y
314	500054000200021000	0.16	Vacant - wooded	Y
315	500053000400005000	0.29	Vacant - wooded	Y
316	500054000100008000	0.85	Vacant - wooded	Y
317	500041000100023000	0.29	Vacant - wooded	Y
318	504012000200006000	0.38	Vacant - wooded	Y
319	500158000300061000	0.18	Vacant - wooded/near residential	Y
320	500158000300045000	0.14	Vacant - wooded/near residential	Y
321	500158000300075000	0.23	Vacant - wooded/near residential	Y
322	500158000300072000	0.18	Vacant - wooded/near residential	Y
323	500158000300077000	0.18	Vacant - wooded/near residential	Y
324	500158000300063000	0.18	Vacant - wooded/near residential	Y
325	500158000300065000	0.23	Vacant - wooded/near residential	Y
326	500181000300032000	0.23	Vacant - wooded/near residential	Y
327	500181000300019000	0.18	Vacant - wooded/near residential	Y
328	100041000300020000	0.25	Vacant - wooded	Y

** indicates parcels located in a cluster*

Executive Summary

Background and Project Need

The Suffolk County Department of Public Works (SCDPW) owns and operates Sewer District No. 3, Southwest - Bergen Point Wastewater Treatment Plant (WWTP) located in Babylon, NY. The WWTP operates under a New York State Pollution Discharge Elimination System (SPDES) permit and has a current permitted treatment capacity of 30.5 million gallons per day (MGD). Treated effluent from the WWTP is discharged to the Atlantic Ocean through a 72-inch diameter outfall. Acoustical monitoring has indicated that the portion of the existing outfall that extends from the WWTP southward beneath Great South Bay to the barrier island is in a failing condition; SCDPW intends to replace this portion of the outfall before failure occurs.

Treated effluent from the Bergen Point WWTP is discharged through a 32,000 foot long outfall constructed in 1977. The outfall consists of 72- inch diameter pre-stressed concrete cylinder pipe (PCCP) and concrete lined steel pipe. The 15,300 foot long PCCP section of the outfall starts at the WWTP effluent pump station and extends beneath the floor of the Great South Bay to the barrier island, (14,200 feet of pipe manufactured by Price Brothers) and then out beyond the surf zone into the ocean (1,100 feet of pipe manufactured by Interpace). The concrete lined steel pipe portion of the outfall extends out into the Atlantic Ocean for an additional 17,200 feet, including the 3,500-foot long diffuser that varies in diameter from 72 to 36 inches.

SCDPW became aware of PCCP pipe failures occurring throughout the world. These pipe failures were related to the breaking of the prestressed wires in the pipe. It has been documented that PCCP with Class IV wire manufactured from 1972 to 1980 has a higher rate of failure than other PCCP installed around the country. The failures are attributed to the use of the very high tensile strength, low ductility Class IV wire, poor quality control during fabrication, pipe coating damage, and/or the effects of corrosive environments. The Bergen Point WWTP outfall has both Class III and Class IV wire.

In 2003, SCDPW implemented a three month monitoring program to assess the condition of the PCCP portion of the WWTP outfall using an inline hydrophone system that recorded and located wire breaks in the PCCP as they occurred. The monitoring program documented the wire breaks that occurred during the testing period. The monitoring results revealed a significant number of breaks within the section of the pipe manufactured by Price Brothers. In fact, Pure Technologies, who performed the monitoring program, reported that the outfall was one of the three worst pipelines for wire breaks that they had ever monitored. It was unknown at the time what stage of deterioration the pipeline was in regarding its overall condition assessment.

The SCDPW subsequently implemented a phased program including a structural integrity analysis, a wire and mortar condition assessment and testing of the cathodic protection system to further evaluate the outfall condition.

Outside specialty contractors were retained to conduct these testing programs that evaluated the condition of the prestressed wires, the steel cylinder, the mortar, the concrete core of the external coating of the pipe, and the cathodic protection system designed to protect the steel cylinder. The evaluations concluded that the pipe condition was compromised, and that the pressure rating of the outfall had been significantly reduced. Because of the unknown condition of the exterior concrete pipe coating and steel cylinder, and the actual number of broken wires, the existing pressure rating of the pipe was assumed to be that of the steel cylinder. To perform the required testing to assess the true condition of the pipeline required dewatering of the pipeline. However, this would require the outfall to be taken out of service and there was no means to bypass the outfall. In addition, there was concern that if the outfall was in a failed condition and was dewatered that it could collapse. Therefore further outfall testing was not pursued. Instead, it was recommended that SCDPW minimize the operating pressure of the outfall pipe to the extent possible, to reduce the potential for pipe failure.

Due to the ramifications of the study conclusions, SCDPW retained additional independent experts to review the results of the pipe testing programs. All experts agreed that the breaks in the prestressed wire have led or will lead to cracking of the exterior concrete, which will allow water to reach the steel cylinder and cause it to corrode, eventually leading to the potential failure of the PCCP pipe. It is unknown exactly where the outfall is in the failure process, but all specialists concurred that based on the number of wire breaks, the outfall is in a deteriorated state and is subject to failure. The specialists unanimously recommended that the County should plan to replace the 14,200 foot PCCP portion of the outfall beneath Great South Bay.

It should be noted that SCDPW conducts semi-annual dye testing of the outfall under low pressure conditions (non-pumping) which continue to indicate that the pipe is not leaking, since no dye has been detected within Great South Bay or along the beaches.

Outfall Replacement Alternatives

Suffolk County identified and evaluated six alternatives to replace the deteriorated PCCP portion of the Bergen Point WWTP outfall beneath Great South Bay. The County also implemented a geotechnical exploration program to collect the subsurface information necessary to develop and evaluate preliminary engineering designs of the tunneling alternatives. Sufficient existing data was available to develop preliminary designs for the alternatives that did not include a new tunnel.

All alternatives include renovation of the existing final effluent pump station.

The implementation of each alternative was developed sufficiently to identify:

- Construction methods,
- Construction-related and operational impacts,
- Permitting requirements,
- Preliminary implementation schedules and
- Capital and operating cost estimates.

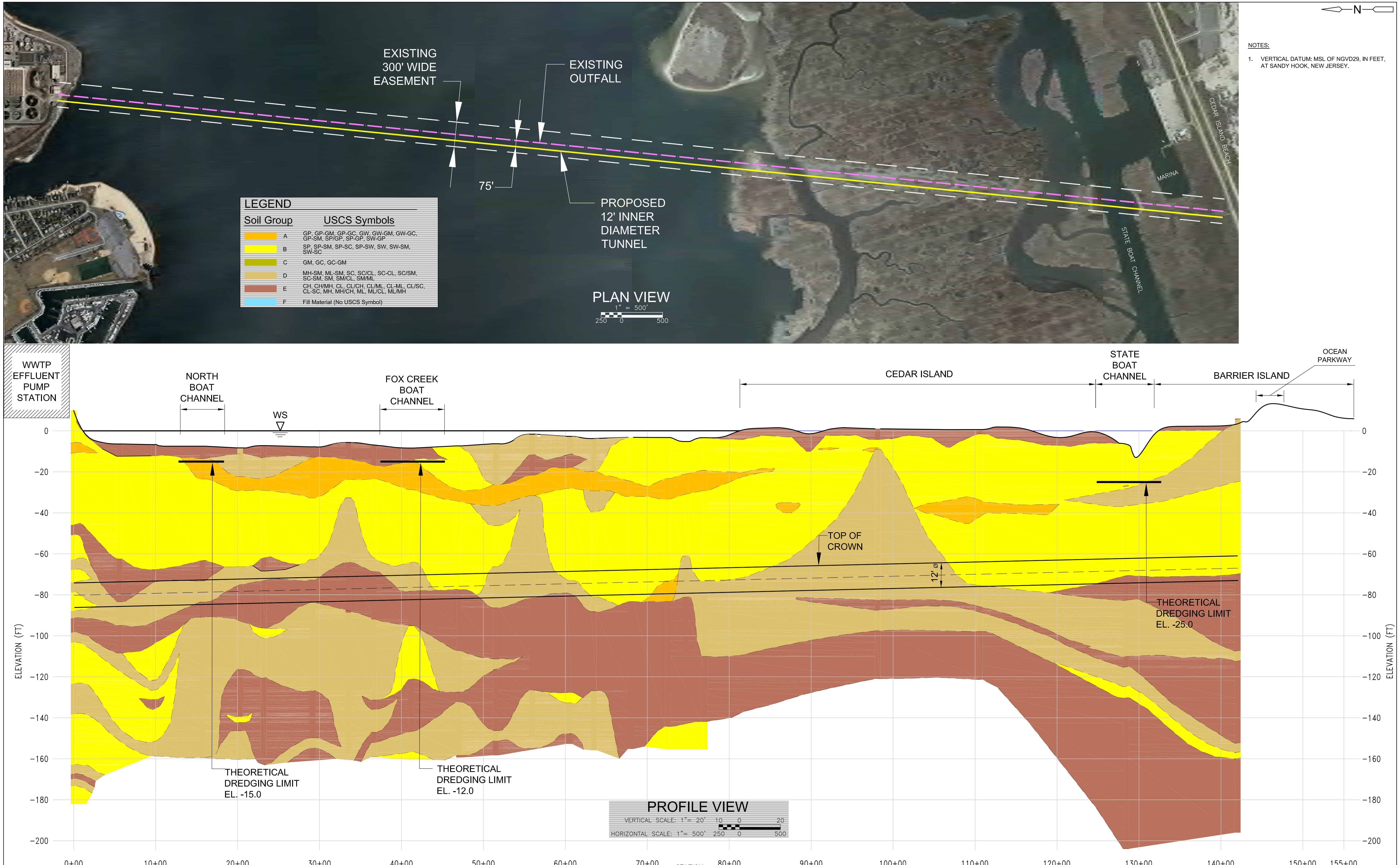
Each of the six alternatives is briefly described below.

Alternative 1 – Replace Outfall with Carrier Pipes Installed within a Tunnel

Alternative 1 would replace the section of the existing outfall extending from the Bergen Point WWTP south beneath Great South Bay to the barrier island by tunneling. On the barrier island, the new outfall section beneath the Bay would be connected to the existing ocean outfall to convey treated effluent to discharge. Most of the construction associated with this alternative would take place underground to avoid impacts to Great South Bay and to the environment. Above ground construction includes an access or working shaft at the Bergen Point WWTP site, and an exit or receiving shaft on the barrier island within the existing easement north of Ocean Parkway.

Several potential tunnel sizes and slopes were considered as this tunnel alternative was developed. **Figure ES-1** depicts the twelve foot diameter option sloped to the north towards the WWTP, in both plan view and section. The overall length of the tunnel would be approximately 14,200 feet. Based on the geotechnical boring program implemented during the winter of 2009, a Tunnel Boring Machine (TBM) was identified as the most feasible approach to construct the tunnel.

Tunnel implementation would begin with construction of an approximately 35-foot diameter access or working shaft at the Bergen Point WWTP site. Several alternative methods of constructing the shaft were considered; ground freezing was recommended to reduce impacts to the surrounding area. The TBM would be lowered into the approximately 70 foot deep shaft, and it would then advance southward along the alignment shown on **Figure ES-1** towards the barrier island. A concrete liner system would be installed as the TBM was advanced. An exit or receiving shaft would be constructed within the existing easement north of Ocean Parkway on the barrier island, where the TBM would be retrieved from the tunnel. It is estimated that approximately three acres at the Bergen Point WWTP site would be disturbed for construction equipment and materials storage, shaft construction and spoils storage. Up to three acres would also be disturbed within the existing easement on the barrier island for receiving/exit shaft construction, equipment storage and connection to the existing outfall.



\\Wbysvr01\Cad3\5175\39512\EAF\EXEC_SUM\ FIG ES-1 06/28/12 09:57 gencorellirj XREFS: CDM_2436

CDM
consulting • engineering • construction • operations

Figure ES-1
Horizontal and Vertical Alignment of Proposed12' Tunnel-Draining North
Alternative 1
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project - Engineering Report

After the tunnel is constructed, two 54-inch diameter steel carrier pipes would be installed within the tunnel. Five hundred and eighty 25-foot long pipe sections would be lowered into the tunnel. The pipes would be joined with lap joints, welded from the inside of the pipes, and the pipes would be grouted in place.

The new section of the outfall would be joined to the existing ocean portion of the outfall within the existing easement north of Ocean Parkway on the barrier island. Treated effluent would then continue to discharge through the outfall to the Atlantic Ocean as has been the case for over 30 years.

When the construction is complete, the disturbed area at the Bergen Point WWTP would be restored and the disturbed area on the barrier island would be revegetated and restored.

Including pump station renovation, it is estimated that implementation of Alternative 1 will take approximately eight years, at a cost of over $270,000,000. The preliminary capital cost for the tunnel, not including the effluent pump station, is estimated to be $244,000,000.

Alternative 2 – Replace Outfall with Tunnel

Alternative 2 would also replace the existing section of the outfall extending from the Bergen Point WWTP south beneath Great South Bay to the barrier island by tunneling. On the barrier island, the new outfall section beneath the Bay would be connected to the existing ocean outfall to convey treated effluent to discharge. Like Alternative 1, most of the construction associated with this alternative would take place underground to avoid impacts to Great South Bay and to the environment. Above ground construction includes an access or working shaft at the Bergen Point WWTP site, and an exit or receiving shaft on the barrier island within the existing easement north of Ocean Parkway. The primary difference between Alternative 1 and Alternative 2 is that no carrier pipes would be installed within the tunnel; the lined tunnel itself would become the replacement outfall.

Because installation of carrier pipes is not included, the tunnel size may be reduced to a ten foot diameter, the minimum size considered to be practicable for a TBM. **Figure ES-2** depicts a ten foot diameter tunnel in both plan view and section, sloped to drain to the north towards the WWTP. The overall length of the tunnel would be approximately 14,200 feet. Based on the geotechnical boring program implemented during the winter of 2009, a TBM was identified as the most feasible approach to replace the existing outfall.

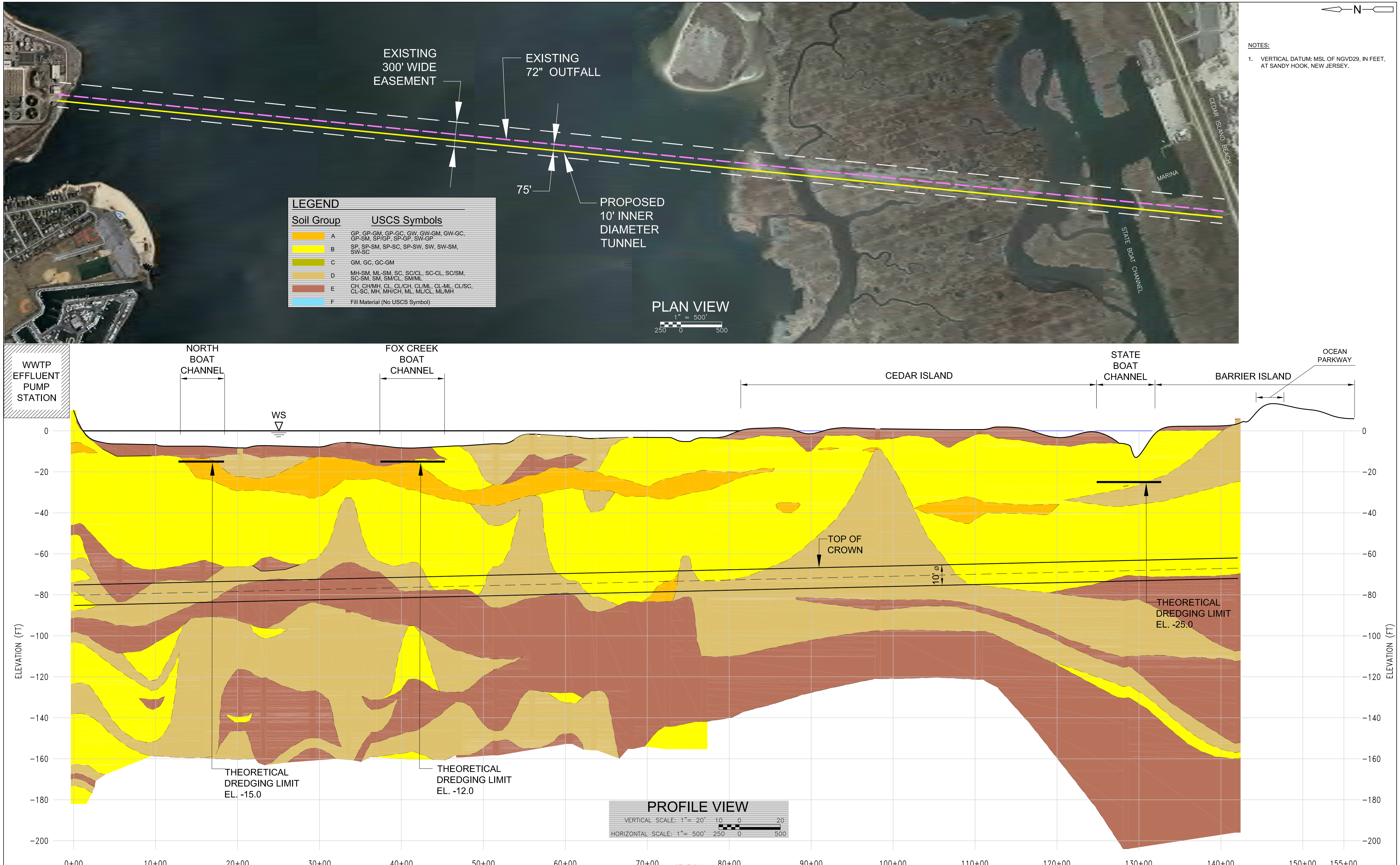


Figure ES-2
Horizontal and Vertical Alignment of 10' Tunnel
Alternative 2
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project - Engineering Report

consulting • engineering • construction • operations

Tunnel implementation would begin with construction of an approximately 30 foot diameter access or working shaft at the Bergen Point WWTP site. Several alternative methods of constructing the shaft were considered; ground freezing was recommended to reduce impacts to the surrounding area. The TBM would be lowered into the approximately 70 foot deep shaft, and then advanced southward along the alignment shown on **Figure ES-2** towards the barrier island. An exit or receiving shaft would be constructed within the existing easement north of Ocean Parkway where the TBM would be retrieved from the tunnel. It is estimated that approximately three acres at the Bergen Point WWTP site would be disturbed for construction equipment and materials storage, shaft construction and spoils storage. Up to three acres would also be disturbed at the receiving/exit shaft within the existing easement on the barrier island for receiving shaft construction, equipment storage and connection to the existing outfall.

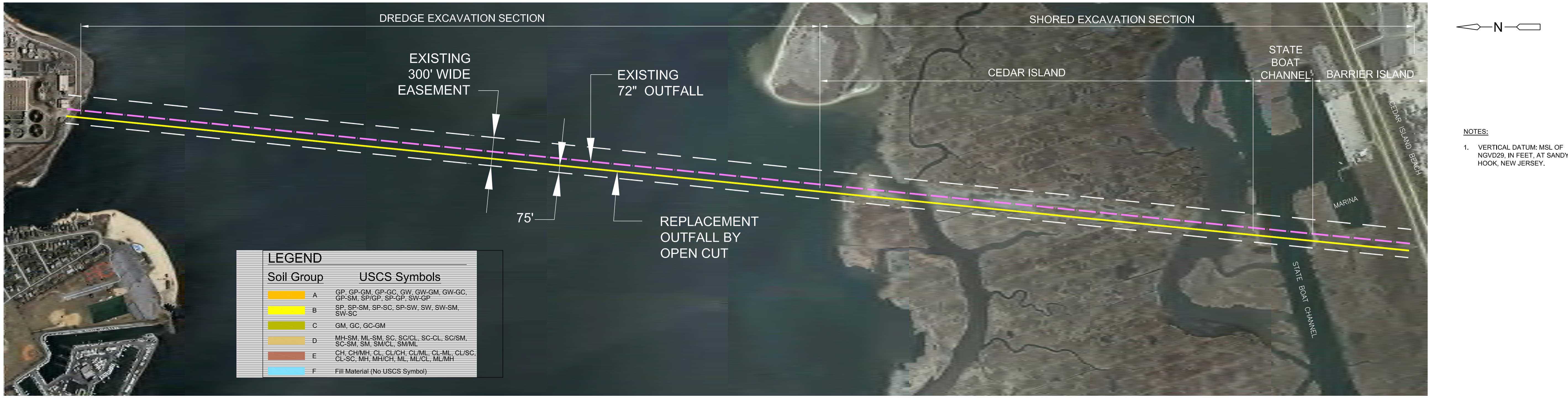
The new section of the outfall would be joined to the existing ocean portion of the outfall within the existing easement north of Ocean Parkway on the barrier island. Treated effluent would then continue to discharge through the outfall to the Atlantic Ocean as has been the case for over 30 years.

When the construction is complete, the disturbed area at the Bergen Point WWTP will be restored and the disturbed area on the barrier island will be revegetated and restored.

Implementation of Alternative 2 will take approximately seven years, at an estimated capital cost of approximately $225,000,000. The preliminary cost of the tunnel project, not including the effluent pump station, is estimated to be $197,000,000.

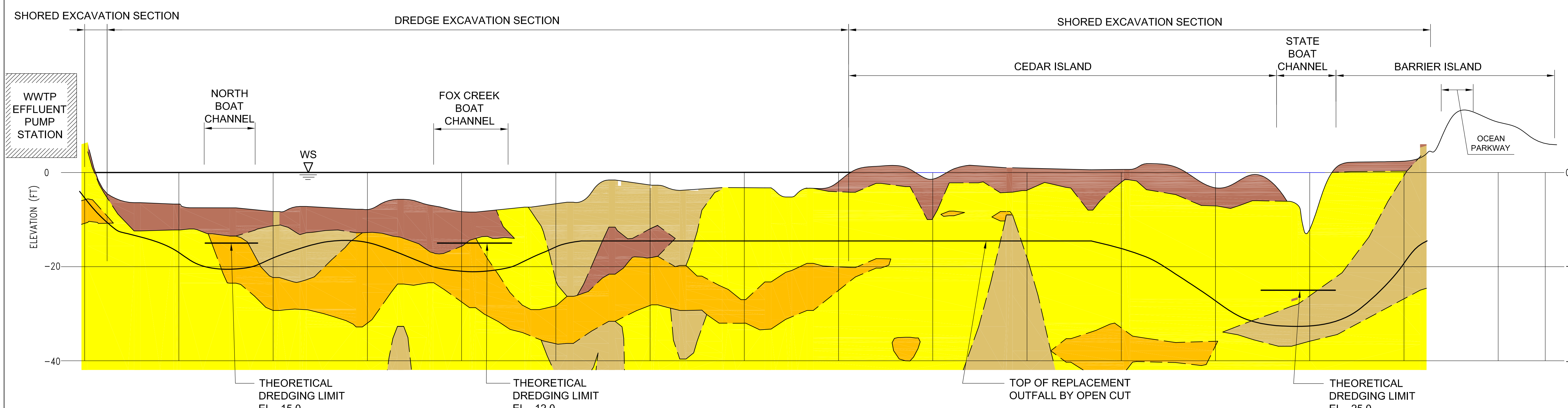
Alternative 3 – Construct Replacement Outfall by Open Cut

The third alternative would replace the existing deteriorated section of the outfall crossing Great South Bay by excavating an approximately 16 foot deep trench approximately 75 feet to the west of the existing outfall, within the existing easement, as shown on **Figure ES-3**. For redundancy, two 54-inch diameter ductile iron pipes would be positioned within the trench, and mechanically joined underwater.
Either mechanical dredging or hydraulic dredging could be used to excavate the trench for the replacement outfall pipes. Because hydraulic dredging would cause the least disturbance to the work area and because it can remove the sands and silts that exist within this alignment twice as fast as a mechanical dredge, it is the recommended method of excavation for construction in the open water part of the crossing. The fluidized materials removed by the hydraulic dredge would be pumped to hopper barges while the pipes were being installed. Due to the shallow nature of the Bay in the area, the barges could only be partially filled to avoid disturbing the bottom. Silt curtains would be required for sediment control.



PLAN VIEW

1" = 500'



PROFILE VIEW

VERTICAL SCALE: 1"= 20'
HORIZONTAL SCALE: 1"= 1000'

Figure ES-3
Replacement Outfall by Open Cut
Alternative 3
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project - Engineering Report

CDM
consulting • engineering • construction • operations

The section of the outfall passing between Cedar Island, the State Boat Channel and the barrier island would be constructed using a mechanical excavator mounted on a jack-up barge or a low draft barge; steel sheeting would be installed to isolate the work area. Construction of the replacement outfall by open cut requires significant work within Great South Bay, and a much greater potential for environmental impact than the other tunnel alternatives.

New York State Department of Environmental Conservation (NYSDEC) identified some of the environmental issues that would have to be addressed if the County chose to pursue a tunnel option that involved open cut construction. These concerns included shellfish, finfish, commercial and recreational fishing, endangered species and submerged aquatic vegetation (SAV) impacts. In addition, NYSDEC assisted in the development of projected project schedules for the tunnel alternatives by identifying the permitted calendar windows for construction – e.g., the maximum window during which work could be allowed within the Bay would extend from September 30th through January 15th to protect the spawning and early life stages of shellfish and of important finfish species such as the winter flounder. Therefore, construction could only occur approximately 15 weeks each year. NYSDEC also noted that the potential for winter closures to accommodate over-wintering waterfowl would also exist and have to be evaluated; this could potentially reduce the work window even further. The permitted construction windows have significant schedule impacts upon the alternatives involving work in Great South Bay– because the work could not be completed in the several months allowed, multiple mobilizations and demobilizations would be required. In addition, construction would occur during the colder months when the weather conditions are generally harsher, rather than the warm weather months. Both of these considerations significantly extend the project schedule and increase project costs.

Preliminary discussions indicated that NYSDEC would require sheeting of the entire tunnel length to reduce impacts of turbidity on the Bay environment. NYSDEC also outlined the baseline monitoring program that would be required prior to consideration of an open cut alternative.

The new section of the outfall would be joined to the existing ocean portion of the outfall within the existing easement north of Ocean Parkway on the barrier island. Treated effluent would then continue to discharge through the outfall to the Atlantic Ocean as it has done for over 30 years.

Due to the extended construction schedule dictated by the limited construction windows and the multiple mobilizations, as well as the baseline monitoring program that would be required to provide the information needed to guide the selection of construction techniques and establish construction constraints and mitigation requirements, it is estimated that project completion would take fifteen years.

The cost to construct the tunnel via open cut is estimated to be approximately $315M; the cost of the tunnel along is almost $278M.

Alternative 4 – Construct New Outfall Discharging to Great South Bay

Alternative 4, construction of a new outfall discharging directly to Great South Bay, was not developed to the same level of detail as the previous alternatives, because it was quickly determined that it was not implementable from a regulatory perspective. Alternative 4 is shown schematically by **Figure ES-4**.

NYSDEC provided a preliminary overview of several years of baseline sampling that would be required prior to consideration of this alternative. The existing Bergen Point WWTP outfall discharges to the Atlantic Ocean, which provides significant dilution of the constituents that are found in effluent from a wastewater treatment facility. In contrast, Great South Bay is a much smaller and shallower water body that would not be expected to assimilate the effluent without unacceptable water quality impacts. Consequently it is anticipated that the existing WWTP would have to be upgraded to provide a higher level of treatment. For example, it is assumed that nitrogen may need to be reduced to a practical technological limit of about 4 mg/L or less. Based on the information provided in the Bergen Point WWTP Expansion Report (CDM-D&B JV, June 2009), seven additional aeration tanks and two additional final clarifiers would need to be added if the nitrogen discharge limit was reduced to 10 mg/L. Further addition of either denitrification filters or membranes would be required to achieve the lower limit anticipated. It would be a challenge to fit all of the additional tankage and processes onto the existing Bergen Point WWTP site.

Along the existing easement following the alignment of the existing outfall, the Bay is very shallow, primarily between one and five feet deep. Several approaches to discharge the treated effluent to the Bay were explored. One option would site a network of diffusers along the Bay bottom to the east of the easement where the water is somewhat deeper; another would carry the treated effluent to the State Boat Channel where additional dilution would be provided. Based on the preliminary dimensions of the diffusers required to discharge the treated effluent, approximately 30 acres of Bay bottom would be disturbed during construction.

In addition to the short term construction-related impacts associated with implementation of this alternative, the potential long-term impacts associated with implementation are significant. They include addition of a significant fresh water flow to the Bay (which would alter local salinity and the distribution of benthic organisms and finfish, and could significantly affect the local ecosystem), closure of shellfish beds and closure of parts of the Bay to recreational users. The U.S. Environmental Protection Agency's designation of the Great South Bay as a no-discharge zone in November 2009, precludes issuance of the permits necessary to construct and operate this alternative.

Figure ES-4
Replacement Outfall Discharging to Great South Bay
Alternative 4
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project - Engineering Report

CDM
consulting • engineering • construction • operations

In the event that the alternative could be approved, it is estimated that it would take up to seventeen years to implement, at a capital cost of $597M. Exclusive of the effluent pump station, the capital cost to implement Alternative 4 would be almost $560M.

Alternative 5 – Line Existing Outfall Pipe (with Temporary Outfall Discharging to Great South Bay)

Alternative 5 would slip line the existing outfall pipe crossing beneath the bottom of Great South Bay. The slip-lining would be implemented by assembling new pipe segments on land or on barges, and then either pushing or pulling the assembled liner pipe through the existing outfall pipe. The ends of the liner pipe would be joined with the existing pipeline using adapters, tested, and put into service. During installation of the slip liner, the existing outfall could not be utilized so treated effluent from the Bergen Point WWTP would need to be redirected for over two years while the slip-lining was being performed. Three slip liner materials (centrifugally cast fiberglass pipe, ductile iron pipe and steel) and four options for bypass of the outfall (on-site storage, removal from the site via tanker truck, temporary outfall discharging to the Atlantic Ocean and temporary outfall discharging to Great South Bay) were considered.

Because of the vertical offsets needed to cross the existing boat channels in Great South Bay, sections of the slip liner and associated fittings would need to be cut and fabricated in the field at the WWTP. A steel liner was selected as the material for the liner pipe.

Several challenges associated with implementation of the slip-lining alternative were identified. The existing outfall pipe would need to be removed from service, dewatered and cleaned prior to installing the 68-inch diameter liner pipe. Based on the information available, it is not known whether the external water pressure would cause the existing outfall to collapse when it was dewatered. If the existing outfall were to collapse, it would have to be replaced by one of the other five alternatives and treated effluent would have to be discharged elsewhere for an extended design and construction period. Due to the limits in pulling or pushing a liner pipe, at least 15 sheeted access points would be required to access the outfall This would require disturbance of the bottom of the Great South Bay.

Four options to dispose of the treated effluent from the Bergen Point WWTP while the outfall pipe is being lined were considered. The first, on-site storage until the outfall was returned to service, was deemed to be infeasible. At an average daily flow rate of 30.5 MGD, over 25 billion gallons of treated effluent would need to be stored on-site. Assuming that fifteen foot deep storage tanks were used, over 5,100 acres would be required for effluent storage. It is anticipated that significantly more storage could be required; during storm events up to 110 MGD of wastewater is treated at the WWTP. Removal of the treated effluent from the site via tanker truck was also considered. Again assuming an average daily flow of 30.5 MGD, 6,100 5,000-gallon tanker trucks would be required to remove treated effluent from the WWTP each day. This second option was also deemed to be impractical.

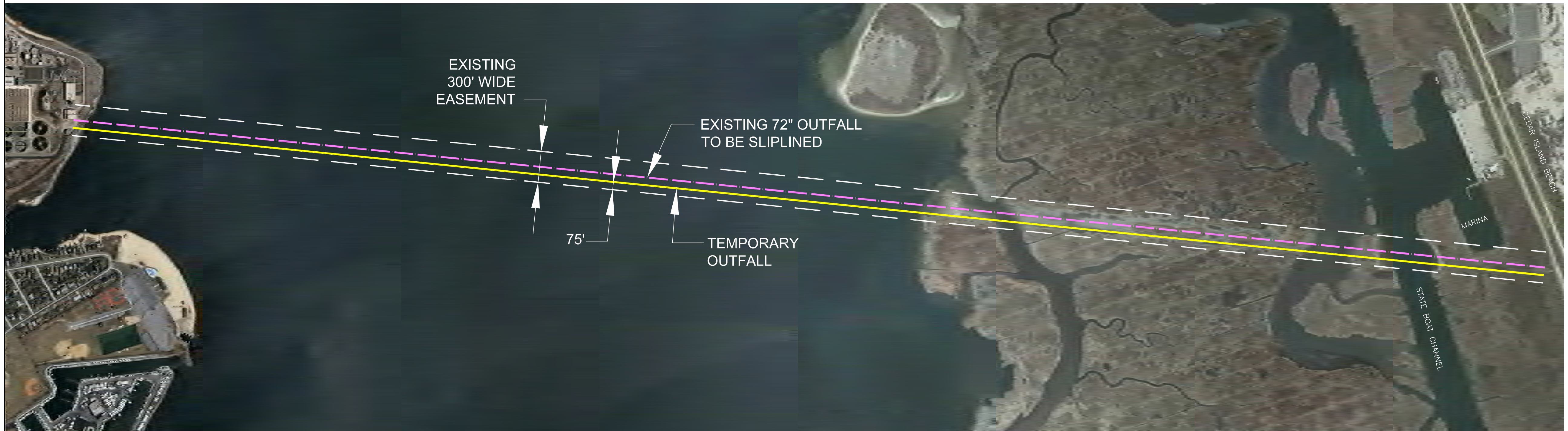
The possibility of floating a temporary outfall across the Bay, or laying it along the Bay bottom to discharge to a shaft on the barrier island where it would connect to the existing ocean portion of the outfall was also evaluated. It was assumed that this temporary outfall would be 72-inches, the same size as the existing outfall. However, based upon the recent bathymetric survey of the outfall easement, the Bay is approximately five feet deep – or shallower – along most of the alignment. The temporary outfall would protrude from the water, would be a hazard to boaters, and would impact the Bay circulation, as shown by **Figure ES-5**. In addition, NYSDEC has indicated that disturbing the Bay bottom from January 15th to September 30th would not be permitted, due to the area's importance for winter flounder. Therefore, this third option was also considered to be infeasible. The last option identified for consideration was a temporary outfall to Great South Bay, as schematically depicted by **Figure ES-6**. Treated effluent would flow upwards from manholes sited in the Bay (to prevent scouring/erosion of the Bay bottom in the vicinity of the discharge, and to reduce the discharge velocity and aid in dispersion). The manholes would be located outside of the boat channels and would be marked with buoys. As described for Alternative 4, it is anticipated that if NYSDEC were to permit this temporary discharge to the Bay, more stringent discharge limits would be imposed, which would necessitate implementation of additional treatment processes for nitrogen removal, etc. at the WWTP.

Given the uncertainty concerning the condition of the existing outfall and the ability to safely dewater it for cleaning and lining, as well as the difficulties associated with temporarily disposing of the treated wastewater, Alternative 5 would be challenging, if not impossible, to implement.

If Alternative 5 could be constructed, it is estimated that it would take up to 17 years to complete the project. The capital cost for lining the existing outfall with a temporary discharge to Great South Bay is estimated to be approximately $454M. The estimated capital cost of the project exclusive of the final effluent pump station upgrade is estimated to be approximately $417M.

Alternative 6 – Replace Existing Outfall with Upland Recharge

Alternative 6 would replace the existing ocean outfall in its entirety with a new upland effluent force main. Treated effluent would be pumped to discharge via a network of recharge basins and/or injection wells located throughout the Southwest Sewer District, to the north of the Bergen Point WWTP.

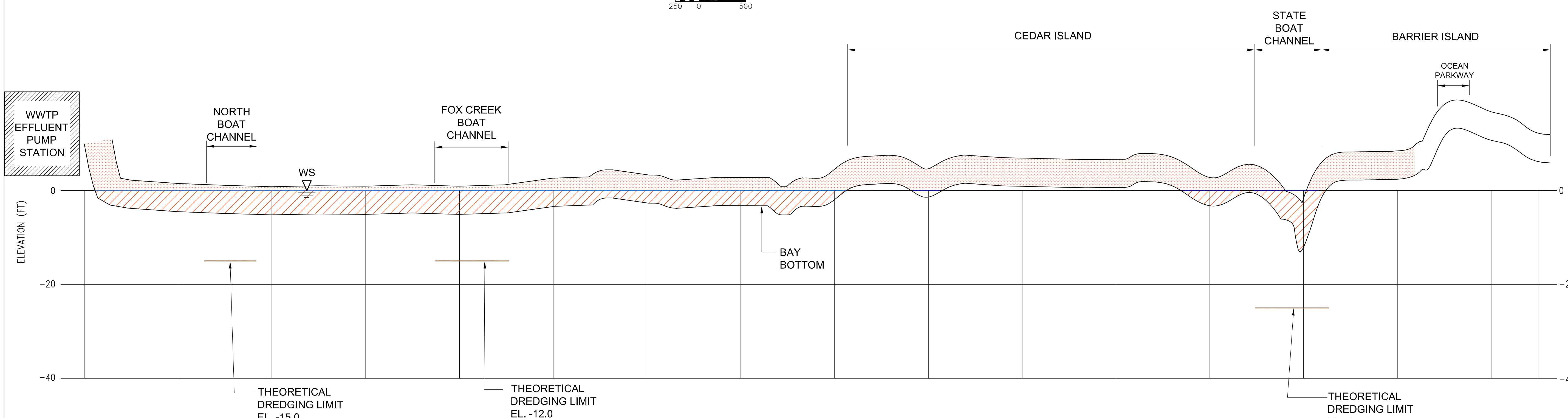


NOTES:

1. VERTICAL DATUM: MSL OF NGVD29, IN FEET, AT SANDY HOOK, NEW JERSEY.

PLAN VIEW

1"= 500'



PROFILE VIEW

VERTICAL SCALE: 1"= 20'

HORIZONTAL SCALE: 1"= 1000'

LEGEND

PIPE ABOVE WATER SURFACE

PIPE BELOW WATER SURFACE

\\WBYSVR01\Cad3\5175\39512\EAF\EXEC_SUM\ FIG ES-5 06/28/12 10:37 gencorellirj XREFS: CDM_2436, CDM_2436(GTS)

CDM

consulting • engineering • construction • operations

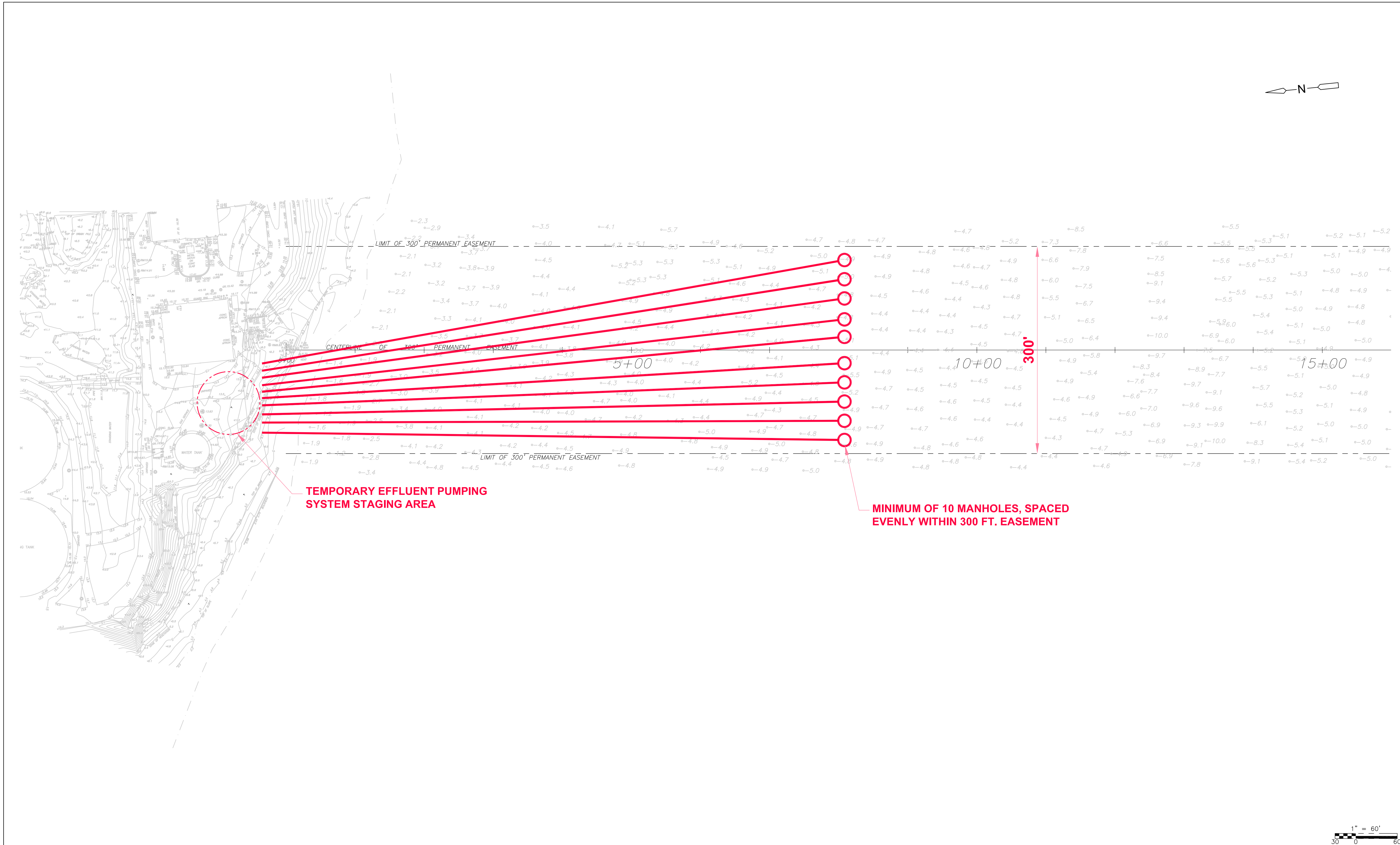
Figure ES-5

Lining Existing Outfall Pipe and Temporary Outfall

Alternative 5 Option

Suffolk County Department of Public Works

Bergen Point WWTP Outfall Replacement Project - Engineering Report



\\WBYSVR01\Cad3\5175\39512\EAF\EXEC_SUM\ FIG ES-6 06/28/12 10:36 gencorellirj

CDM
consulting • engineering • construction • operations

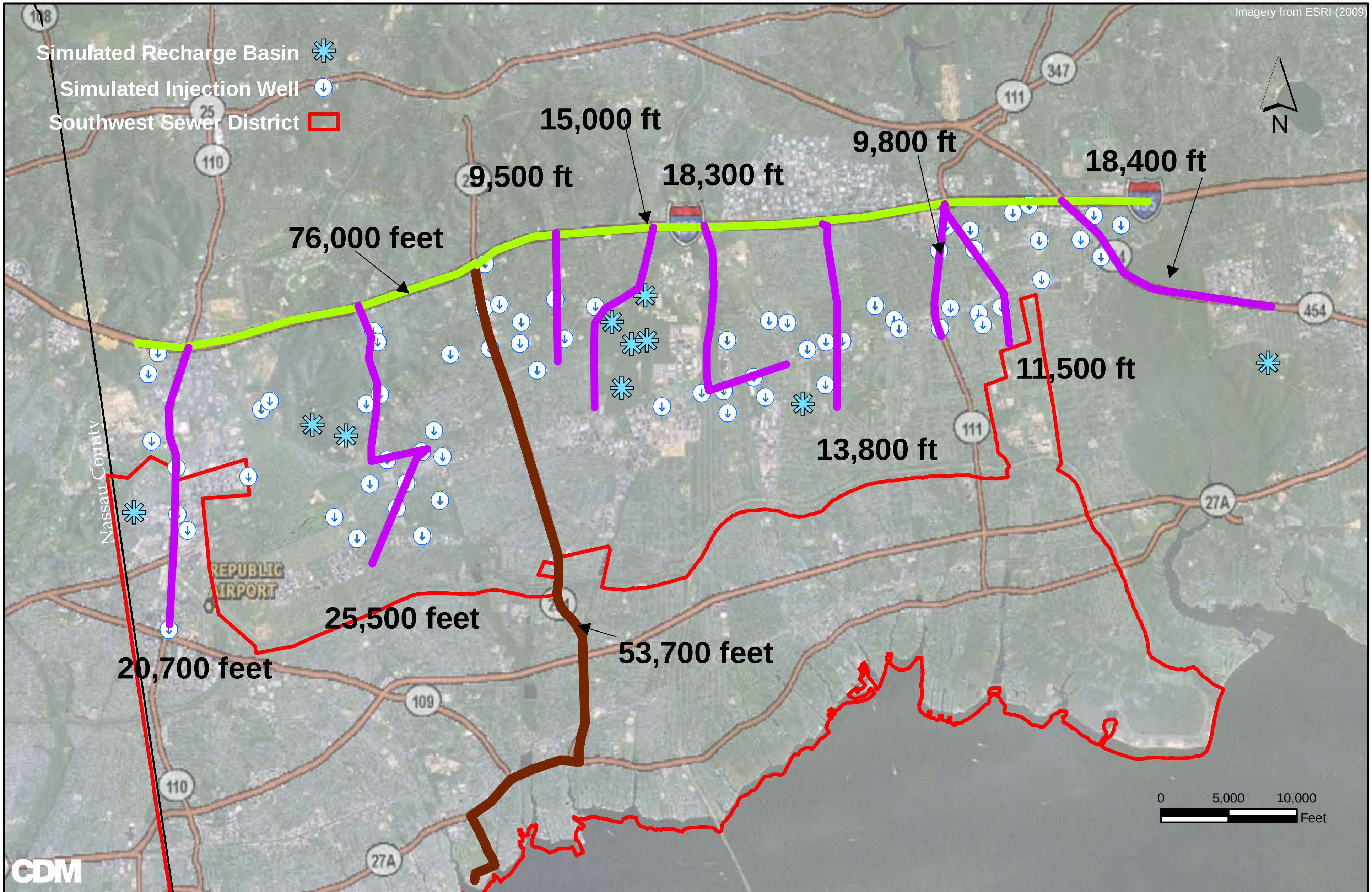
Figure ES-6
Temporary Discharge to Great South Bay
Alternative 5 Option
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project - Engineering Report

Alternative 6, shown schematically by **Figure ES-7** would require:

- Upgrade of the Bergen Point WWTP to provide the higher level of treatment required to achieve groundwater (drinking water) standards,
- Booster pump stations (in addition to the upgraded effluent pump station) to convey the treated wastewater to the distribution network,
- A piping/distribution network to convey the treated effluent to the recharge/injection locations,
- A network of recharge basins/injection wells to recharge the treated effluent to the groundwater system,
- Instrumentation and SCADA system to monitor water levels at the recharge facilities and turn the pumps on/off at specific locations, and
- Network of monitoring wells for routine testing of groundwater downgradient of the recharge locations.

Because upland recharge will directly affect the quality of area groundwater and because groundwater is the sole source of potable supply in the County, it is anticipated that a higher level of wastewater treatment will be required before the treated effluent can be released to the aquifer. For example, based on current standards, most treatment plants in Suffolk County that discharge to groundwater must remove nitrogen to less than 10 mg/L. Because most of the potential recharge sites would be located within Hydrogeologic Zones I or II, where the maximum target nitrogen concentration is 6 mg/L, it is also possible that removal of nitrogen to less than 6 mg/L or even 4 mg/L may be required. Based on the information provided in the Bergen Point WWTP Expansion Report (CDM-D&B JV, June 2009), seven additional aeration tanks and two additional final clarifiers would need to be added if the nitrogen discharge limit was reduced to 10 mg/L. Addition of either denitrification filters or membranes would be required to achieve the even lower limits anticipated. It would be a challenge to fit all of the additional tankage and processes onto the existing Bergen Point WWTP site.

The final effluent pump station would be renovated for each of the alternatives. For this alternative, the new pumps in the renovated pump station would need to be sized for the head conditions associated with pumping the treated effluent to the higher elevations found upgradient of the plant. It is also anticipated that booster pump stations would be required at each recharge site; these booster pump stations would include a minimum of two pumps, local controls and a security system. A dual 54-inch diameter force main would convey the flow from the WWTP to the upland recharge locations. The force mains would be installed north to the Long Island Expressway, where they would be installed within the LIE right-of-way running west to east.



Suffolk County Department of Public Works

Alternative 6 - Bergen Point WWTP Outfall Replacement Project

Figure ES-7

The ability to recharge up to 90 MGD of wet weather flow via recharge basins, leaching pools and/or injection wells was evaluated. Based on Suffolk County Department of Health Services (SCDHS) design standards regarding minimum setback requirements, design flow and redundancy, a minimum depth to groundwater of 30 feet and existing land use, potential locations for effluent disposal were identified.

Based on the preliminary estimate of the number of leaching pools that would be required to recharge 90 to 110 MGD, it was determined that the use of leaching pools would be eliminated from further consideration and recharge via open recharge basins and/or injection wells would be evaluated. The initial list of parcels potentially available for recharge was further reduced after review of aerial photography; a total of 10 parcels large enough to recharge a minimum of 1 MGD via recharge basins was identified, and approximately 79 parcels were identified as potential sites for injection wells.

The recharge piping network would be equipped with flow meters and flow control valves at key distribution points to distribute flow to the appropriate recharge facilities. The system would be monitored by a SCADA system that would indicate active recharge sites, operating pumps, flow distribution, ground water levels, recharge basin levels, operational use and alarm conditions. The central control system would be located at the Bergen Point WWTP. The recharge facilities would need to be monitored and maintained so that they would continue to function as intended. In addition, it is anticipated that a minimum of one upgradient and one downgradient monitoring well would be required at each recharge location; these wells would be monitored on a quarterly basis.

It is estimated that Alternative 6 would take up to 15 years to implement, at an estimated cost of $1.02B. The estimated cost of Alternative 6, exclusive of the effluent pump station is approximately $984M. The operation and maintenance costs associated with Alternative 6 have not been defined, but are significantly higher than the operation and maintenance costs for any of the other alternatives.

No Action Alternative

Because of the potential consequences of outfall failure (e.g., release of treated effluent directly to Great South Bay), the no-action alternative was not considered to be a viable option for the County.

Evaluation of Alternatives

SCDPW identified three primary criteria that were used to identify the preferred alternative:

- Can be implemented most cost-effectively,,

- Will have the least adverse impact to the environment, considering both construction and operational impacts, and
- Can be implemented the most quickly, to reduce the risk of outfall failure.

The potential outfall replacement alternatives were discussed with NYSDEC in 2008 and in 2009, to identify the regulatory requirements associated with implementation of each alternative as well as associated resource protection requirements. NYSDEC described their recommended approach to project implementation as:

- Avoid environmental impacts,
- Minimize environmental impacts, and finally
- Mitigate any unavoidable impacts.

NYSDEC guidance was used to help to guide the evaluation of construction methods, mitigation requirements, and scheduling; this information also directly impacted the cost.

Table ES-1 summarizes the evaluation of each of the six alternatives in terms of implementability, impacts, schedule and cost.

Replacement of the existing outfall pipeline beneath Great South Bay by Alternative 2, the tunnel, was identified as the recommended alternative, because it was the least environmentally damaging practicable alternative. It is one of two alternatives that will have the least impact to the area's ground and surface water resources and environment, and it is the alternative that has the shortest construction duration, enabling the County to replace the deteriorating outfall most quickly. Although the capital cost is significant, it is the lowest capital cost of all of the alternatives, and also is one of the alternatives with the lowest long-term operating cost.

Description of Preferred Alternative

The preferred alternative for replacement of the deteriorating section of the Bergen Point WWTP outfall beneath Great South Bay is Alternative 2, a tunnel. Alternative 2 has been selected as the preferred alternative because:

- It is one of the three alternatives that avoids construction within Great South Bay and/or any discharge to Great South Bay, which significantly reduces the potential for impact to the environment.
- It is one of the two alternatives with the lowest capital cost, and is one of the three alternatives with the lowest operational cost.

Table ES-1
Comparison of Bergen Point WWTP Outfall Replacement Alternatives

Criteria	Alternative 1- Tunnel with Carrier Pipes	Alternative 2 – Tunnel	Alternative 3 Open Cut	Alternative 4 Discharge to Great South Bay	Alternative 5 Line Existing Pipe/Temporary Discharge to Bay	Alternative 6 Upland Recharge of Treated Effluent
Implementability						
Permittable	Yes	Yes	Potential	No	No	Potential
Impacts						
Short Term Impacts to Great South Bay	Low	Low	Localized Significant	Potential Significant	Potential Significant	None
Long Term Impacts to Great South Bay	None	None	Potential Significant	Potential Significant	Potential	None
Short Term Impacts to Upland Neighborhoods	Minor – Construction Traffic	Minor – Construction Traffic	Minor – Construction Traffic	Minor – Construction Traffic	Minor – Construction Traffic	Significant
Long Term Impacts to Upland Neighborhoods	None	None	None	None	None	Significant
Impacts to Aquifer	None	None	None	None	None	Significant
Implementation Schedule						
Short (0 to 5 Years) *Medium (5 to 10 Years)* *Long (10 to 15 Years)* *Very Long (> 15 Years)*	Medium	Medium	Long to Very Long	Very Long	Very Long	Very Long

Cost						
Capital Cost *Lowest (0 - $250M)* *High ($250M - $500M)* *Very High ($500M - $750M)* *Highest (>$750M)*	High	Lowest	High	Very High	High	Highest
Operation and Maintenance Cost *(based on Treatment and Pumping requirements)*	Lowest	Lowest	Low	High	High	Very High

- The implementation schedule for Alternative 2 is significantly shorter than the other alternatives, thus reducing any potential impact to the Bay resulting from future failure of the existing outfall.
- It is one of the alternatives with the least impact to the surrounding community.

Description of Outfall Tunnel Construction

A minimum 10-foot inner diameter outfall tunnel that would be constructed to replace the existing 72-inch diameter PCCP outfall from the Bergen Point WWTP south beneath Great South Bay to the barrier island, was shown in plan and profile by **Figure ES-2**. The 14,200 linear foot tunnel would be constructed using a TBM. The TBM will be lowered into position through an approximately thirty-foot diameter 70 foot deep working shaft located at the southwest side of the Bergen Point WWTP site. The tunnel would be advanced southwards beneath the bottom of Great South Bay, to a new exit shaft, to be located just north of Ocean Parkway within the existing easement on the barrier island. The tunnel would be lined, and the lined tunnel would become the replacement outfall. On the barrier island, the new outfall would be connected to the existing ocean outfall to convey treated effluent to discharge.

Shaft and Tunnel Construction

Shaft Construction

The initial construction activity for the tunnel would be construction of an approximately 30-foot diameter working or access tunnel shaft for TBM access. The access shaft would also support the tunnel construction activities by providing access for transportation of personnel and materials to the tunnel heading and removal of excavated soil or muck during the tunnel excavation. Although there are several methods to construct the shaft and to support the walls of the excavation, it is recommended that ground freezing be utilized to minimize impacts to the surrounding environment.

The depth of the working shaft subgrade from the ground surface to the bottom of the tunnel lining is estimated to be approximately 70 feet. After the working shaft is completed, the contractor will most likely hand mine a tail tunnel in the opposite direction of the tunnel drive. This tail tunnel would extend the working area at the bottom of the shaft and would provide the room necessary to more efficiently move materials to the tunnel heading.

The staging area adjacent to the working or access shaft must provide sufficient area to allow the TBM to be lowered into the shaft; provide storage space for the shafts' equipment, tunnel lining material and excavated spoil removal; provide space for construction equipment (e.g., cranes) and workshops; provide adequate power supply for the TBM and temporary utility connections for potable water, storm drainage, electricity and provide access to the site for materials delivery.

A similar process of excavating and supporting the exit or receiving shaft would be required to remove the TBM on the barrier island. Because there is less work associated with tunnel construction at the exit shaft, the diameter of this shaft is usually smaller than the working shaft diameter.

It is anticipated that the staging area at the plant would be approximately 3 acres, and the staging area on the barrier island would be between 1 and 3 acres.

Tunnel Construction

A minimum ten-foot inner diameter tunnel would be constructed moving south from the working shaft to the exit or receiving shaft on the barrier island, to the west of the existing outfall tunnel within the existing easement. The vertical profile of the tunnel was established based upon maintenance of a depth of 2.5 tunnel bored diameters between the dredge depths of the two boating channels and the tunnel crown. The tunnel would be driven up gradient to provide the ability to drain the outfall back to the working or access shaft at the treatment plant after the outfall is in service. A slight up slope of 0.1% was selected as the gradient, because it is adequate for the long term function of draining the tunnel during operation and because it also provides the necessary slope for drainage during construction.

The bored tunnel diameter of ten feet was selected as the minimum economical bored diameter to drive the tunnel and transport crew and materials (lighting, ventilation and lining segments) to the tunnel heading and to remove tunnel muck. Space within a tunnel is limited and haul times and related costs are weighed against the TBM size, and the increased cost for a larger diameter tunnel. The tunnel would be constructed using a TBM. The soil would be excavated at the front of the TBM through a cased auger screw, deposited onto a conveyor belt, and then transferred to muck carts which transport the muck to the working or launch shaft and then out of the tunnel to the ground surface. The screw helps to reduce the pressure of the material from the higher pressures encountered at the tunnel face, to normal atmospheric pressure conditions existing within the tunnel. Limiting the screw rotation enables a pressure to be built up in the forward chamber that helps to support the tunnel face; providing the name "Earth Pressure Balance" TBM.

By careful and continual monitoring of the face pressure to balance the resisting force to maintain a stable heading and without applying excess pressure that can cause the soil to fail and result in disturbance to the Bay bottom, the tunnel can be driven without causing disturbance to the Bay. As the work is proceeding at the front of the TBM, a tunnel lining is installed within the tail of the machine by a team working in atmospheric conditions. The subaqueous tunnel lining system consists of precast concrete ring segments with gaskets that are assembled into a ring as shown on **Figure ES-8**. The TBM then extends jacks against the newly assembled ring, exposing the ring to the soil outside of the tunnel bore.

Figure ES-8
Stacked Precast Concrete Segments (left) and The Assembled Ring during Construction with Lighting, Yellow Ventilation, Utility Pipes and Railroad Tracks in the Tunnel (right)

As the tunnel is advanced in this manner, a cement grout is simultaneously injected through grout ports to fill the space between the outside of the ring and the soil to keep soil and water out of the tunnel. This process is repeated until the tunnel has been driven from the working shaft on the plant site south to the exit/receiving shaft on the barrier island.

Connection to Existing Outfall

The outfall will connect to the existing ocean portion of the outfall near the existing sample chamber on the barrier island just north of the Ocean Parkway, within the existing easement. The existing outfall must remain in operation while the connection is made. To connect to the existing outfall, a bypass system with line stops would be installed as shown on **Figure ES-9**. The existing outfall would be tapped upstream and downstream of the area of the new tunnelled outfall connection. The taps on each side of the work area are for a bypass connection and for a line stop. The bypass piping is installed, followed by the line stops to direct the flow through the bypass piping and around the existing outfall piping to be removed and replaced. New piping with fittings and valving to isolate the new and existing outfalls would be installed and then the line stops and bypass piping removed and the exising outfall put back into normal operation. The tunnel outfall would then be connected to the existing outfall but the isolation valves will remain closed until the new outfall is ready for operation.

Disposal of Excavated Materials

Construction of the tunnel will generate a significant quantity of spoils that must be removed, managed and disposed. For the ten-foot inner diameter upgradient driven tunnel, it is estimated that up to 90,000 cubic yards of material (including excavated materials from the access/working and exit/receiving shafts) will require disposal. It is not anticipated that the materials removed from the sub-surface tunnel alignment

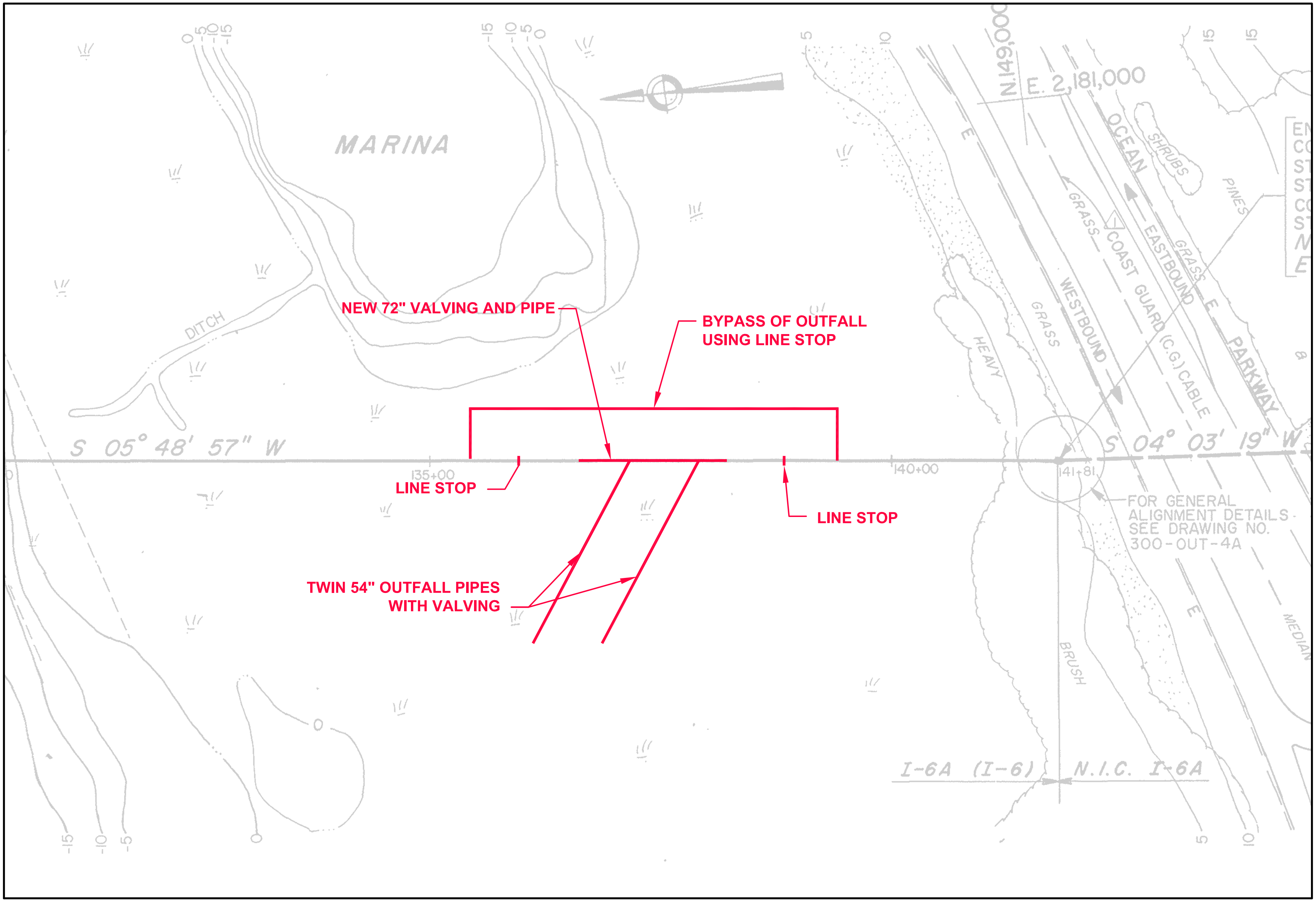


Figure ES-9
New Outfall Connection at Barrier Island
Suffolk County Department of Public Works
Bergen Point WWTP Outfall Replacement Project - Engineering Report

CDM
consulting • engineering • construction • operations

would be contaminated so that they could either be stock-piled on-site in the spoils area for future use by the County, or transported off-site for disposal by the contractor.

Project Schedule

A preliminary schedule for project implementation is shown on **Figure ES-10**.

Project Costs

Estimated total project costs are summarized on **Table ES-2**.

Table ES-2
Preliminary Cost Estimate for the Recommended Tunnel Alternative

Project Component	10-foot Diameter Tunnel ($)
Launch and Receiving Shafts	**$7,255,000**
Tunnel Boring Machine	**$20,000,000**
Tunnel Drive	**$110,000,000**
Site Restoration	**$255,000**
Effluent Pump Station Connection	**$3,300,000**
Barrier Island Connection	**$850,000**
Subtotal	**$141,660,000**
Contingency @ 20%	**$28,332,000**
Total	**$169,992,000**
Escalation (2% for four years)	**$184,005,000**
Engineering (7%)	**$12,880,000**
Total Estimated Project Cost	**$196,885,000**

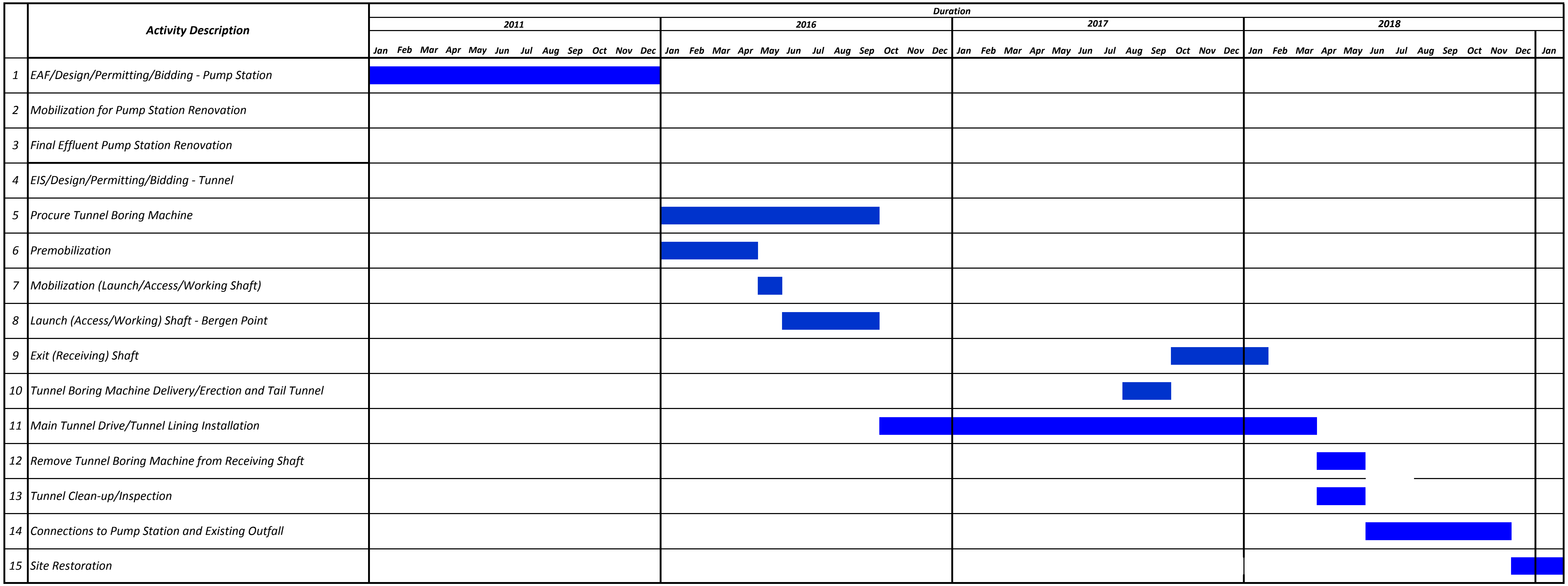
Project Approvals

A preliminary list of potential permit and approval requirements is summarized on **Table ES-3.**

SCDPW's Capital Program 8108 is being implemented in two phases. Phase I, the Final Effluent Pump Station renovation, includes replacement of the pumps, electrical controls and mechanical systems and construction is scheduled to begin in 2013. Renovation of the pump station was previously designated as a Type II action via Resolution No. 156-2011.

Funding for Phase II of the program is included in the Capital Program and Budget for 2014-2016.

Figure ES-10 Preliminary Schedule for Alternative 2, Construct Replacement Outfall by Tunneling, Revised 6/2012



Note: Schedule was Revised from May 2011 Preliminary Engineering Design Report to show updated schedule, based upon projected County Budget

Table ES-3

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
FEDERAL				
Section 10 Permit – Nationwide/General/ Individual	U.S. Army Corps of Engineers – NY District	Section 10, Rivers and Harbors Act of 1899	Required for construction activities within navigable waters of the U.S. Nationwide Permit 7 covers the construction/repair of an outfall while NWP 12 covers the installation of utility lines. Pre-construction notification is required to obtain coverage under these existing permits.	Frank Verga (KAS table) (917) 790-8212
Approval	U.S. Coast Guard Coast Guard Sector Long Island Sound	N.A.	Construction activities within navigable waters may require a consultation and/or review, but typically no formal permit	Lt. Douglas J. Miller Chief, Waterways Management Division 203-468-4596
Consultation &/or Essential Fish Habitat Assessment	National Marine Fisheries Service (NOAA)– Habitat Conservation Division	Code of Federal Regulations, Title 50, Part 600, 1996 amendments to the Magnuson-Stevens Fishery Conservation & Mgt Act Section 305(b)(2) Act (Essential Fish Habitat), Endangered Species Act	Required for all activities impacting Essential Fish Habitat Areas	Peter Colosi Assistant Regional Administrator 978-282-9332
Consultation &/or Jeopardy/ No Jeopardy Determination	U.S. Fish & Wildlife Service – Division of Endangered Species	Code of Federal Regulations, Title 50, Part 17 - Section 7(a)(2) of the Endangered Species Act	Required for proposed activities that may have an effect upon threatened and/or endangered species	Long Island Field Office 631-776-1401 (KAS table)

Table ES-3

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
STATE				
Section 401 Water Quality Certification	NYS Department of Environmental Conservation – Region 1	ECL Article 15, Title 15 – NYCRR Title 6, Part 608.9 – Federal Water Pollution Control Act, Section 401	Project includes placement of fill or activities that result in a discharge to jurisdictional waters. NYSDEC has issued/agreed to standard conditions associated with many of the NWP issued by ACOE.	Roger Evans, Regional Permit Administrator 631-444-0361
SPDES General Permit for Stormwater Discharges from Construction Activities (GP-0-08-001)	NYS Department of Environmental Conservation	Article 17, Titles 7,8 and Article 70 of the ECL – NYCRR Title 6, Parts 750-757	Required for construction projects that require 1 acre of disturbance or more.	Division of Water 625 Broadway, 4th Floor Albany, NY 12233-3505
Coastal Zone Consistency Assessment	NYS Department of State – Division of Coastal Resources	15 CFR Part 930 and State Approved Coastal Zone Management Plan	Activities that would occur within the state designated coastal zone boundary require consistency assessment approval	NYSDOS One Commerce Plaza 99 Washington Ave, Suite 1010 Albany, NY 12231 Jeff Zappieri, Supervisor of Consistency Review 518-474-6000
Air Registration	NYS Department of Environmental Conservation	Environmental Conservation Law Article 19 New York Code of Rules and Regulations Title 6, Part 200-203	Contractor maybe required to obtain permit for onsite generators required for ground freezing event on barrier island.	Roger Evans, Regional Permit Administrator 631-444-0361
Approval	NYS Parks – LI State	N.A.	Regulates access of parkland, including use	Scott Fish 631-669-1000

Table ES-3

Potential Permits and Approvals for Alternative 2, Construct Replacement Outfall by Tunneling

PERMIT/ APPROVAL	REGULATORY AGENCY	JURISDICTIONAL BASIS	REGULATED ACTIVITIES	KEY CONTACT
	Park Region		of commercial vehicles.	Land Management and Regulatory Affairs Coordinator 631-321-3580
Divisible Load Permit Highway Work Permit for Utility Work	NYSDOT – Region 10	NYCRR Title 17, Part 126 – NYS Vehicle & Traffic Law Section 385 NY Highway Law Article 52	NYSDOT regulates the use of NYS roadways. Permit required by vehicles that exceed the road weight. Permit required to work within a NYS ROW &/or install MPTs	Gene Smith, Regional HWP Contact 631-952-6028
LOCAL				
Consultation	SCDPW		Approval of Plans and Specifications	John Donovan, Chief Engineer 631-852-4204
Review and comment	SCDHS			Office of Ecology 631-852-5811
Consultation	Town of Babylon		The Department of Environmental Control enforces provisions of the Town Code as it pertains to Environmental Protection, including actions within the Great South Bay.	Vicky Russell, Commissioner Environmental Control 631-422-7640

LAID ON THE TABLE AUGUST 21, 2012
LADS REPORT PREPARED BY:
Michele Gerardi
(Revised 8/22/2012

Type II Action 6 NYCRR 617.5(c)(20)(27)	1839.	Honoring an American Hero, Specialist Jacob S. Fletcher, by renaming a portion of County Road 34. (Stern) PUBLIC WORKS AND TRANSPORTATION
Type II Action 6 NYCRR 617.5(c)(20)(27)	1840.	Adopting Local Law No. -2012, A Local Law to expedite the return of blighted properties to the tax roll and productive use. (Anker) WAYS & MEANS
Type II Action 6 NYCRR 617.5(c)(20)(21)(27)	1841.	Authorizing planning steps for the acquisition of land under the Suffolk County Drinking Water Protection Program, as amended by Local Law No. 24-2007 (Tuccio property – Town of Southampton) (SCTM No. 0900-248.00-01.00-110.003). (Schneiderman) ENVIRONMENT, PLANNING AND AGRICULTURE
Type II Action 6 NYCRR 617.5(c)(20)(27)	1842.	To appoint member to the Teen Pregnancy Advisory Board (Susan B. Koenig). (Spencer) HUMAN SERVICES
Type II Action 6 NYCRR 617.5(c)(16)(20)(27)	1843.	Appropriating funds in connection with Pedestrian Enhancement Traffic Signal Improvement Program (CP 5406). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION
Type II Action 6 NYCRR 617.5(c)(2)(20)(25)(27)	1844.	Transferring Assessment Stabilization Reserve Fund to the Capital Fund, amending the 2012 Operating Budget, amending the 2012 Capital Budget and Program, and appropriating funds for improvements to Suffolk County Sewer District No. 2 - Tallmadge Woods (CP 8188). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION
Type II Action 6 NYCRR 617.5(c)(20)(21)(27)	1845.	Amending the 2012 Capital Budget and Program and appropriating funds in connection with safety improvements at various intersections (CP 3301). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION
Type II Action 6 NYCRR 617.5(c)(11)(20)(27)	1846.	Authorizing execution of an amended agreement by the Administrative Head of Suffolk County Sewer District No. 3 - Southwest and 270 South Service Road (HU-1470.1). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION
Unlisted Action	1847.	Sale of County-owned real estate pursuant to Local Law No. 13-1976 288 Properties, LLC (SCTM No. 0900-205.00-02.00-111.000). (Co. Exec.) WAYS & MEANS
Unlisted Action	1848.	Authorizing the sale of County-owned real property pursuant to Section 72-h of the General Municipal Law to the Village of Mastic Beach for Affordable Housing purposes. (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION
Unlisted Action	1849.	Sale of County-owned real estate pursuant to Section 72-h of the General Municipal Law - Town of Brookhaven (SCTM No. 0200-509.00-05.00-003.000). (Co. Exec.) WAYS & MEANS
Unlisted Action	1850.	Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Arthur Reynolds (SCTM No. 0200-983.20-06.00-058.000). (Co. Exec.) WAYS & MEANS

Unlisted Action 1851. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Jose Machuca (SCTM Nos. 0400-146.00-03.00-027.003 n/k/a p/o 0400-146.00-03.00-027.005). (Co. Exec.) WAYS & MEANS

Unlisted Action 1852. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Barbara E. Blue and Life Estate of Lawrence J. Wright (SCTM No. 0100-080.00-03.00-072.000). (Co. Exec.) WAYS & MEANS

Unlisted Action 1853. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Steve Delacrausaz and Alanna Delacrausaz, husband and wife (SCTM No. 0100-130.00-02.00-148.003). (Co. Exec.) WAYS & MEANS

Unlisted Action 1854. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Theodore M. Oliver (SCTM No. 0100-159.00-04.00-001.000). (Co. Exec.) WAYS & MEANS

Unlisted Action 1855. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act the Voutsinas Merrick family limited partnership (SCTM No. 0100-189.00-02.00-006.000). (Co. Exec.) WAYS & MEANS

Unlisted Action 1856. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act W.G.B. Realty, LLC (SCTM No. 0400-072.00-02.00-002.001). (Co. Exec.) WAYS & MEANS

Unlisted Action 1857. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Jason Madr (SCTM No. 0900-166.00-03.00-002.001). (Co. Exec.) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c)(20)(27) 1858. Approving the appointment of Dr. Hafiz Ur Rehman to the Suffolk County Human Rights Commission. (Co. Exec.) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c)(20)(27) 1859. Approving the reappointment of Dionne Walker-Belgrave to the Suffolk County Human Rights Commission. (Co. Exec.) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c)(20)(27) 1860. Approving the reappointment of Gary Mar to the Suffolk County Human Rights Commission. (Co. Exec.) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c)(20)(27) 1861. Approving the appointment of Bonnie Cannon to the Suffolk County Human Rights Commission. (Co. Exec.) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c)(20)(27) 1862. Approving the reappointment of Rachel Davis to the Suffolk County Human Rights Commission. (Co. Exec.) PUBLIC SAFETY

Unlisted Action 1863. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Martin Mangels, Jr. and Louise Mangels (SCTM No. 0200-128.00-02.00-002.000). (Co. Exec.) WAYS & MEANS

Unlisted Action 1864. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Michael Mahlstadt (SCTM No. 0500-009.00-04.00-128.000). (Co. Exec.) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c) (20)(25)(27) 1865. Appropriating funds in connection with the expansion of video conferencing at various locations (CP 3020). (Co. Exec.) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c) (20)(27) 1866. To readjust, compromise, and grant refunds and chargebacks on correction or errors/County Treasurer by: County Legislature No. 374. (Co. Exec.) BUDGET AND FINANCE

Unlisted Action 1867. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Georgette Grier-Key (SCTM No. 0200-424.00-02.00-027.001). (Co. Exec.) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c) (20)(27) 1868. Amending the 2012 Adopted Operating Budget to accept and appropriate 100% State Aid from the New York State Office of Mental Health to the Long Island Home to perform Family Court Ordered Evaluations. (Co. Exec.) HEALTH

Type II Action 6 NYCRR 617.5(c) (20)(27) 1869. Accepting and appropriating year three of a grant sub-award from Tidewater Community College for a Department of Health and Human Services Health Information Technology Project, 100% reimbursed by Federal funds at Suffolk County Community College. (Co. Exec.) EDUCATION AND INFORMATION TECHNOLOGY

Type II Action 6 NYCRR 617.5(c) (15)(20)(27) 1870. Approving a License Agreement for D. Brodie to reside in the Gate House, at Southaven County Park, Yaphank. (Co. Exec.) PARKS & RECREATION

Type II Action 6 NYCRR 617.5(c) (15)(20)(27) 1871. Approving a License Agreement for P. Mayer to reside in the apartment, at North Fork Preserve County Park, Aquebogue. (Co. Exec.) PARKS & RECREATION

Type II Action 6 NYCRR 617.5(c) (20)(25)(27) 1872. Permitting the Suffolk Cooperative Library System to purchase fuel from the County. (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION

Type II Action 6 NYCRR 617.5(c) (20)(25)(27) 1873. Accepting and appropriating a 75% Project Share from the Federal Emergency Management Agency and 12.5% Project Share from the New York State Emergency Management Office for damage associated with Hurricane Irene at Green's Creek County Park and Coindre Hall from August 26 thru September 5, 2011. (Co. Exec.) PARKS & RECREATION

Type II Action 6 NYCRR 617.5(c) (20)(27) 1874. To appoint member to the Teen Pregnancy Advisory Board (Jeannette Morales). (Spencer) HUMAN SERVICES

Type II Action 6 NYCRR 617.5(c) (20)(21)(27) 1875. Directing the Department of Public Works to study the feasibility of siting a solar farm on County-owned property. (Cilmi) PUBLIC WORKS AND TRANSPORTATION

Type II Action 6 NYCRR 617.5(c) (20)(21)(27) 1876. Establishing a task force to optimize early intervention for children with special needs. (Spencer) HUMAN SERVICES

Type II Action 6 NYCRR 617.5(c) (20)(27) 1877. Directing the Department of Fire, Rescue and Emergency Services to develop an online firefighter training program. (Hahn) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c) (20)(25)(27)	1878.	Appropriating funds in connection with Fiber Cabling Network and WAN Technology upgrades (CP 1726). (Co. Exec.) EDUCATION AND INFORMATION TECHNOLOGY
Type II Action 6 NYCRR 617.5(c) (20)(25)(27)	1879.	Appropriating funds in connection with the Suffolk County Disaster Recovery Project (CP 1729). (Co. Exec.) EDUCATION AND INFORMATION TECHNOLOGY
Type II Action 6 NYCRR 617.5(c) (20)(25)(27)	1880.	Appropriating funds in connection with the Purchase and Replacement of Nutrition Vehicles for the Office for the Aging (CP 1749). (Co. Exec.) VETERANS AND SENIORS
Type II Action 6 NYCRR 617.5(c) (20)(27)	1881.	Amending the 2012 Adopted Operating Budget and the 2012 Capital Budget and Program and accepting and appropriating funds in connection with the construction management and inspection at Suffolk County Sewer District No. 3 - Southwest (CP 8155). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION
Unlisted Action	1882.	Authorizing the acquisition of a certain unopened right-of way known as Nicolls Road, and having a Suffolk County Tax Map Identification Number of District 0100 Section 010.00 for municipal purposes and requesting conveyance of all of their right, title and interest to same from the Town of Babylon, Suffolk County, New York for conveyance of same (CP 5510.211). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION
Type II Action 6 NYCRR 617.5(c) (1)(2)(20)(25)(27)	1883.	Appropriating funds in connection with waterproofing, roof and drainage at the Suffolk County Vanderbilt Museum (CP 7439). (Spencer) PARKS & RECREATION
NYSDEC is SEQRA Lead Agency	1884.	Authorizing the County Executive to execute an access Agreement/Temporary Easement with the New York State Department of Environmental Conservation for the continuation of the Shinnecock inlet dredging project. (Co. Exec.) **ADOPTED WITH C/N 8/21/2012**
Type II Action 6 NYCRR 617.5(c) (20)(27)	1885.	Authorizing a community college charge back line on real property tax bills prepared by Towns. (Gregory) WAYS & MEANS

PROCEDURAL MOTION

Type II Action 6 NYCRR 617.5(c) (20)(27)	PM.14	Apportioning Mortgage Tax By: County Treasurer. (Pres. Off.) **ADOPTED ON 8/21/2012**
Type II Action 6 NYCRR 617.5(c) (20)(27)	PM.15	Approving partial settlement of AWP Litigation (Actavis, Hoffman La Roche, Mylan, Tap). (Pres. Off.) **ADOPTED ON 8/21/2012**

LAID ON THE TABLE SEPTEMBER 13, 2012

LADS REPORT PREPARED BY:
Michele Gerardi
(Revised 9/13/2012)

Type II Action 6 NYCRR 617.5(c) (20)(22)(27)	1886.	Ratifying and approving the Memorandum of Agreement with the County's employee unions relating to the Employee Medical Health Plan. (Pres. Off.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION
Type II Action 6 NYCRR 617.5(c) (20)(27)	1887.	Amending the Suffolk County Classification and Salary Plan in connection with a new position title in the Department of Health Services: Forensic Scientist IV (Quality Assurance). (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION
Type II Action 6 NYCRR 617.5(c) (20)(27)	1888.	Accepting and appropriating 100% funding from the New York State Office of Children and Family Services (OCFS) for improving staff-to-client ratios in the Department of Social Services - Child Protective Services Bureau. (Co. Exec.) HUMAN SERVICES
Unlisted Action	1889.	Authorizing the sale of County-owned real property pursuant to Section 72-h of the General Municipal Law to the Town of Riverhead for Affordable Housing purposes (SCTM No. 0600-105.00-02.00-069.000). (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION
Unlisted Action	1890.	Sale of County-owned real estate pursuant to Local Law No. 13-1976 Goorpersad Sookoo (SCTM No. 0500-066.00-02.00-069.000). (Co. Exec.) WAYS & MEANS
Unlisted Action	1891.	Sale of County-owned real estate pursuant to Local Law No. 13-1976 Myron A. Hauptman and Ralph Delea, Trustees (SCTM No. 0200-189.00-01.00-010.000). (Co. Exec.) WAYS & MEANS
Unlisted Action	1892.	Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Refik Kavazovic and Rifat Kavazovic as joint tenants with the right of survivorship (SCTM No. 0200-658.00-02.00-011.000). (Co. Exec.) WAYS & MEANS
Unlisted Action	1893.	Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act Linda Meyer as the sole surviving heir of Orville Meyer (SCTM No. 0200-981.00-04.00-014.000). (Co. Exec.) WAYS & MEANS
Unlisted Action	1894.	Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act West Hills Realty, LLC (SCTM No. 0400-194.00-01.00-067.000). (Co. Exec.) WAYS & MEANS
Unlisted Action	1895.	Authorizing the sale of County-owned real property pursuant to Section 72-h of the General Municipal Law to the Town of Brookhaven for Affordable Housing purposes (SCTM No. 0200-958.00-08.00-032.000). (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Unlisted Action 1896. Sale of County-owned real estate pursuant to Local Law No. 13-1976 Gary B. Olsen and Theresa Olsen, his wife and Valentine Horvath and Renate Horvath, his wife (SCTM No. 0200-367.00-08.00-010.000). (Co. Exec.) WAYS & MEANS

Unlisted Action 1897. Authorizing the sale, pursuant to Local Law No. 16-1976, of real property acquired under Section 46 of the Suffolk County Tax Act John Gallagher (SCTM No. 0900-315.00-02.00-006.000). (Co. Exec.) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c)(20)(27) 1898. To readjust, compromise, and grant refunds and charge-backs on real property correction of errors by: County Legislature (Control No. 903-2012). (Co. Exec.) BUDGET AND FINANCE

Type II Action 6 NYCRR 617.5(c)(20)(21)(27) 1899. Appropriating planning funds for the New Replacement Correctional Facility a Yaphank Phase II (CP 3008). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION

Type II Action 6 NYCRR 617.5(c)(20)(27) 1900. Amending the 2012 Operating Budget to transfer funds to the March of Dimes Perinatal Program at SUNY Stony Brook. (Nowick) BUDGET AND FINANCE

Type II Action 6 NYCRR 617.5(c)(20)(27) 1901. Accepting and appropriating Federal funding in the amount of $25,000 from the United States Department of Justice, Organized Crime Drug Enforcement Task Forces (OCDETF), for the Suffolk County Police Department's participation in OCDETF 2012 with 78.89% support. (Co. Exec.) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c)(20)(25)(27) 1902. Accepting the donation of two (2) all terrain vehicles from the Central Pine Barrens Commission for use by the Suffolk County Parks Police. (Co. Exec.) PARKS & RECREATION

Type II Action 6 NYCRR 617.5(c)(1)(2)(20)(27) 1903. Appropriating funds in connection with construction of sidewalks on various County Roads (CP 5497). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION

Type II Action 6 NYCRR 617.5(c)(20)(25)(27) 1904. Appropriating funds in connection with the acquisition and implementation of a County Attorney Case Management System (CP 1811). (Co. Exec.) EDUCATION AND INFORMATION TECHNOLOGY

Type II Action 6 NYCRR 617.5(c)(20)(27) 1905. Authorizing certain technical correction to Adopted Resolution No. 616-2012. (Co. Exec.) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c)(20)(27) 1906. Amending prior capital authorized appropriations for the historic restoration and preservation at Third House, Theodore Roosevelt County Park, Montauk (CP 7510). (Schneiderman) PARKS & RECREATION

Type II Action 6 NYCRR 617.5(c)(20)(21)(27) 1907. Authorizing planning steps for the acquisition of land under the Suffolk County Drinking Water Protection Program, as amended by Local Law No. 24-2007 - Detmer property – Town of Brookhaven (SCTM No. 0200-132.00-04.00-001.005). (Hahn) ENVIRONMENT, PLANNING AND AGRICULTURE

Type II Action 6 NYCRR 617.5(c)(20)(21)(27) 1908. Directing the Department of Public Works to study alternative methods for purchasing transit fares. (Hahn) PUBLIC WORKS AND TRANSPORTATION

Type II Action 6 NYCRR 617.5(c) (20)(27) — 1909. Adopting Local Law No. -2012, Amending Local Law No. 25-2009 in regard to the membership of the Aquaculture Lease Board established under the Suffolk County Shellfish Aquaculture Lease Program in Peconic Bay and Gardiners Bay. (Co. Exec.) ENVIRONMENT, PLANNING AND AGRICULTURE

Type II Action 6 NYCRR 617.5(c) (18)(20)(21)(27) — 1910. Amending the 2012 Capital Budget and Program and appropriating funds in connection with Engineering, Planning, and Design of Ronkonkoma Hub Sewer Project (CP 8156). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION

Type II Action 6 NYCRR 617.5(c) (20)(21)(27) — 1911. Amending the 2012 Operating Budget and establishing a County Policy to maximize savings through the Early Retirement Incentive Program. (Kennedy) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c) (15)(20)(27) — 1912. Amend Resolution No. 764-2012, use of Southaven County Park for Craig Elberth Cross Country 5k Run. (Browning) PARKS & RECREATION

Type II Action 6 NYCRR 617.5(c) (20)(21)(27) — 1913. Authorizing planning steps for the acquisition of Farmland Development Rights under the Suffolk County Drinking Water Protection Program, as amended by Local Law No. 24-2007 - Luce Property - Town of Riverhead (SCTM No. 0600-008.00-02.00-013.004). (Romaine) ENVIRONMENT, PLANNING AND AGRICULTURE

SEQRA Complete — 1914. Amending the 2012 Capital Budget and Program and appropriating funds in connection with acquisition of lands for intersection improvements on CR 100, Suffolk Avenue at Brentwood Road/Washington Avenue, Town of Islip (CP 5065). (Co. Exec.) PUBLIC WORKS AND TRANSPORTATION

Type II Action 6 NYCRR 617.5(c) (20)(22)(27) — 1915. Authorizing the County Executive to execute an agreement with the Suffolk County Police Benevolent Association covering the terms and conditions of employment for the period of January 1, 2011 through December 31, 2018. (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Town is SEQRA Lead Agency / SEQRA Complete — 1916. Authorizing funding of infrastructure improvements and oversight of real property under the Suffolk County Affordable Housing Opportunities Program (Concern Amityville). (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c) (20)(25)(27) — 1917. Approving payment to General Code Publishers for Administrative Code. (Pres. Off.) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c) (20)(25)(27) — 1918. Approving payment to General Code Publishers for Administrative Code. (Pres. Off.) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c) (20)(27) — 1919. Adopting Local Law No. -2012, A Local Law terminating the Suffolk County Public Employment Relations Board. (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c) (20)(27) — 1920. Establishing “The Truth About Energy Drinks” public education campaign to increase awareness of side effects associated with energy drink consumption. (Spencer) HEALTH

Type II Action 6 NYCRR 617.5(c)(20)(27) 1921. Amending the 2012 Operating Budget to provide funding for the Medford Chamber of Commerce. (Calarco) BUDGET AND FINANCE

Type II Action 6 NYCRR 617.5(c)(20)(27) 1922. Authorizing the disbursement of funds from the Suffolk County Contingent Jail Medical Fund for the housing of inmates out of the County and the expansion of services in the Jail Medical Unit at both correctional facilities. (Co. Exec.) HEALTH

Type II Action 6 NYCRR 617.5(c)(20)(27) 1923. Transferring and appropriating Living Wage Contingency Funds to the Federation of Organizations for the NYS Mentally Disabled, Inc., Respite Fee Subsidy. (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c)(20)(27) 1924. Accepting and re-appropriating 100% funding for Program Year 2011 Adult, Dislocated Worker, Youth and Administrative Funds from the New York State Department of Labor for the Workforce Investment Act (WIA) Program. (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c)(20)(27) 1925. Authorizing the disbursement of funds from the Suffolk County Living Wage Contingency Fund for Lazy Cow, Inc. dba Kiddie Care Early Learning Center, the Community Programs Center of Long Island, Inc. - Port Jefferson, the Community Programs Center of Long Island, Inc. - Ronkonkoma, Colonial Youth and Family Services, Inc. and Brightwaters Child Care and Development Center, Inc. dba Kiddie Academy of Brightwaters Day Care Providers under contract with the Department of Social Services. (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c)(20)(27) 1926. Adopting Local Law No. -2012, A Charter Law to strengthen and improve the County's economic efforts by consolidating departmental functions within a newly created Department of Labor, Licensing and Consumer Affairs. (Co. Exec.) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c)(20)(21)(27) 1927. Adopting Local Law No. -2012, A Local Law to establish collaborative long-term visioning plans among County Departments ("The Suffolk County Visioning Act"). (Gregory) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

NYSDEC is SEQRA Lead Agency 1928. Amending the 2012 Capital Budget and Program and appropriating funds in connection with dredging of County waters (CP 5200). (Browning)

Type II Action 6 NYCRR 617.5(c)(20)(27) 1929. Adopting Local Law No. -2012, A Local Law to strengthen requirements for safe disposal of expired and unused medications. (Hahn) HEALTH

Type II Action 6 NYCRR 617.5(c)(20)(27) 1930. Authorizing one-time exception to allow carry over of accrued vacation time by Board of Elections Employees. (Romaine) GOVERNMENT OPERATIONS, PERSONNEL, HOUSING & CONSUMER PROTECTION

Type II Action 6 NYCRR 617.5(c)(20)(27) 1931. Removing certain parcels from County auction list. (Romaine) WAYS & MEANS

Type II Action 6 NYCRR 617.5(c)(20)(27) 1932. Declaring September 19, 2012 as "Don't Text and Drive Awareness Day" in Suffolk County. (Spencer) PUBLIC SAFETY

Type II Action 6 NYCRR 617.5(c)(20)(21)(27) 1933. Authorizing an appraisal of the John J. Foley Skilled Nursing facility. (Muratore) HEALTH

Type II Action 6 NYCRR 617.5(c)(20)(27) 1934. To appoint John H. Finkenberg as a member of the Suffolk County Citizens Advisory Board for the Arts. (Horsley) PARKS & RECREATION