The Long Beach WPCP Consolidation project aims to decommission the Long Beach WPCP and instead pump the wastewater through a force main to the Bay Park STP. For this goal, several alternatives were proposed and summarized in this memorandum.

The memorandum is broken down into the following sections:

1. Purpose and Need
2. Alternatives Evaluation
3. Cost Summary
4. Conclusions/Recommendations

1. **Purpose and Need**

The Western Bays region is Nassau County’s most significant natural resource, and its world-class beaches and waterways create recreational and employment opportunities for millions of people each year. Moreover, in 2012 Super Storm Sandy showed how the Western Bays ecosystem plays a critical role in protecting Southern Nassau County from climate change and extreme weather conditions. Over the past century, the Western Bays region and its complex ecosystem has been gradually degrading in a manner not unlike Jamaica Bay to the west. One of the major causes of that degradation is the presence of nitrogen in the waterways. Excess nitrogen changes the marsh grass growth rate and ultimately destabilizes the marsh edges, making them susceptible to erosional forces from wave energy and currents.

Studies by the U.S. Environmental Protection Agency consultants indicate that the majority of the nitrogen loading to the Western Bays is from the Bay Park Sewage Treatment Plan (STP), as well as the smaller but still significant discharge from the City of Long Beach Water Pollution Control Plant (WPCP). To improve water quality in the Western Bays, Nassau County is committed to reducing nitrogen being discharged into the Western Bays from wastewater treatment plants, and has been active over the past decade pursing this goal with the consolidation of treatment facilities at Cedarhurst, Lawrence, and Jones Beach. In another significant and ongoing project, the County also has committed to convey the Bay Park STP effluent out of the Western Bays and through the Cedar Creek ocean outfall.

The County is now focused on the last remaining point source, the Long Beach WPCP. The County and the City of Long Beach have agreed to implement the Long Beach Consolidation project (“the Project”) to
decommission the Long Beach WPCP, and instead pump the wastewater through a force main to the Bay Park STP for advanced treatment and eventual conveyance to the Cedar Creek ocean outfall.

The proposed Project, in combination with the conveyance of treated effluent from the Bay Park STP to the Cedar Creek ocean outfall will significantly reduce nitrogen loading to the Western Bays, resulting in improved water quality in the Western Bays. By reducing nitrogen discharges to the Western Bays and, hence, excess nutrient nitrogen, which is a significant driver of tidal marsh loss, the project will make a major contribution to improving the health of the Western Bay marsh ecosystem.

In addition to the primary purpose of reducing nitrogen loadings to the Western Bays, the Project also intends to restore and enhance low elevation wetlands and/or mudflats that were adversely affected by prior construction of the existing Bay Park STP outfall through the middle of the Pearsalls and North and South Black Bank Hassocks. Since the Western Bays are is in a densely urban area that has significantly reduced natural sediment inputs, the secondary objective of the project is to augment the sediment supply to these low elevation marsh platforms by specifically increasing the elevation of marsh platforms that are most vulnerable to sea level rise. Coastal marshes in this densely urban landscape are highly susceptible to the combined impacts of human activity and sea level rise and can no longer keep up with the changing conditions by trapping sediment and accumulating root biomass to maintain a favorable elevation to support vegetative growth. Vegetated marshes that cannot keep up with the rising sea levels will be flooded too frequently, which will stress and eventually kill the plants, and ultimately convert these habitats to unvegetated mudflats. This process is already happening within the Western Bays, and most notably for this project at the southern end of the South Black Banks Hassock.

This sediment enhancement approach has been used successfully across the country but most notably within the Gateway National Recreation Area in Jamaica Bay. The approach incorporated into this project augments sediment inputs within the Western Bays to strategically increase the elevation of threatened vegetated marsh platforms that were previously disturbed by past anthropogenic disturbance. By raising the marsh elevation, the project will increase primary productivity of native vegetation and, in turn, increase ecological functioning and long-term resilience of these wetlands within the Western Bays. The cumulative effect of this project is intended to reverse historical trends of wetland loss within the Western Bays and provide needed sediment to these native habitats to better help them adapt to anticipated future changes in sea levels, sediment inputs and nutrients.

2. Alternatives Evaluation

The sections below summarize the constructability, community impact, and ecological impact evaluation of the following eight (8) alternatives:

- Alternative A (Previously Alternative 3A) – Hassocks In-Water Route (HDD)
- Alternative B (Previously Alternative 1B) – Austin Boulevard (HDD)
- Alternative C – Harbor Isle & Hassocks (HDD)
- Alternative D (Previously Alternative 1) – Austin Boulevard (Open Cut)
- Alternative E (Previously Alternative 2A) – Long Beach Road (Open Cut)
- Alternative F (Previously Alternative 2B) – Long Beach Road (Hybrid Route)
MEMORANDUM (Cont'd)

- Alternative G (Previously Alternative 3B) – Harbor Isle & Hassocks (Hybrid Route)
- Alternative H – Rehabilitation of Existing Plant to Meet DFE

Images of conceptual routing for all alternatives are included in Appendix A. A detailed analysis of these alternatives as they relate to all screening criteria is included in Appendix B.

3. Cost Summary

The PM-JV performed a conceptual level cost estimate for each of these routes, shown in Table 1 below, to aid in order to determining the most cost-effective alternative.

Table 1. Cost Summary of Design Alternatives

<table>
<thead>
<tr>
<th>Design Alternatives</th>
<th>Route Description</th>
<th>Total Construction Costs</th>
<th>Total Project Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative A</td>
<td>Force Main through Hassock Islands (HDD)</td>
<td>$64,000,000</td>
<td>$76,000,000</td>
</tr>
<tr>
<td>Alternative B</td>
<td>Force Main through Austin Blvd &amp; Mainland (HDD)</td>
<td>$70,000,000</td>
<td>$83,000,000</td>
</tr>
<tr>
<td>Alternative C</td>
<td>Force Main through Harbor Isle &amp; Hassocks (HDD)</td>
<td>Not constructible</td>
<td></td>
</tr>
<tr>
<td>Alternative D</td>
<td>Force Main through Austin Blvd &amp; Mainland (Open Cut)</td>
<td>$82,000,000</td>
<td>$96,000,000</td>
</tr>
<tr>
<td>Alternative E</td>
<td>Force Main through Long Beach Rd &amp; Mainland (Open cut)</td>
<td>$97,000,000</td>
<td>$113,000,000</td>
</tr>
<tr>
<td>Alternative F</td>
<td>Force Main through Long Beach Rd &amp; Hassocks Islands (Hybrid)</td>
<td>$84,000,000</td>
<td>$99,000,000</td>
</tr>
<tr>
<td>Alternative G</td>
<td>Force Main through Harbor Isle &amp; Hassocks Islands (Hybrid)</td>
<td>Not Constructible</td>
<td></td>
</tr>
<tr>
<td>Alternative H</td>
<td>Upgrades to the Existing Plant</td>
<td>$152,500,000</td>
<td>$177,325,000</td>
</tr>
</tbody>
</table>
MEMORANDUM (Cont’d)

The estimates show that Alternative A – “Force Main through Hassock Islands (HDD Method)” has the lowest total project cost. This can be attributed to several factors including, but not limited to, the following:

- Minimizing the length of installation by open cut which reduces the amount of dewatering and active shoring.
- Minimizing the quantity of existing infrastructure relocations.
- Minimizing the quantity of traffic management considerations.

As stated previously, these estimates are conceptual in nature. The level of project definition at the time of this memo dictates that the estimates be crafted to meet the requirements of a Class 5 estimate as established by the Association for the Advancement of Cost Engineering (AACE) which indicates an accuracy range of -20% to +100%. Considering this accuracy range, in conjunction with foundational project knowledge, the following contingencies were applied:

- Segments Constructed by Horizontal Directional Drilling: 30%
- Segments Constructed by Open cut or Microtunneling: 40%
- Pump Station Construction and Long Beach WPCP: 40%

4. Conclusions/Recommendation

Constructability, community impacts, ecological impacts, and cost were evaluated for all identified alternatives as critical screening criteria to arrive at a recommendation for a preferred route. After analysis, Alternative A (formerly Alternative 3A) was confirmed to be the recommended alternative for this project. In addition to being the lowest cost alternative, this alternative limits community impacts and has minimal constructability concerns (refer to Appendix C for construction staging figures). While permitting is anticipated to be more complex, and temporary environmental impacts are higher than for the alternatives that route down Austin Boulevard or Long Beach Road, this alternative provides an opportunity to restore the wetlands as part of the project (refer to Appendix D for marshland restoration plans).

Pearsalls Hassock and North and South Black Hassocks were adversely impact by prior construction of the existing Bay Park STP outfall. Alternative A provides an opportunity to restore Hassock wetlands and stabilize shorelines to preserve the existing marsh footprint. Additionally, the Project can evaluate the potential for restoring eroded shorelines and provide a stepwise habitat adaptation to Sea Level Rise (SLR), another contributing factor to the loss of marshland in the Western bays. Such an adaptive approach would allow the Hassocks to adapt to increasing SLR as the high marsh zone transitions to low marsh and upland to high marsh.
APPENDIX A

Conceptual Routing of Alternatives
**Legend**

- **FORCE MAIN (HDD)**
- **FORCE MAIN (OPEN-CUT)**
- **FORCE MAIN (MICROTUNNELING)**
- **FORCE MAIN (AERIAL BRIDGE ATTACHMENT)**
- **LONG BEACH WPCP AND BAY PARK STP**

**NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS**
**CITY OF LONG BEACH**
**LONG BEACH WPCP CONSOLIDATION PROJECT**

**ALTERNATIVE B**

---

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Earth i, Shelby County Government, and the GIS User Community
LONG BEACH WPCP

Legend

- **FORCE MAIN (HDD)**
- **FORCE MAIN (OPEN-CUT)**
- **LONG BEACH WPCP AND BAY PARK STP**

ALTERNATIVE C
ALTERNATIVE D

Legend

- FORCE MAIN (HDD)
- FORCE MAIN (OPEN-CUT)
- FORCE MAIN (MICROTUNNELING)
- FORCE MAIN (AERIAL BRIDGE ATTACHMENT)
- LONG BEACH WPCP AND BAY PARK STP
Legend

- **FORCE MAIN (HDD)**
- **FORCE MAIN (OPEN-CUT)**
- **FORCE MAIN (MICROTUNNELING)**
- LONG BEACH WPCP AND BAY PARK STP
LEGEND

- **FORCE MAIN (HDD)**
- **FORCE MAIN (OPEN-CUT)**
- **LONG BEACH WPCP AND BAY PARK STP**

ALTERNATIVE G
APPENDIX B

Screening Matrix
### Long Beach WPCP Consolidation Project

#### Project
- **Purpose**: Screening Matrix of Various Design Alternatives

#### Action Alternative H:
- **Description**: Rehabilitation & Outfall to existing plant

<table>
<thead>
<tr>
<th>Screening Matrix</th>
<th>Alternative A</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
<th>Alternative E</th>
<th>Alternative F</th>
<th>Alternative G</th>
<th>Alternative H</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disruption/ Local Community</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conformance</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Land Acquisition</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Utility Conflicts</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Community Disruption/ Social Benefits Impacts</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>Total Construction Cost</strong></td>
<td>$84,606,000</td>
<td>$70,100,000</td>
<td>na</td>
<td>$82,600,000</td>
<td>$77,000,000</td>
<td>$87,100,000</td>
<td>na</td>
<td>$84,600,000</td>
</tr>
<tr>
<td><strong>Total Project Cost</strong></td>
<td>$76,306,000</td>
<td>$68,000,000</td>
<td>na</td>
<td>$84,000,000</td>
<td>$70,000,000</td>
<td>$77,100,000</td>
<td>na</td>
<td>$84,000,000</td>
</tr>
</tbody>
</table>

#### Action Alternative G:
- **Description**: Harbor Island/ Nashua Island Route

<table>
<thead>
<tr>
<th>Screening Matrix</th>
<th>Alternative A</th>
<th>Alternative B</th>
<th>Alternative C</th>
<th>Alternative D</th>
<th>Alternative E</th>
<th>Alternative F</th>
<th>Alternative G</th>
<th>Alternative H</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disruption/ Local Community</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conformance</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Land Acquisition</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Utility Conflicts</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Community Disruption/ Social Benefits Impacts</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
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<tr>
<td><strong>Total Construction Cost</strong></td>
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<tr>
<td><strong>Total Project Cost</strong></td>
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<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

#### Primary Construction Method
- **Alternative A**: Horizontal Directional Drilling (HDD) and/or Direct Trenching
- **Alternative B**: Horizontal Directional Drilling (HDD) and/or Direct Trenching
- **Alternative C**: Horizontal Directional Drilling (HDD) and/or Direct Trenching
- **Alternative D**: Horizontal Directional Drilling (HDD) and/or Direct Trenching
- **Alternative E**: Horizontal Directional Drilling (HDD) and/or Direct Trenching
- **Alternative F**: Horizontal Directional Drilling (HDD) and/or Direct Trenching
- **Alternative G**: Horizontal Directional Drilling (HDD) and/or Direct Trenching
- **Alternative H**: Horizontal Directional Drilling (HDD) and/or Direct Trenching

#### Utility Conflicts
- **Horizontal Directional Drilling (HDD)**: No
- **Direct Trenching**: No

#### Land Acquisition
- **Open Cut**: 36 months, 12,250 ft
- **Suspension**: 36 months, 430 ft
- **Micro tunnel**: 36 months, 200 ft

#### Community Disruption/ Social Benefits Impacts
- **Open Cut**: 36 months, 12,250 ft
- **Suspension**: 36 months, 430 ft
- **Micro tunnel**: 36 months, 200 ft

#### Construction Duration
- **Open Cut**: 36 months, 12,250 ft
- **Suspension**: 36 months, 430 ft
- **Micro tunnel**: 36 months, 200 ft

#### Construction Technology
- **Horizontal Directional Drilling (HDD)**: Yes
- **Direct Trenching**: Yes

#### Conformance
- **Yes**: Yes
- **No**: No

#### Significant Adverse Impacts
- **Significant Adverse Impacts**: Potential significant adverse impacts to certain businesses at HDD entry and exit points.
- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.

#### Utility Conflicts
- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.
- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.
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- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.

#### Construction
- **Open Cut**: 36 months, 12,250 ft
- **Suspension**: 36 months, 430 ft
- **Micro tunnel**: 36 months, 200 ft

#### Significant Adverse Impacts
- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.
- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.
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- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.

#### Action Alternative H:
- **Description**: Rehabilitation & Outfall to existing plant

#### Utility Conflicts
- **Horizontal Directional Drilling (HDD)**: No
- **Direct Trenching**: No

#### Significant Adverse Impacts
- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.
- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.
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- **Significant Adverse Impacts**: Potential significant adverse impacts to dozens of local businesses along the route from utility service disruptions, loss of on-street parking, impaired access, traffic detours, and extended closure to vehicular access to property.

#### Summary
- **Total Construction Cost**: $84,606,000
- **Total Project Cost**: $76,306,000

#### Notes
- There are a total of 9 impacted parcels based on this layout due to HDD staging requirements. These 9 properties are owned by a mix of public, private, and currently unknown owners.
- There are a total of至少 7 impacted parcels based on this layout due to HDD staging requirements. Of these 7 properties, 2 are private owned, and 5 are public owned.
- There are a total of至少 7 impacted parcels based on this layout due to HDD staging requirements. Of these 7 properties, 2 are private owned, and 5 are public owned.
- There are a total of至少 7 impacted parcels based on this layout due to HDD staging requirements. Of these 7 properties, 2 are private owned, and 5 are public owned.
- There are a total of至少 7 impacted parcels based on this layout due to HDD staging requirements. Of these 7 properties, 2 are private owned, and 5 are public owned.
- There are a total of 9 impacted parcels based on this layout due to HDD staging requirements. These 9 properties are owned by a mix of public, private, and currently unknown owners.
- There are a total of至少 7 impacted parcels based on this layout due to HDD staging requirements. Of these 7 properties, 2 are private owned, and 5 are public owned.
- There are a total of至少 7 impacted parcels based on this layout due to HDD staging requirements. Of these 7 properties, 2 are private owned, and 5 are public owned.
- There are a total of at least 3 impacted parcels based on this layout due to HDD staging requirements. Of these 3 properties, 2 are private owned, 3 are public owned, and 3 are unknown.
- There are a total of at least 3 impacted parcels based on this layout due to HDD staging requirements. Of these 3 properties, 2 are private owned, 3 are public owned, and 3 are unknown.
- There are a total of at least 3 impacted parcels based on this layout due to HDD staging requirements. Of these 3 properties, 2 are private owned, 3 are public owned, and 3 are unknown.
- There are a total of at least 3 impacted parcels based on this layout due to HDD staging requirements. Of these 3 properties, 2 are private owned, 3 are public owned, and 3 are unknown.
- There are a total of at least 3 impacted parcels based on this layout due to HDD staging requirements. Of these 3 properties, 2 are private owned, 3 are public owned, and 3 are unknown.
- There are a total of at least 3 impacted parcels based on this layout due to HDD staging requirements. Of these 3 properties, 2 are private owned, 3 are public owned, and 3 are unknown.
- There are a total of at least 3 impacted parcels based on this layout due to HDD staging requirements. Of these 3 properties, 2 are private owned, 3 are public owned, and 3 are unknown.
**Nassau County Department of Public Works**

**Long Beach WPCP Consolidation Project**

**Client:**

**SCREENING**

Low Adverse Impact. None or limited lane closures. - Expected minimal impacts to previously disturbed and Bay Park STP.

**Alternative 3A Hassocks - In-Water Route**

- The majority of route occurring below the Hassocks including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

Moderate Adverse Impact

- Routes under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Long Beach WPCP Consolidation Project Alternatives Screening Matrix**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Action Alternative</th>
<th>Description</th>
</tr>
</thead>
</table>
| Alternatives A & Alternatives B - Rood to Hassocks - HDD | Action Alternative | Construction site and a proper traffic evaluation is required. Possible industrial operations within adjacent areas will require disruption of native habitats providing ecological benefits to imperiled bay.

**Structural Damage (Settlement)**

**Low Adverse Impact.** No structures within zone of influence of construction.

**Significant Adverse Impact.** Roads, railroads, homes, and businesses within zone of influence of construction. Structural damage possible due to surface settlement from tunneling/drilling, vibration from vibratory hammers for sheet pile installation, or dewatering activities.

**Significant Adverse Impact.** Roads, railroads, homes, and businesses within zone of influence of construction. Structural damage possible due to surface settlement from tunneling/drilling, vibration from vibratory hammers for sheet pile installation, or dewatering activities.

**Alternative 2A - Long Beach Road & Tie-in Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 2B - Island Park/Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 2C - Hassocks/Bay Park - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Low Adverse Impact.** No specific areas of structural damage will be significant. Possible industrial operations within adjacent areas will require disruption of native habitats providing ecological benefits to imperiled bay.

**Alternative 3A - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 3B - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 3C - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 4 - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 5 - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 6 - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 7 - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 8 - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 9 - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.

**Alternative 10 - Hassocks - In-Water Route**

- Route cross under open waters and two hazards including intertidal wetlands. HDD launching/receiving pits situated in wetted areas which will cause temporary impacts to waters and wildlife of a maximum of 5.5 acres. Temporary impacts to be addressed through comprehensive mitigation plan.
- Possible minor permanent impacts from air vents or manholes will be mitigated at a 3:1 ratio.
### Nassau County Department of Public Works

**Screening Matrix of Various Design Alternatives**

**Client:**

*Conservatively SCREENING proximity to protected species.*

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**Adverse Impact: A portion of the project area is within a NYSHPO designated archaeologically sensitive area; Phase 3 survey will be likely with potential for a Phase 4 survey.**
APPENDIX C

HDD-Construction Staging
Legend
- HDD
- Open Cut
- Pipe String Out
- Drill Entry/Exit w/ 100' Open Cut
- Access Road

Long Beach WPCP Consolidation Project
Alternative A - Hassocks In-Water Route

DATE: August 2019
FIGURE: Construction Layout
Figure 2. Rig Side Work Space

1. Rig Unit
2. Control Cab Power Unit
3. Drill Pipe
4. Water Pump
5. Slurry Mixing Tank
7. Slurry Pump
8. Bentonite Storage
9. Power Generators
10. Spares Storage
11. Site Office
12. Site Office
13. Entry Point Slurry Containment
14. Cuttings Settlement Pit
Figure 3. Pipe Side Work Space
1. Cuttings Settlement Pit
2. Exit Point Slurry Containment Pit
3. Pipeline Rollers
4. Product Pipeline
5. Construction Equipment
6. Drill Pipe
7. Spares Storage
APPENDIX D
Marshlands Restoration Plan
NOTES:
1. ALL DATA PROJECTED IN NAD 1983 STATE PLANE NEW YORK LONG ISLAND COORDINATE SYSTEM
2. 2016 BASEMAP IMAGE ACCEDED VIA ESRI ONLINE MAPPING
3. “ENHANCEMENT” ZONE REPRESENTS ADDITION OF SEDIMENT TO A VEGETATED MARSH PLATFORM TO AUGMENT NATURAL SEDIMENT INPUTS AND PROVIDE GREATER RESILIENCE TO ADAPT TO ANTICIPATED SEA LEVEL RISE.
4. “RESTORATION” ZONE REPRESENTS ADDITION OF SEDIMENT TO EXISTING MUDFLATS TO A SUITABLE ELEVATION TO SUPPORT NATIVE LOW MARSH VEGETATION. AREAS TARGETED BY THIS PLAN ARE HISTORIC LOW MARSH HABITATS THAT HAVE BEEN LOST DUE TO SHORELINE EROSION OR SUBSIDENCE. AREAS TARGETED BY THIS PLAN ARE HISTORIC LOW MARSH HABITATS THAT HAVE BEEN LOST DUE TO SHORELINE EROSION OR SUBSIDENCE.
5. LOW MARSH HABITAT ZONE ARE LOW MARSH HABITATS ON LOW END OF THE SUITABLE ELEVATION RANGE TO SUPPORT NATIVE VEGETATION. THESE ARE THE HABITATS AT LOWEST RISK OF SUBSIDENCE AND CONVERSION TO MUDFLATS.
6. HIGH MARSH AND UPLAND HABITAT ZONE. ON THE HASSOCKS OF CONCERN, THIS HABITAT ZONE TYPICALLY REPRESENTS PREVIOUS SEDIMENT DISPOSAL AREAS THAT MAY PROVIDE A SUITABLE BORROW AREA FOR SEDIMENT. IT IS ALSO ASSUMED THAT HIGH MARSH HABITATS WITHIN THIS ZONE HAVE BEEN INVADED BY MONOCULTURES OF PHRAGMITES AUSTRALIS.
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Legend:
- Mean Low Water
- Mean High Water
- Fill Source
- Restoration Zone
- Enhancement Zone
- Low Marsh Habitat Zone
- High Marsh and Upland Habitat Zone
NOTES:

1. “ENHANCEMENT” ZONE REPRESENTS ADDITION OF SEDIMENT TO A VEGETATED MARSH PLATFORM TO AUGMENT NATURAL SEDIMENT INPUTS AND PROVIDE GREATER RESILIENCE TO ADAPT TO ANTICIPATED SEA LEVEL RISE.

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LEGEND

- Mean Low Water
- Mean High Water
- Fill Source
- Restoration Zone
- Enhancement Zone
- High Marsh and Upland Habitat Zone
- Low Marsh Habitat Zone

NASSAU COUNTY DEPARTMENT OF PUBLIC WORKS
CITY OF LONG BEACH
LONG BEACH WPCP CONSOLIDATION
PROJECT CONCEPTUAL RESTORATION APPROACH

FIGURE 1
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