

Alternatives Evaluation Report

Mill River District Shoreline Analysis New Haven, Connecticut



Mill River District, looking west. Photo taken from Google Maps.

Submitted: December 30, 2016

Prepared By:



RT Group, Inc.

Engineered from the Ground UpSM

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GEO-ENVIRONMENTAL - STRUCTURAL - CIVIL

Prepared For:

City of New Haven
165 Church Street, 4R
New Haven, CT 06510



RTG Project No. 15103.00

City Project No. 15-195-21

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This Report was prepared under the direction of:



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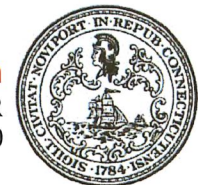
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Introduction

In recent years, the devastating effects of coastal storms, flooding, and sea level rise on coastal communities throughout the United States have made international headlines with concerning frequency and severity. This comes at a time when development and population growth along our coasts is increasing. As a result, more coastal development and infrastructure are at risk than ever before, compelling cities and towns throughout the country to confront this issue by taking steps to protect their existing coastal assets and proposed development. These steps may include, but are not limited to beach re-nourishment, the establishment of coastal dunes, the flood proofing of existing structures, installing flood proofing barriers, and/or elevating structures above the anticipated flood waters.

Background

The *Mill River District Planning Study* (Utile, Inc. and Ninigret Partners, June 2013) was completed for the City of New Haven (the City) to help formulate a strategy for promoting commercial development within the Mill River District (the District). The District is an area of the City that is considered by many to be well suited for commercial development. However, despite all it has to offer (e.g., large underdeveloped parcels, close proximity to the downtown area, easy access to main transportation corridors), its risk of flooding during significant storm events stands as a substantial threat that must first be addressed.

Purpose and Scope

This Alternatives Evaluation Report was prepared for the City by RT Group, Inc. (RTG) following the submission of the Design Flood Memorandum (DFM) (RTG, May 13, 2016). The Report was prepared to more fully evaluate the flood protection alternatives presented in the DFM, estimate their implementation costs, and provide recommendations as appropriate. For simplicity, the Report divides the District into five (5) discrete and manageable areas (Area A through E), as discussed in more detail below.

District Limits



District Areas

Following the DFM Review Meeting that was held between the City and RTG, the City identified several properties within the District that have or are in the process of addressing their vulnerability to flooding. These properties include 470 James Street, McVac Ecotab, the Powerhouse Building, and United Illuminating's Grand Avenue Substation (refer to the DFM for detailed Site Plans). The remaining properties within the District were grouped into five (5) discrete District Areas for evaluating flood protection alternatives. Each Area contains land with similar characteristics (e.g., existing grade, use, etc.) and it was assumed that the requirements of the flood protection improvements would be comparable at locations within a selected Area. This grouping was considered to be a more efficient way of evaluating the District, since it should be more cost-effective to apply flood protection measures to a group of properties rather than individual ones.

Area A

Area A includes the Gateway Terminal (west) and former Simkins properties. These properties include open gravel spaces containing some structures, rail, and salt storage. For this Area, it was assumed that the existing structures and rail would be demolished, removed, and/or relocated as required prior to the implementation of any flood protection alternatives.

Area B

Area B includes the former Saint Gobain properties. These properties include open gravel and paved spaces as well as existing structures. For this Area, it was assumed that the existing structures would remain and that flood protection alternatives would be implemented to protect them. It was also assumed that existing open spaces could be utilized for the construction of new improvements.

District Areas



Area C

Area C includes the property containing English Station. This property includes open gravel/paved spaces, the Abandoned Power Station, and other abandoned structures. For this Area, it was assumed that the existing structures would be demolished and removed prior to the implementation of any flood protection improvements.

Area D

Area D includes 299 Chapel Street, Hillard Bloom Shellfish, New NRB #3, Gateway Terminal (east), and O&G properties, among others. These properties include open gravel spaces containing some small structures. For this Area, it was assumed that the existing structures would be demolished and removed prior to the implementation of any flood protection alternatives.

Area E

Area E includes Grand Paint, Radiall, and the vacant property located north of Radiall, among others. These properties include existing structures; paved roads, driveways, and parking lots; and grass areas. For this Area, it was assumed that the existing structures would remain and that flood protection alternatives would be implemented to protect them. It was also assumed that existing open spaces could be utilized for the construction of new improvements.

Development of Alternatives

The DFM summarizes the existing conditions within the District, the flood criteria, and flood protection alternatives that take into consideration the Management Approaches presented in the previously referenced *Mill River District Planning Study*. These Management Approaches include (1) Natural Attenuation (i.e., minimal intervention), (2) Paired Capacity Investment (i.e., the protection of selected properties against flooding), and (3) Intensive Infrastructure Investment (i.e., District-wide flood protection).

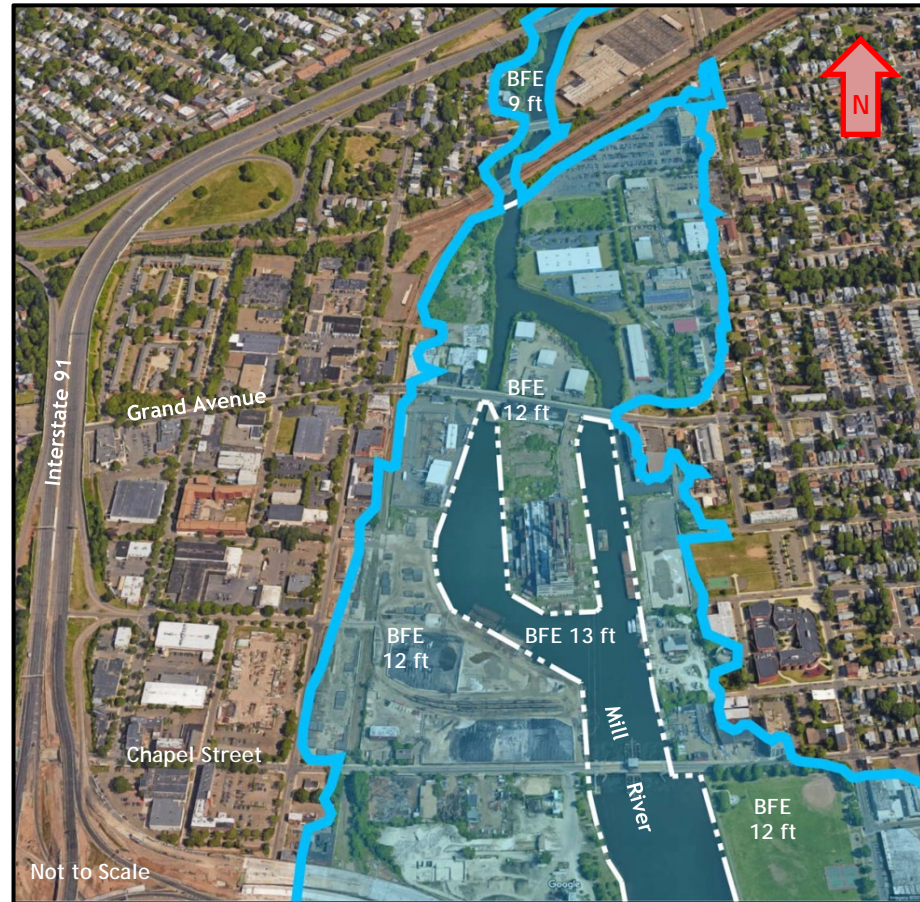
In accordance with the DFM Review Meeting held between the City and RTG, it was agreed that the flood protection alternatives presented under the Natural Attenuation and Intensive Infrastructure Investment Flood Management Approaches were not consistent with the City's long-term goals for the District and/or that they would be too expensive to implement. Accordingly, this Alternatives Evaluation Report focuses on those flood protection alternatives that are consistent with the Paired Capacity Investment Flood Management Approach.

For the Paired Capacity Investment Management Approach, a variety of alternatives were developed in order to provide flood protection. These alternatives include (1) Raising Grade, (2) Installing Flood Proofing Barriers, (3) Elevating the Development, and (4) Dry Flood Proofing.

Description of Alternatives

For each developed alternative, the recommended Design Flood Elevation (DFE) was provided relative the North American Vertical Datum of 1988 (NAVD 88). The DFE is equal to the sum of the Federal Emergency Management Agency (FEMA) 100-year base flood elevation (BFE), the future potential sea-level rise (SLR) (1.5 feet assumed over a 50-year design life), and freeboard (FB) as required based on the alternative being evaluated (rounded to the nearest one foot). Each alternative is described in more detail below.

FEMA Flood Boundaries



Alternative No. 1 - Raising Grade

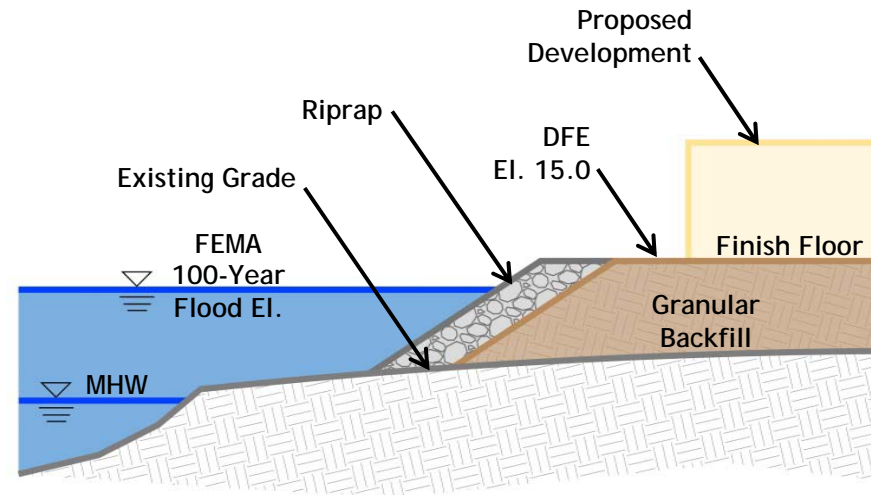
Under this alternative, vegetation would be cleared and existing topsoil stripped from within the limits of the proposed development. Following this work, the subgrade would be compacted and then backfilled with imported granular backfill up to the DFE. For this alternative, it was assumed that the DFE was equal to elevation 15.0 feet (12.0 feet BFE + 1.5 feet SLR + 1.0 foot FB).

After raising grade to the DFE¹, the exposed side slopes would be protected from scour/erosion using riprap. Under this Alternative, the area of the proposed development would be located entirely above the FEMA BFE. Accordingly, it would be protected from flooding during the 100-year storm event and development could proceed without any additional flood protection requirements.

In general, this alternative was considered applicable to those properties that have existing open and/or underutilized spaces as well as properties with existing structures that are abandoned and that could be demolished and removed prior to development.

Should this alternative be implemented, compensatory flood storage would need to be provided so that the water holding capacity of the floodplain was not reduced. This storage could be provided either on-site or off-site, as approved by the City².

Alternative No. 1 - Raising Grade



Not to Scale

Footnotes:

¹ It was assumed that the subsurface conditions would allow grade to be raised in combination with shallow spread footings for the proposed development without inducing excessive total and differential settlements. If organics or other compressible soils are present, then pre-loading would be required in conjunction with raising grade in order to induce the anticipated settlements prior to constructing the building foundation systems.

² In accordance with the City of New Haven's Flood Damage Prevention Ordinance.

Alternative No. 2 - Flood Proofing Barrier

Under this alternative, a barrier would be installed around the perimeter of the existing or proposed development. As part of construction, vegetation would be cleared and existing topsoil stripped within the alignment of the proposed barrier. Following this work, the flood proofing barrier would be installed up to the DFE elevation. For this alternative, it was assumed that the DFE was equal to elevation 17.0 feet (12.0 feet BFE + 1.5 feet SLR + 3.0 feet FB³).

The final configuration of the flood proofing barrier is expected to vary based on several site-specific considerations, including but not limited to its required height and horizontal clearance limitations. For the purposes of preparing this Report, the barrier configuration shown on this page was assumed, which satisfies FEMA's requirements that a "hardened" (e.g., concrete or steel) structure be provided^{4,5}.

After the flood proofing barrier was constructed, the area landward of the barrier would be protected from flooding during a 100-year storm event. As such, existing developments within the flood proofing barrier would be protected and new developments could be constructed without any additional flood protection requirements.

In general, this alternative was considered applicable to those properties that contain existing developments that need to be maintained and protected from flooding, but could also be utilized for protecting new developments, if determined to be cost effective. Similar to Alternative No. 1, compensatory flood storage would need to be provided so that the water holding capacity of the floodplain was not reduced. Depending on the size of the area protected by the barrier, and the corresponding volume of water diverted during the 100-year storm event, the required compensatory flood storage could be significant.

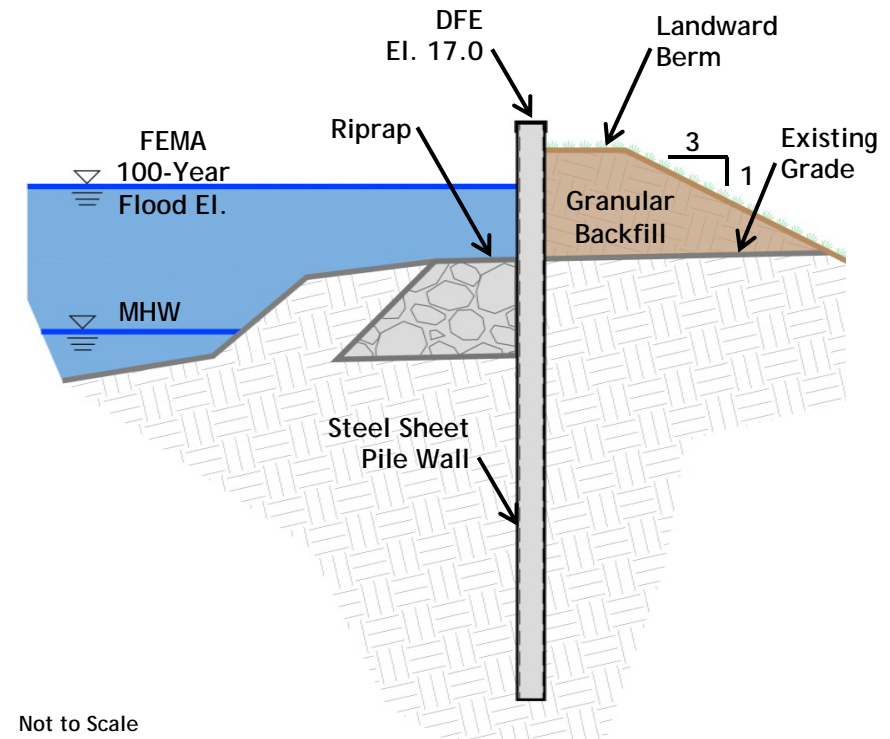
Footnotes:

³ A freeboard of 3.0 feet was selected for this alternative in accordance with FEMA standards for riverine flood proofing barriers.

⁴ This is a requirement in order to be considered eligible for a FEMA FIRM revision.

⁵ It was assumed that the subsurface conditions would support the use of 30-foot-long cantilevered sheet piles and a 3H:1V landward slope to resist the anticipated flood loading.

Alternative No. 2 - Flood Proofing Barrier

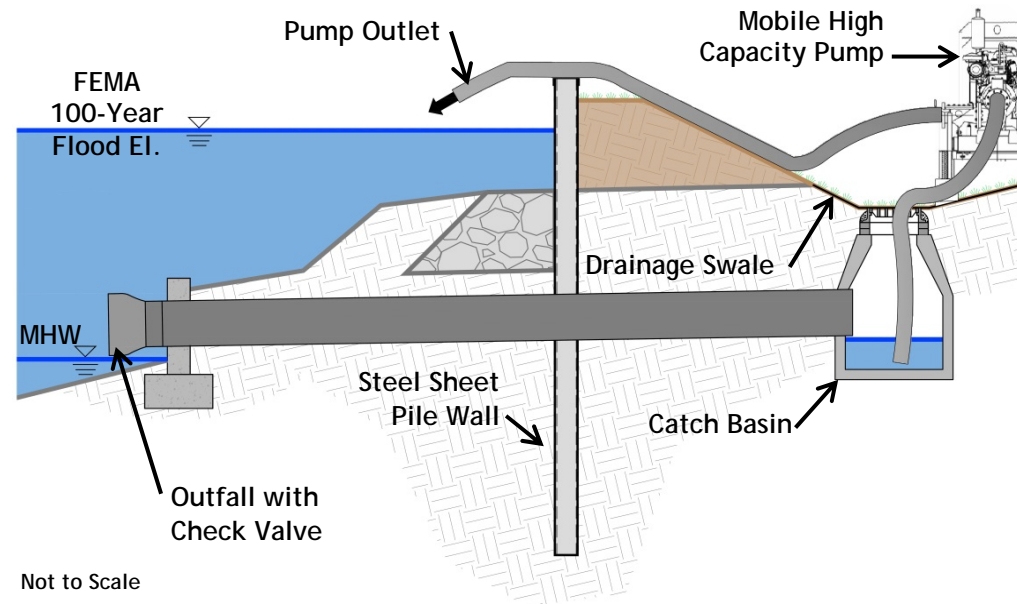


Under this alternative, Stormwater Management would also be required in order to allow runoff to be discharged into the Mill River (the River) during both normal operating and flood conditions.

During normal operating conditions, when the head of water within the property is greater than the elevation of the River, stormwater would be allowed to gravity drain to the River through outfall structures. During a flood condition, when the River elevation is greater than the elevation of water within the property, stormwater would need to be pumped into the River as shown.

The pumping system could consist of a dedicated pump station or mobile high capacity pumps. Each of these systems has their advantages and disadvantages. However, for the purposes of preparing this Report it was assumed that mobile high capacity pumps would be utilized. In addition, it was assumed that duckbill check valves would be installed at all outfall structures to prevent River water from entering the property during a flood condition.

Stormwater Management for Alternative No. 2



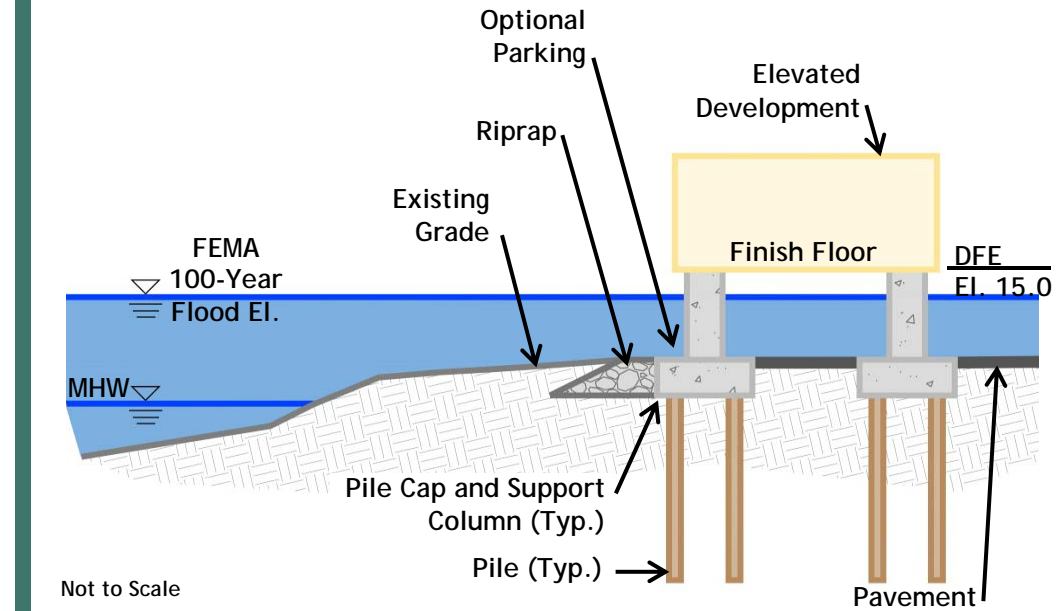
In addition, it was assumed that duckbill check valves would be installed at all outfall structures to prevent River water from entering the property during a flood condition.

Alternative No. 3 - Elevated Development

Under this alternative, new developments would be designed to provide a finish floor elevation equal to or above the DFE. This could be accomplished by either extending the foundation walls vertically or by supporting the entire building on a pile supported foundation system. For this alternative, it was assumed that the DFE was equal to elevation 15.0 feet (12.0 feet BFE + 1.5 feet SLR + 1.0 foot FB).

The final configuration of the elevated development is expected to vary based on several site-specific considerations, including but not limited to subsurface conditions and existing grade, and could include provisions for an optional lower level of parking/storage that would be allowed to flood in the event of a significant storm event. For the purposes of preparing this Report, it was assumed that the elevated development would bear on a pile supported foundation system as shown⁶.

Alternative No. 3 - Elevated Development



In general, this alternative was considered applicable to those properties that are currently vacant and/or that contain existing structures that are abandoned and that could be demolished and removed prior to development. Similar to Alternative Nos. 1 and 2, compensatory flood storage would need to be provided so that the water holding capacity of the flood plain was not reduced. However, under this alternative the compensatory flood storage would be relatively small due to the limited volume of water that would be displaced by the support columns.

Footnotes:

⁶ It was assumed that the subsurface conditions would support the use of 65-foot-long H-piles to support the proposed development.

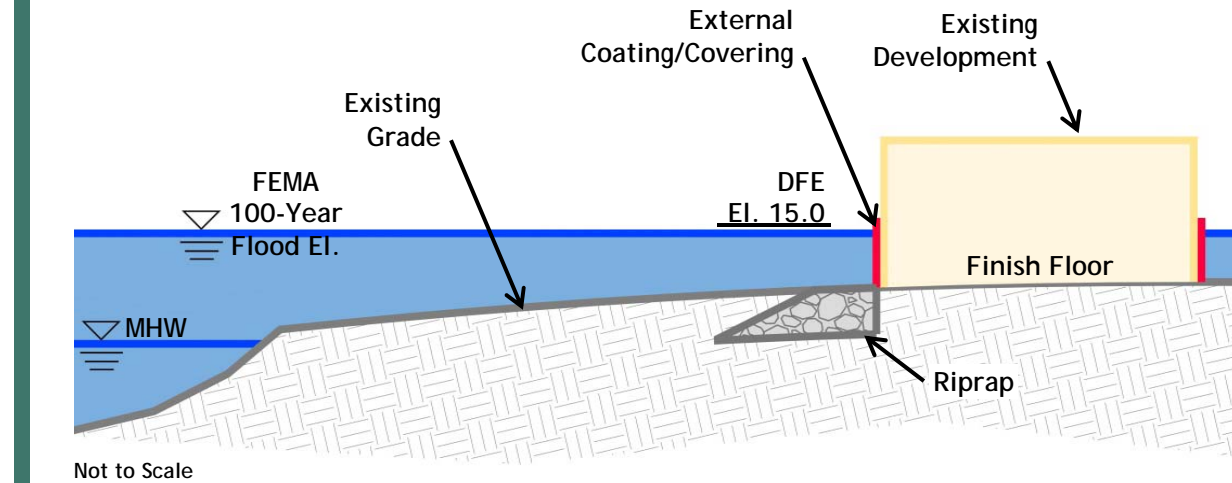
Alternative No. 4 - Dry Flood Proofing

Under this alternative, existing structures would be retrofitted with an impervious external coating/covering up to the DFE.

The coating/covering would be installed in conjunction with water-tight closures at existing openings in the building such as windows and doors. For this alternative, it was assumed that the DFE was equal to elevation 15.0 feet (12.0 feet BFE + 1.5 feet SLR + 1.0 foot FB).

After installation, flood waters from a 100-year storm event would be prevented from entering the structure.

Alternative No. 4 - Dry Flood Proofing



In general, this alternative was considered applicable to those properties that contain existing occupied structures that will remain in service. Similar to Alternative Nos. 1, 2, and 3, compensatory flood storage would need to be provided so that the water holding capacity of the floodplain was not reduced. For this alternative, it was assumed that the compensatory flood storage would be equal to the volume of water displaced by the existing structure due to the installation of the Dry Flood Proofing.

Potential Ancillary Improvements

Potential ancillary improvements that may need to be implemented in conjunction with the flood protection alternatives described previously include providing shoreline stabilization, as described in more detail below.

Shoreline Stabilization

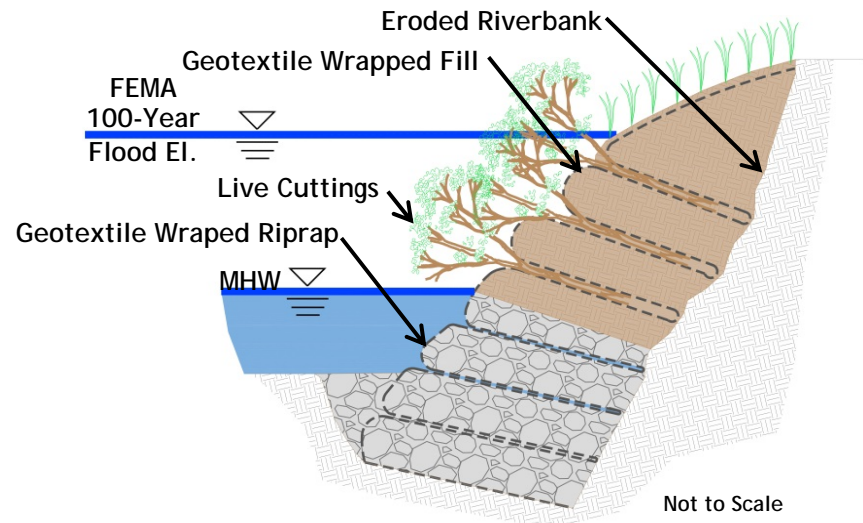
For properties that currently have a sloped natural shoreline and that require protection from erosion/scour, shoreline stabilization could consist of the installation of vegetated geogrid, gabion baskets, and/or riprap. For the purposes of preparing this Report, a vegetated geogrid shoreline treatment was assumed for properties with a sloped natural shoreline.

For properties that currently contain an existing hardened shoreline structure (e.g., bulkhead, seawall, etc.) that is in poor condition, shoreline stabilization could consist of either repairing the subject structure or installing a new hardened structure directly seaward of the existing one. For the purposes of preparing this Report, it was assumed that existing hardened structures that are in poor condition would be replaced by a new steel sheet pile bulkhead (i.e., oversheeting)⁷.

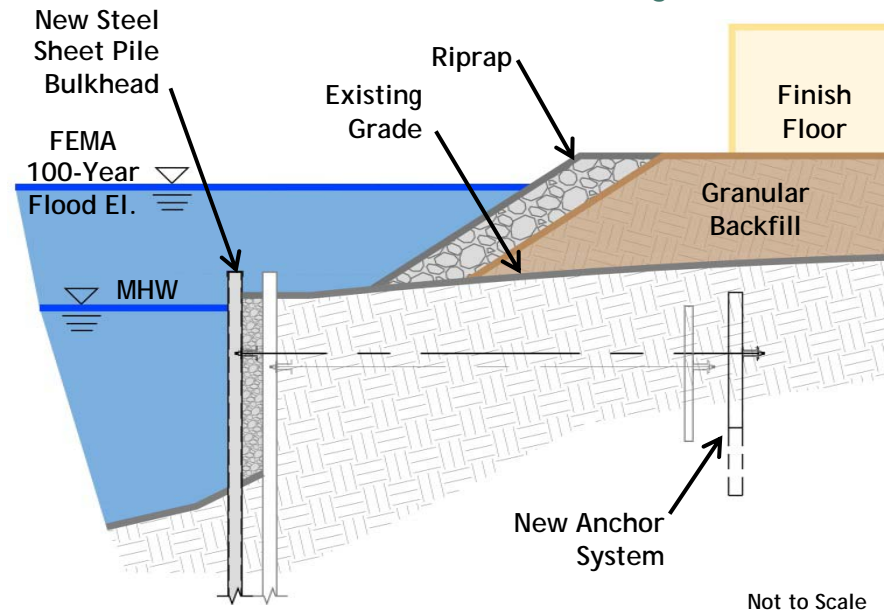
Footnote:

⁷ It was assumed that the subsurface conditions would support the use of 40-foot-long anchored steel sheet piles (Areas A & D) and 30-foot-long cantilevered steel sheet piles (Area B) to resist the anticipated loading.

Shoreline Stabilization - Vegetated Geogrid



Shoreline Stabilization - Oversheeting



Alternative Evaluation by District Area

The previously described alternatives were evaluated on a District Area basis to determine which alternative(s) should be carried forward for further consideration and pricing. When new developments would be constructed (i.e., Alternative Nos. 1 and 3), the evaluation was performed based on a hypothetical development with a building footprint of about 20,000 Square Feet (SF) (the actual building footprint could vary, multiple stories assumed). The results of the evaluation are presented below.

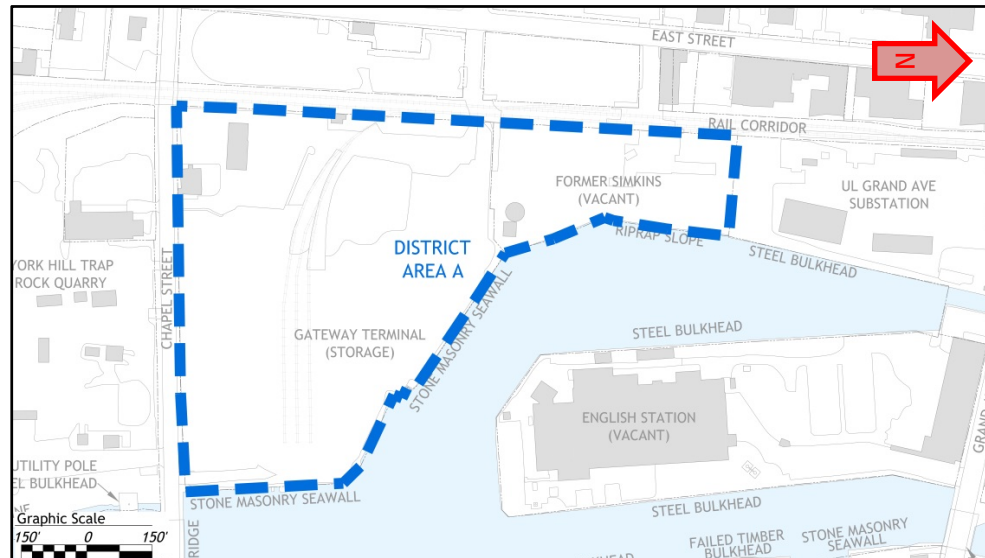
Area A

As previously discussed, Area A is located west of the River and includes the Gateway Terminal and former Simkins properties. The Area's waterfront consists of a stone masonry seawall and a sloped natural shoreline that includes about 15 acres of developable land. It was assumed that the existing structures within Area A would be demolished, removed, and/or relocated prior to the implementation of any flood protection alternative. Accordingly, Alternative No. 4 - Dry Flood Proofing was eliminated from further consideration.

Alternative No. 2 - Flood Proofing Barrier was also eliminated from further consideration. The top of the existing seawall and sloped natural shoreline range from about elevation 5.0 to 7.0 feet, and the DFE for the flood proofing barrier is 17.0 feet, which is about 10.0 to 12.0 feet higher than these features. Therefore, the construction of a flood proofing barrier to this elevation was considered cost prohibitive. In addition, the resulting reduction in flood plain storage would require that a very large compensatory flood storage basin be constructed.

Based on the above, Alternative No. 1 - Raising Grade and Alternative No. 3 - Elevated Development were carried forward for further consideration and pricing. Under Alternative No. 1 - Raising Grade, the DFE is elevation 15.0 feet, which would require

Area A



that site grades be raised by about 7.0 to 8.0 feet. For the assumed building footprint of 20,000 SF, about 10,000 Cubic Yards (CY) of backfill would need to be imported to the site (4H:1V side slopes assumed), which is considered feasible.

If site grades were raised, it was assumed that the development would be constructed a minimum of about 15 feet from the River, with access roads and parking areas located along the outer perimeter of the development and approximately at existing grade. While this would not eliminate the need to retrofit/replace the existing seawall/sloped natural shoreline, it would minimize the additional surcharge load associated with raising grade since no additional surcharge load would be transferred to the seawall or other shoreline features.

Under Alternative No. 3 - Elevated Development, it was assumed that the finish floor elevation of the proposed development would be set at 15.0 feet, which is about 7.0 to 8.0 feet above existing grade (about 1 story). While this would result in additional costs (e.g., pile supported foundations, the loss of useable/rentable space at ground level, and raising the electrical and mechanical services above the DFE), it is considered feasible. Potential types of developments under this alternative could include retail, condominium, and office space that does not require at-grade loading dock access.

Compensatory flood storage would need to be provided under both Alternative Nos. 1 and 3 so that the capacity of the floodplain was not reduced. This would require that a basin with a surface area of about 36,000 SF and least 7.0 to 8.0 feet deep (i.e., about 10,000 CY) be constructed onsite for Alternative No. 1, reducing the overall developable acreage. A smaller basin would be required for Alternative No. 3 due to the minimal floodplain reduction associated with it (i.e., less than 100 CY). Alternatively, compensatory flood storage could be provided offsite for both alternatives at additional cost (e.g., easements, land acquisition, additional permitting).

Given the poor condition of both the seawall and sloped natural shoreline (see DFM), potential ancillary improvements could need to be installed as part of Alternative Nos. 1 and 3 to help minimize the potential for erosion due to flooding. For the purposes of estimating costs, it was assumed that the existing seawall would be over-sheeted with a new steel sheet pile bulkhead and that the existing sloped natural shoreline would be augmented with a vegetated geogrid shoreline treatment.

Alternative Evaluation Summary - Area A

- Alt. Nos. 1 & 3 qualified for further consideration/pricing.
- DFE = 15.0 feet for Alt. Nos. 1 & 3.
- Alternative No. 1 - Raising Grade:
 - Grade raised 7 to 8 ± feet within footprint of new structure.
 - Access roads and parking lots installed at grade.
 - Large compensatory flood storage required either onsite or offsite.
- Alternative No. 3 - Elevated Development:
 - 1st floor of new structure 7 to 8 ± feet above grade.
 - New structure supported by pile-supported foundation system.
- New Hardened Shoreline Structure & Vegetated Geogrid Shoreline Treatment:
 - Required to prevent further collapse/erosion for Alt. Nos. 1 & 3.

Area B

Area B is located west of the River and includes the former Saint Gobain properties. The Area can be broken up into two (2) subareas which include its southern half, containing about 3.1 acres of land with existing vacant structures and a timber bulkhead along its waterfront, and its northern half, containing about 3.4 acres of developable land with a sloped natural shoreline.

Alternative No. 2 - Flood Proofing Barrier was eliminated from further consideration. The top of the existing bulkhead and sloped natural shoreline range from about elevation 5.0 to 7.0 feet, and the DFE for the flood proofing barrier is 17.0 feet, which is about 10.0 to 12.0 feet higher than these features. Therefore, the construction of a flood proofing barrier to this elevation was considered cost prohibitive. In addition, there is insufficient space for a barrier along the southern subarea and a barrier around the northern subarea would result in a reduction in flood plain storage that would require a very large compensatory flood storage basin be constructed.

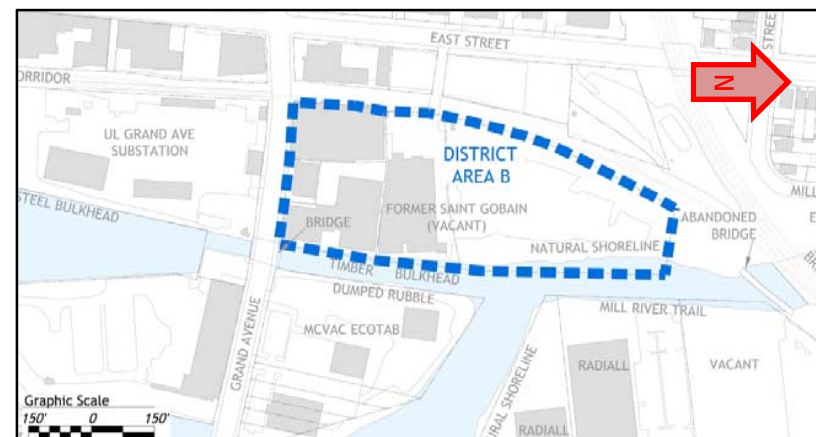
Based on the above, Alternative No. 1 - Raising Grade and Alternative No. 3 - Elevated Development were carried forward for further consideration and pricing for the northern subarea as well as for the southern subarea, assuming the existing buildings were demolished and removed. Alternative No. 4 - Dry Flood Proofing was carried forward for further consideration and pricing for the southern subarea, assuming the existing buildings remained.

Under Alternative No. 1 - Raising Grade, the DFE is elevation 15.0 feet, which would require that site grades be raised by about 7.0 to 8.0 feet. For the assumed building footprint of 20,000 SF, about 10,000 CY of backfill would need to be imported to the site (4H:1V side slopes assumed), which is considered feasible.

If site grades were raised, it was assumed that the development would be constructed a minimum of about 15 feet from the River, with access roads and parking areas located along the outer perimeter of the development and at approximately existing grade. While this would not eliminate the need to improve the existing bulkhead/sloped natural shoreline, it would minimize additional surcharge load associated with raising grade since no additional surcharge load would be transferred to the bulkhead or other shoreline features.

Under Alternative No. 3 - Elevated Development, it was assumed that the finish floor elevation of the proposed development would be set at elevation 15.0 feet, which

Area B



is about 7.0 to 8.0 feet above existing grade (about 1 story). While this would result in additional costs (e.g., pile supported foundations, the loss of useable/rentable space at ground level, and raising the electrical and mechanical services above the DFE), it is considered feasible. Potential types of developments under this alternative could include retail, condominium, and office space that does not require at-grade loading dock access.

Under Alternative No. 4 - Dry Flood Proofing, it was assumed that impervious external coatings/coverings would be installed along the perimeter of the existing buildings up to elevation 15.0 feet, which ranges from about 3.0 to 9.0 feet higher than existing grade around the perimeter of the existing buildings. However, FEMA recommends that Dry Flood Proofing not be considered if more than 3 feet of flooding is expected due to the high external hydrostatic pressures applied to buildings from the flood waters. Accordingly, and in order to keep this alternative applicable for selected structures, the DFE was revised to exclude SLR (i.e., DFE = 13.0 feet). With this DFE, the existing structure located within the southwest corner of the Area was considered eligible for Dry Flood Proofing and the remaining buildings were not.

Compensatory flood storage would need to be provided under Alternative Nos. 1, 3, and 4 so that the capacity of the flood plain was not reduced. This would require that a basin with a surface area of about 36,000 SF and least 7.0 to 8.0 feet deep (i.e., about 10,000 CY) be constructed onsite for Alternative No. 1, reducing the overall developable acreage. A smaller basin would be required for Alternative Nos. 3 (i.e., less than 100 CY) and 4 (i.e., less than 2,000 CY) due to the minimal resulting floodplain reduction associated with them. Alternatively, compensatory flood storage could be provided offsite for each alternative at additional cost (e.g., easements, land acquisition, additional permitting).

Given the poor condition of both the bulkhead and sloped natural shoreline (see DFM), potential ancillary improvements could need to be installed as part of Alternative Nos. 1, 3, and 4 to help minimize the potential for erosion from flooding. For the purposes of estimating costs, it was assumed that the existing timber bulkhead would be over-sheeted with a new steel sheet pile bulkhead and that the existing sloped natural shoreline would be augmented with a vegetated geogrid shoreline treatment.

Alternative Evaluation Summary - Area B

- ❑ Alt. Nos. 1, 3, & 4 qualified for further consideration/pricing.
- ❑ DFE = 15.0 feet for Alt. Nos. 1 & 3
DFE = 13.0 feet for Alt. No. 4 (SLR = 0 feet)
- ❑ Alternative No. 1 - Raising Grade:
 - Grade raised 7 to 8 ± feet within footprint of new structure.
 - Access roads and parking lots installed at grade.
 - Large compensatory flood storage required either onsite or offsite.
- ❑ Alternative No. 3 - Elevated Development:
 - 1st floor of new structure 7 to 8 ± feet above grade.
 - New structure supported by pile-supported foundation system.
- ❑ Alternative No. 4 - Dry Flood Proofing:
 - Applicable to the Area's southwest building only (if SLR = 0 feet).
- ❑ New Hardened Shoreline & Veg Geogrid Shoreline Treatment:
 - Required to prevent further collapse/erosion for Alt. Nos. 1, 3, & 4.

Area C

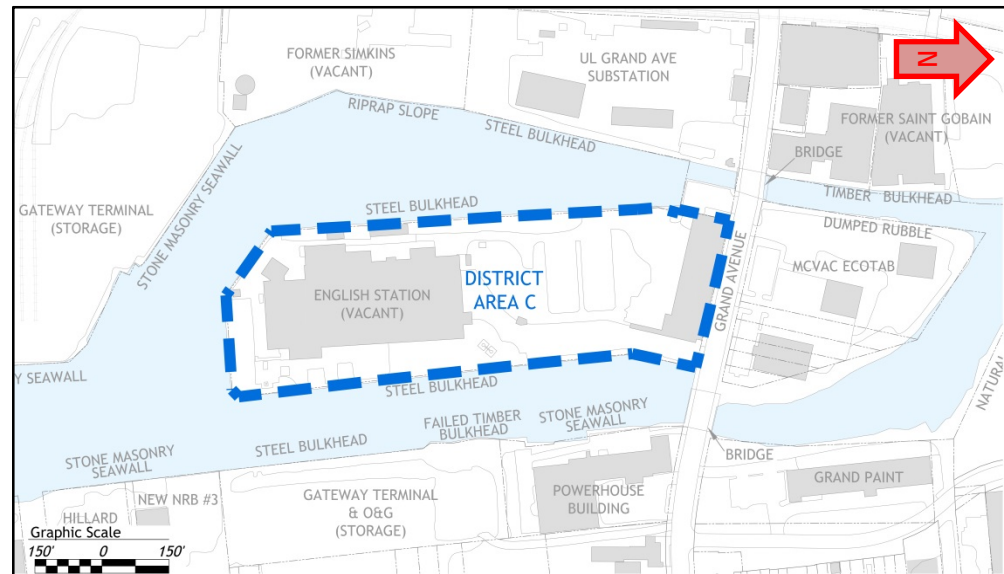
Area C is located within Ball Island and includes English Station (former Power Station) and several other abandoned structures. This manmade island is supported by a steel sheet pile bulkhead that runs along its entire perimeter and includes about 8.3 acres of developable land. As mentioned, McVac Ecotab, which is also located on Ball Island, is in the process of addressing its vulnerability to flooding and was not addressed as part of this Report.

It was assumed that English Station and other abandoned structures within Area C would be demolished and removed (by others) prior to the implementation of any flood protection alternatives. It was assumed that these structures would be too expensive to retrofit and/or that they were unsuitable for reuse due to potential environmental contamination. Accordingly, Alternative No. 4 - Dry Flood Proofing was eliminated from further consideration.

Alternative No. 2 - Flood Proofing Barrier was also eliminated from further consideration. The top of the existing steel sheet pile bulkhead is at about elevation 7.5 feet, and the DFE for the flood proofing barrier is 17.0 feet, which is about 9.5 feet higher. Therefore, the construction of a flood proofing barrier to this elevation, either in front of or behind the existing bulkhead was considered cost prohibitive. In addition, the resulting reduction in flood plain storage would require that a very large compensatory flood storage basin be constructed.

Based on the above, Alternative No. 1 - Raising Grade and Alternative No. 3 - Elevated Development were carried forward for further consideration and pricing. Under Alternative No. 1 - Raising Grade, the DFE is elevation 15.0 feet, which would require that site grades be raised by about 8.0 to 9.0 feet. For the assumed building footprint of 20,000 SF, about 12,000 CY of backfill would need to be imported to the site (4H:1V side slopes assumed), which is considered feasible.

Area C



If site grades were raised, it was assumed that the development would be constructed within the approximate center of the island, with access roads and parking areas located along the outer perimeter of the development and at approximately existing grade. This would likely eliminate the need to retrofit/replace the existing steel sheet pile bulkhead since the additional surcharge load associated with raising grade should not be transferred to the bulkhead.

Under Alternative No. 3 - Elevated Development, it was assumed that the finish floor elevation of the proposed development would be set at 15.0 feet, which is about 8.0 to 9.0 feet above existing grade (about 1 story). While this would result in additional costs (e.g., pile supported foundations, the loss of useable/rentable space at ground level, and raising the electrical and mechanical services above the DFE), it is considered feasible. Potential types of developments under this alternative could include retail, condominium, and office space that does not require at-grade loading dock access.

Compensatory flood storage would need to be provided under both Alternative Nos. 1 and 3 so that the capacity of the flood plain was not reduced. This would require that a basin with a surface area of about 38,000 SF and least 8.0 to 9.0 feet deep (i.e., about 12,000 CY) be constructed onsite for Alternative No. 1, reducing the overall developable acreage. A smaller basin would be required for Alternative No. 3 (i.e., less than 100 CY) due to the minimal resulting floodplain reduction associated with it.

The existing soils on this site are expected to be contaminated and it was assumed that increased disposal costs associated with the construction of compensatory flood storage could be required (these costs are not included herein). Alternatively, compensatory flood storage could be provided offsite for both alternatives at additional cost (e.g., easements, land acquisition, additional permitting).

Alternative Evaluation Summary - Area C

- Alt. Nos. 1 & 3 qualified for further consideration/pricing.
- DFE = 15.0 feet for Alt. Nos. 1 & 3.
- Alternative No. 1 - Raising Grade:
 - Grade raised 8 to 9 ± feet within footprint of new structure.
 - Access roads and parking lots installed at grade.
 - Large compensatory flood storage either onsite or offsite.
- Alternative No. 3 - Elevated Development:
 - 1st floor of new structure 8 to 9 ± feet above grade.
 - New structure supported by pile-supported foundation system.

Area D

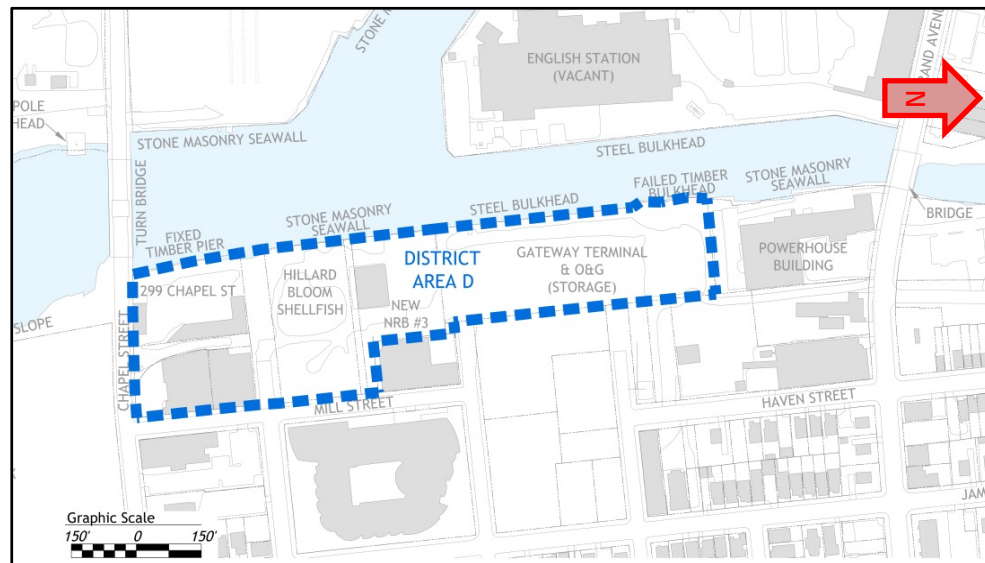
Area D is located east of the River and includes the 299 Chapel St., Hillard Bloom Shellfish, New NRB #3, Gateway Terminal, and other neighboring properties. The Area's waterfront includes a fixed timber pier, a stone masonry seawall, a steel sheet pile bulkhead, and remnants of a timber bulkhead and includes about 8.6 acres of developable land. It was assumed that the existing structures within Area D would be demolished, removed, and/or relocated prior to the implementation of any flood protection alternative. Accordingly, Alternative No. 4 - Dry Flood Proofing was eliminated from further consideration⁸.

Alternative No. 2 - Flood Proofing Barrier was also eliminated from further consideration. The top of the existing shoreline structures range from about elevation 4.0 to 8.0 feet, and the DFE for the flood proofing barrier is 17.0 feet, which is about 9.0 to 13.0 feet higher than these features. Therefore, the construction of a flood proofing barrier to this elevation, either in front of or behind the existing shoreline structures was considered cost prohibitive. In addition, the resulting reduction in flood plain storage would require that a very large compensatory flood storage basin be constructed.

Based on the above, Alternative No. 1 - Raising Grade and Alternative No. 3 - Elevated Development were carried forward for further consideration and pricing. Under Alternative No. 1 - Raising Grade, the DFE is elevation 15.0 feet, which would require that site grades be raised by about 7.0 to 8.0 feet. For the assumed building footprint of 20,000 SF, about 10,000 CY of backfill would need to be imported to the site (4H:1V side slopes assumed), which is considered feasible.

If site grades were raised, it was assumed that the development would be constructed a minimum of about 15 feet from the River, with access roads and parking areas located along the outer perimeter of the development and at approximately existing grade. While this would not eliminate the

Area D



Footnote:

⁸ The DFE is in excess of 3 feet above grade around the perimeter of the existing structures, deeming them non-eligible for Dry Flood Proofing.

need to retrofit/replace the existing shoreline structures, it would minimize additional surcharge load associated with raising grade since no additional surcharge load would be transferred to the waterfront structures.

Under Alternative No. 3 - Elevated Development, it was assumed that the finish floor elevation of the proposed development would be set at 15.0 feet, which is about 7.0 to 8.0 feet above existing grade (about 1 story). While this would result in additional costs (e.g., pile supported foundations, the loss of useable/rentable space at ground level, and raising the electrical and mechanical services above the DFE), it is considered feasible. Potential types of developments under this alternative could include retail, condominium, and office space that does not require at-grade loading dock access.

Compensatory flood storage would need to be provided under both Alternative Nos. 1 and 3 so that the capacity of the floodplain was not reduced. This would require that a basin with a surface area of about 36,000 SF and least 7.0 to 8.0 feet deep (i.e., about 10,000 CY) be constructed onsite for Alternative No. 1, reducing the overall developable acreage. A smaller basin would be required for Alternative No. 3 (i.e., less than 100 CY) due to the minimal floodplain reduction associated with it. Alternatively, compensatory flood storage could be provided offsite for both alternatives at additional cost (e.g., easements, land acquisition, additional permitting).

Given the poor condition of the Area's waterfront structures (see DFM), potential ancillary improvements could need to be installed as part of Alternative Nos. 1 and 3 to help minimize the future potential erosion due to flooding. For the purposes of estimating costs, it was assumed that the existing waterfront structures would be over-sheeted with a new steel sheet pile bulkhead.

Alternative Evaluation Summary - Area D

- Alt. Nos. 1 & 3 qualified for further consideration/pricing.
- DFE = 15.0 feet for Alt. Nos. 1 & 3.
- Alternative No. 1 - Raising Grade:
 - Grade raised 7 to 8 ± feet within footprint of new structure.
 - Access roads and parking lots installed at grade.
 - Large compensatory flood storage required either onsite or offsite.
- Alternative No. 3 - Elevated Development:
 - 1st floor of new structure 7 to 8 ± feet above grade.
 - New structure supported by pile-supported foundation system.
- New Hardened Shoreline Structure:
 - Required to prevent further collapse/erosion for Alt Nos. 1 & 3.

Area E

Area E is located east of the River and includes the Grand Paint and Radiall properties along with several other neighboring properties. The Area's waterfront consists primarily of a sloped natural shoreline and includes about 28 acres of land that is currently occupied with commercial and residential structures that need to be maintained and protected from flooding. In addition, the Area includes vacant and open spaces currently utilized for parking that have the potential to be further developed.

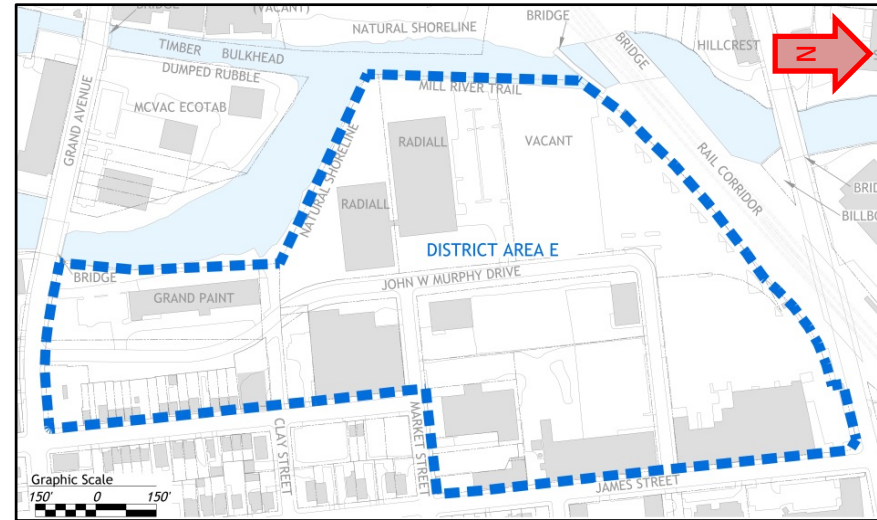
Based on the above, Alternative No. 1 - Raising Grade, Alternative No. 2 - Flood Proofing Barrier, Alternative No. 3 - Elevated Development, and Alternative No. 4 - Dry Flood Proofing were carried forward for further consideration and pricing. Alternative Nos. 1 and 3 would be limited to vacant and open spaces and properties where the existing structures would be demolished and removed. Alternative No. 2 would be applied to the waterfront along the Area. Alternative No. 4 would be limited to the existing structures that need to be maintained and protected from flooding which require a maximum of 3 feet of vertical protection.

Under Alternative No. 1 - Raising Grade, the DFE is elevation 15.0 feet, which would require that site grades be raised by about 5.0 to 7.0 feet at the location of the existing open spaces. For the assumed building footprint of 20,000 SF, about 7,000 CY of backfill would need to be imported to the site (4H:1V side slopes assumed), which is considered feasible.

If site grades were raised, it was assumed that the development would be constructed a minimum of about 15 feet from the River, with access roads and parking areas located along the outer perimeter of the development and at approximately existing grade. While this would not eliminate the need to retrofit the existing sloped natural shoreline, it would minimize additional surcharge loading associated with raising grade since no additional surcharge load would be transferred to the shoreline features.

Under Alternative No. 2 - Flood Proofing Barrier, the top of the sloped natural shoreline ranges from about elevation 5.0 to 7.0 feet, and the DFE for the flood proofing barrier is 17.0 feet, which is about 10.0 to 12.0 feet higher than these features. While the construction of a flood proofing barrier was considered cost prohibitive at other Areas requiring a barrier of similar size, the type

Area E

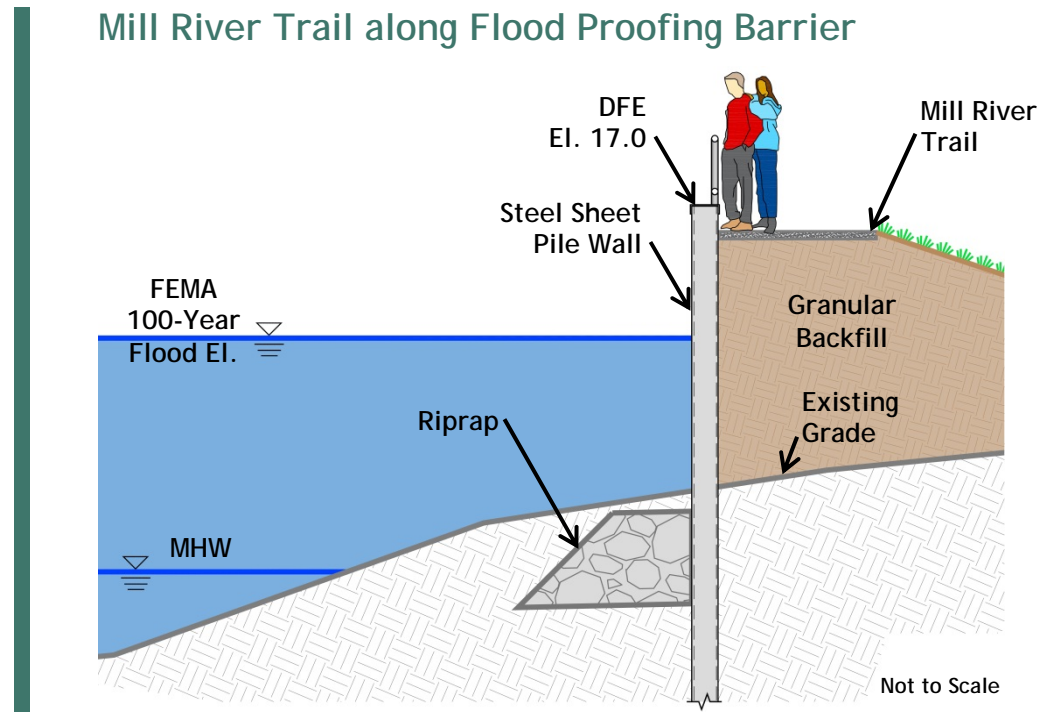


and quantity of developed properties that the barrier would protect may warrant its expense. These properties include prominent businesses that the City would like to keep from relocating due to flooding potential.

The flood proofing barrier would begin at the south side of the rail corridor and extend along the shoreline towards Grand Avenue where it would return towards the existing elevation 17.0 contour near John W Murphy Drive. The total length of the flood proofing barrier would be about 2,000 linear feet (LF). In addition, the barrier could incorporate the Mill River Trail into its design. The barrier would serve as an excellent vantage point to view the River and other areas of the District.

Under Alternative No. 3 - Elevated Development, it was assumed that the finish floor elevation of the proposed development would be set at elevation 15.0 feet, which is about 5.0 to 7.0 feet above existing grade (about 1 story). While this would result in additional costs (e.g., pile supported foundations, the loss of useable/rentable space at ground level, and raising the electrical and mechanical services above the DFE), it is considered feasible. Potential types of developments under this alternative could include retail, condominium, and office space that does not require at-grade loading dock access.

Under Alternative No. 4 - Dry Flood Proofing, it was assumed that permanent impervious external coatings/coverings would be installed along the perimeter of the existing buildings up to elevation 15.0 feet, which ranges from about 3.0 to 9.0 feet higher than existing grade around the perimeter of the existing buildings. However, FEMA recommends that Dry Flood Proofing not be considered if more than 3 feet of flooding is expected due to the high external hydrostatic pressures applied to buildings from the flood waters. Accordingly, and in order to keep this alternative applicable for selected structures, the DFE was revised to exclude SLR (i.e., DFE = 13 feet). With this DFE, Radiall was considered eligible for Dry Flood Proofing and the remaining buildings were not.



Compensatory flood storage would need to be provided under Alternative Nos. 1, 2, 3, and 4 so that the capacity of the flood plain was not reduced. This would require that a basin with a surface area of about 26,000 SF and least 5.0 to 7.0 feet deep (i.e., about 7,000 CY) be constructed onsite for Alternative No. 1, reducing the overall developable acreage. A smaller basin would be required for Alternative No. 3 (i.e., less than 100 CY) due to the minimal resulting floodplain reduction associated with it. A similar size basin would be required for Alternative No. 4 (i.e., about 7,500 CY) due to the existing footprint of the Radial buildings. Alternatively, compensatory flood storage could be provided offsite for these alternatives at additional cost (e.g., easements, land acquisition, additional permitting). In regard to Alternative No. 2, offsite compensatory flood storage would be required (potentially at multiple sites) as the barrier would result in a substantial reduction in flood plain storage (i.e., about 180,000 CY).

Given the poor condition of the sloped natural shoreline (see DFM), potential ancillary improvements could need to be installed as part of Alternative Nos. 1, 2, 3, and 4 to help minimize the potential for erosion from flooding. For the purposes of estimating costs, it was assumed that the existing sloped natural shoreline slope would be augmented with a vegetated geogrid shoreline treatment.

Alternative Evaluation Summary - Area E

- Alt. Nos. 1, 2, 3, & 4 qualified for further consideration/pricing.
- DFE = 15.0 feet for Alt. Nos. 1 & 3.
DFE = 17.0 feet for Alt. No. 2.
DFE = 13.0 feet for Alt. No. 4 (SLR = 0 feet)
- Alternative. No. 1 - Raising Grade:
 - Grade raised 5 to 7 ± feet within footprint of new structure.
 - Access roads and parking lots installed at grade.
 - Compensatory flood storage required either onsite or offsite.
- Alternative. No. 2 - Flood Proofing Barrier:
 - Barrier constructed along existing shoreline (2,000 LF).
 - Entire Area protected.
 - Very large compensatory flood storage required offsite.
- Alternative No. 3 - Elevated Development:
 - 1st floor of new structure 5 to 7 ± feet above grade.
 - New structure supported by pile-supported foundation system.
- Alternative No. 4 - Dry Flood Proofing:
 - Applicable to Radial only (if SLR = 0 feet).
 - Compensatory flood storage required either onsite or offsite.
- New Vegetated Geogrid Shoreline Treatment:
 - Required to prevent further collapse/erosion.
 - Required for Alt Nos. 1, 2, 3, & 4.

Permitting Requirements

It is expected that the proposed work under each alternative will fall under the jurisdiction of several permitting agencies at the municipal, state, and federal levels. In general, the permitting agencies are expected to include the City, the Connecticut Department of Energy & Environmental Protection (CTDEEP) Office of Long Island Sound Programs (OLISP), FEMA, and the United States Army Corps of Engineers (USACE). In Connecticut, the USACE and CTDEEP work in conjunction with each other for the permitting of certain projects in an attempt to prevent overlap and duplication during the review process. The tables below present a summary of the anticipated permitting required for each flood protection alternative and the potential ancillary improvements.

Alternative Nos. 1, 2, 3, & 4

In regard to municipal permitting, it is expected that a City Plan Commission review will be required for each flood protection alternative in order to aid the City in determining the conformity of the proposed work to specific provisions of the Zoning Ordinance (Zoning Ordinance, Section 64). This will require the submission of a Site Plan Application and will include a coastal site plan review (Zoning Ordinance Section 55), a flood damage prevention review (Zoning Ordinance Section 56), an inland wetlands and watercourses review (Zoning Ordinance Section 57), a soil erosion and sediment control review (Zoning Ordinance Section 58), and a stormwater management plan review (Zoning Ordinance Section 60). After approval from the City Plan Commission, it is expected that a Flood Plain Development Permit (Zoning Ordinance Section 56) will be required since the work will take place within the established FEMA floodplain.

In general, Alternative Nos. 1, 3, and 4 will be constructed landward of the CTDEEP Coastal Jurisdiction Line (CJL) and outside of tidal wetlands. Based on this, CTDEEP or USACE permits are not expected to be required for these alternatives. However, based on our correspondence with the CTDEEP, it is our understanding that the City is mandated to refer the Site Plan

Permitting Summary

Table 1 Alternative Nos. 1, 3, & 4		
Permitting Agency	Permit Application	Notes
The City	Site Plan Application & Flood Plain Development Permit	Required for Construction
CT DEEP OLISP	Not Required	Assumes all work is landward of the Coastal Jurisdiction Line
USACE	Not Required	Assumes all work is outside of navigable waterways
FEMA	Not Required	Assumes that FIRM revisions are not required

Application to the CTDEEP for their review and comment (i.e., 109d application).

In regard to Alternative No. 2 - Flood Proofing Barrier, the municipal permitting discussed above is expected to be required (i.e., Site Plan Application, Flood Plain Development Permit). While the majority of work will be out of the CTDEEP's and USACE's jurisdictions, the stormwater drainage system will not and will require new outfalls into the River. Accordingly, CTDEEP and USACE permits are expected to be required for this work.

After the construction of Alternative No. 2 - Flood Proofing Barrier, it may be possible to revise the FEMA flood maps so that the area protected by the barrier would be reclassified from an AE-12 to an X Flood Zone. This would require that a Conditional Letter of Map Revision (CLOMR) application be submitted prior to construction and a Letter of Map Revision (LOMR) application be submitted following construction.

The CLOMR would allow FEMA to review the project and provide comments as to whether or not the project meets minimum National Flood Insurance Program (NFIP) requirements, or proposed hydrology changes per the Code of Federal Regulations (CFR). Should it meet these requirements, reclassification of the flood zone behind the flood proofing barrier would be warranted. A reclassification would allow conventional buildings to be constructed in the future (e.g., shallow spread footing foundations, no special flood protection details).

The primary advantage of obtaining a LOMR is that it would help to minimize future construction costs and it could lower the City's insurance rates. An additional benefit is that such a zone change has the potential to improve the City's Community Rating with respect to existing structures/buildings already located within the AE flood-zone.

Permitting Summary

Permitting Agency	Permit Application	Notes
The City	Site Plan Application & Flood Plain Development Permit	Required for Construction
CT DEEP OLISP	Water Quality Certificate & Individual Permit (required for drainage outfalls)	Assumes some work is within the Costal Jurisdiction Line
USACE	General Permit Self-Verification with Pre-Construction Notification (required for drainage outfalls)	Assumes some work is within navigable waterways
FEMA	CLOMR/LOMR	Required to revise the effective FIRMs to show the protected area as an X Flood Zone

Potential Ancillary Improvements

The potential ancillary improvements are expected to require the municipal permitting discussed above (i.e., Site Plan Application, Flood Plain Development Permit) in addition to state and federal permits.

For the installation of vegetated geogrid shoreline treatments, a CTDEEP Water Quality Certificate and Certificate of Permission (COP) are anticipated to be required. A CTDEEP Individual Permit (i.e., Structures, Dredging, & Fill Permit) could also be required depending on the magnitude of the proposed work. In regard to USACE permitting, this work is not expected to be eligible for a General Permit as it could exceed the maximum length/area allowed. As such, a USACE Individual Permit is expected to be required for this work.

For oversheeting the existing hardened shoreline structures, it is likely that this work could be permitted under a CTDEEP COP and a USACE General Permit, providing that the additional encroachment into the tidal waters is no more than about 18 inches. A CTDEEP Water Quality Certificate should not be required for the completion of this work. In addition, the work could be eligible for a USACE Self-Verification, under which the submission of an application to the USACE would not be required. Instead, CTDEEP OLISP would coordinate with the USACE on the required permitting.

Permitting Summary

Table 3 Potential Ancillary Improvements Shoreline Stabilization		
Permitting Agency	Permit Application	
	Vegetated Geogrid Shoreline Treatment	Oversheeting
The City	Site Plan Application & Flood Plain Development Permit	Site Plan Application & Flood Plain Development Permit
CTDEEP OLISP	COP and Water Quality Certification (Individual Permit may be required)	COP
USACE	Individual Permit and Water Quality Certification	General Permit
FEMA	Not Required	Not Required

Budget-Level Cost Estimates

The estimated flood protection costs by District Area are presented in Table 4. The cost estimates are presented in two formats; (1) the Total Increased Development Cost and (2) the Unit Increased Development Cost (e.g., per SF cost). The latter was estimated based on an assumed hypothetical building footprint for new developments (Alternative Nos. 1 and 3), and the total footprint of existing buildings to be protected (Alternative Nos. 2 and 4).

For Alternative Nos. 1 - Raising Grade and 3 - Elevated Development, the cost estimates are based on an assumed building footprint of 20,000 SF (the actual building footprint could vary, 4 stories assumed). The cost estimates include design, permitting, and construction and represent the increased development costs within a District Area above and beyond the cost of the development itself (i.e., building, utilities, roads, parking, and site restoration are not included).

For Alternative No. 2 - Flood Proofing Barrier, the cost estimates are based on the assumption that a flood proofing barrier would be constructed around selected properties within Area E (2,000 LF of flood proofing barrier assumed). For Alternative No. 4 - Dry Flood Proofing, the cost estimates are based on the assumption that an impervious external coating would be installed on selected existing buildings within Areas B and E. Similar to Alternative Nos. 1 and 3, the cost estimates include design, permitting, and construction.

In addition to the flood protection implementation cost estimates presented in Table 4, cost estimates were also prepared for the potential ancillary improvements, which include vegetated geogrid shoreline treatments and over sheeting of existing hardened shoreline structures that are in poor condition (Table 5). The ancillary improvement cost estimates are presented for information only in order to give the City an idea of what these potential future costs could be, which may impact the overall development of the subject properties.

The cost estimates are based on 2016 USD and have been prepared without the benefit of site-specific subsurface information (e.g., soil borings) or final plans and specifications. Accordingly, a 25% Scope & Budget Contingency has been included at this preliminary stage of the project and the cost estimates should be considered "order of magnitude" level. Final costs are expected to vary from the estimates presented herein based on actual labor and material costs, competitive market conditions, final agreed to project scope, final implementation schedule, and other variable factors.

A breakdown of the budget level costs for each alternative is presented in Appendix A, including figures which help illustrate some of the assumptions made for estimating quantities.

Budget-Level Cost Estimate Summary

District Area	Alternative	Total Increased Development Cost (2016 USD)	Unit Increased Development Cost (2016 USD)
A	No. 1 - Raising Grade ^{1,2}	\$1,400,000.00	\$70/SF ⁷
	No. 3 - Elevated Development ^{1,2}	\$2,500,000.00	\$125/SF ⁸
B	No. 1 - Raising Grade ^{1,2}	\$1,400,000.00	\$70/SF ⁷
	No. 3 - Elevated Development ^{1,2}	\$2,500,000.00	\$125/SF ⁸
	No. 4 - Dry Flood Proofing ^{3,4}	\$600,000.00	\$20/SF
C	No. 1 - Raising Grade ^{1,2}	\$1,700,000.00	\$85/SF ⁷
	No. 3 - Elevated Development ^{1,2}	\$2,500,000.00	\$125/SF ⁸
D	No. 1 - Raising Grade ^{1,2}	\$1,400,000.00	\$70/SF ⁷
	No. 3 - Elevated Development ^{1,2}	\$2,500,000.00	\$125/SF ⁸
E	No. 1 - Raising Grade ^{1,2}	\$1,000,000.00	\$50/SF ⁷
	No. 2 - Flood Proofing Barrier ⁵	\$13,600,000.00	\$60/SF ⁹
	No. 3 - Elevated Development ^{1,2}	\$2,500,000.00	\$125/SF ⁸
	No. 4 - Dry Flood Proofing ^{3,6}	\$1,100,000.00	\$20/SF

Footnotes:

¹Estimated costs assume a hypothetical building footprint of 20,000 SF and assume that onsite soils are not contaminated.

²Estimated costs represent the cost for flood protection only. The cost of the development itself (e.g., building, utilities, roads, parking, and site restoration) would be in addition to the cost estimate shown.

³Estimated costs represent dry flood proofing a selected existing building within the Area based on its existing perimeter.

⁴Estimated costs represent dry flood proofing the building located in the southeast corner of the Area only. All other buildings assumed not applicable.

⁵Estimated costs represent about 2,000 LF of barrier and a stormwater drainage system.

⁶Estimated costs represent dry flood proofing the Radial Buildings only. All other buildings assumed not applicable.

⁷In Areas where preloading is required due to the presence of compressible soils, it is estimated that an additional cost of about \$30 to \$40/SF could be required to complete this work.

⁸In Areas where longer support piles are required due to the presence of compressible soils, it is estimated that an additional cost of about \$30 to \$40/SF could be required to complete this work.

⁹The unit increased development cost is the total cost of the Flood Proofing Barrier divided by the total footprint of existing structures that the barrier would protect. It does not include any new developments in this Area.

Budget-Level Cost Estimate Summary

District Area	Alternative	Total Increased Development Cost	
		Vegetated Geogrid Shoreline Treatment Estimated Total Cost (2016 USD)	Over sheeting Estimated Total Cost (2016 USD)
A	No. 1 - Raising Grade ¹	\$500,000.00	\$3,600,000.00
	No. 3 - Elevated Development ¹	\$500,000.00	\$3,600,000.00
B	No. 1 - Raising Grade ²	\$500,000.00	\$1,400,000.00
	No. 3 - Elevated Development ²	\$500,000.00	\$1,400,000.00
	No. 4 - Dry Flood Proofing ²	\$500,000.00	\$1,400,000.00
C	No. 1 - Raising Grade	NA	NA
	No. 3 - Elevated Development	NA	NA
D	No. 1 - Raising Grade ³	NA	\$6,600,000.00
	No. 3 - Elevated Development ³	NA	\$6,600,000.00
E	No. 1 - Raising Grade ⁴	\$1,100,000.00	NA
	No. 2 - Flood Proofing Barrier ⁴	\$1,100,000.00	NA
	No. 3 - Elevated Development ⁴	\$1,100,000.00	NA
	No. 4 - Dry Flood Proofing ⁴	\$1,100,000.00	NA

Footnotes:
¹Estimated costs based on about 600 LF of Vegetated Geogrid Shoreline Treatment and 630 LF of Oversheeting.
²Estimated costs based on about 500 LF of Vegetated Geogrid Shoreline Treatment and 430 LF of Oversheeting.
³Estimated costs based on about 1,330 LF of Oversheeting.
⁴Estimated costs based on about 1,600 LF of Vegetated Geogrid Shoreline Treatment.

Conclusions and Recommendations

For new developments, Alternative No. 1 - Raising Grade was determined to be the most cost effective flood protection alternative. The increased development costs associated with raising grade ranges from about \$50 to \$85/SF for a hypothetical building footprint of about 20,000 SF. This compares to an increased development cost of about \$125/SF for Alternative No. 3 - Elevated Development⁹ (refer to Table 4 for the estimated increase in costs if compressible soils are determined to be present).

Alternative No. 2 - Flood Proofing Barrier was determined to be applicable within Area E only, where the type and quantity of developed properties that the barrier would protect may warrant its expense. Its estimated cost is about \$6,800/LF, or \$60/SF for the existing building footprint within the protected area. The estimated cost is based on about 2,000 LF of flood proofing barrier, which would protect about 27 acres, including existing developments (e.g., Radiall) and potential new developments.

Alternative No. 4 - Dry Flood Proofing was determined to be applicable within Areas B and E, where the flood waters are expected to extend vertically up the sidewalls of selected existing building less than 3.0 feet and where the potential for a 1.5 foot future sea level rise in 50 years was ignored (assumed unconservative). The estimated cost for Dry Flood Proofing is about \$20/SF, based on the estimated footprint of the subject buildings.

In addition to the increased development costs associated with the flood protection alternatives, the cost of potential ancillary improvements (e.g., vegetated geogrid shoreline treatment, new steel sheet pile bulkhead) will also need to be accounted for. In many cases, these costs are expected to be significant (Table 5) based on the actual condition of the existing shoreline, as documented in the DFM.

Based on the above, and in accordance with the City's goal help create jobs, stimulate private sector investment, and create additional tax base within the District, several steps would need to be taken in order to make selected properties within the District more attractive to potential buyers/developers. These steps could include, but would not be limited to providing incentives to promote development and implementing a District-wide site readiness program in order to streamline the permitting process and create pad ready building sites.

The above steps could include providing direct financial assistance to potential buyers/developers in the form of tax subsidies or credits. They could also include obtaining the necessary City (e.g., Site Plan Application), State (e.g., CTDEEP), and Federal (e.g., USACE, FEMA) permits ahead of time, based on an assumed development configuration, which would remove some of the uncertainty in the redevelopment process, making selected sites more attractive to potential buyers/developers.

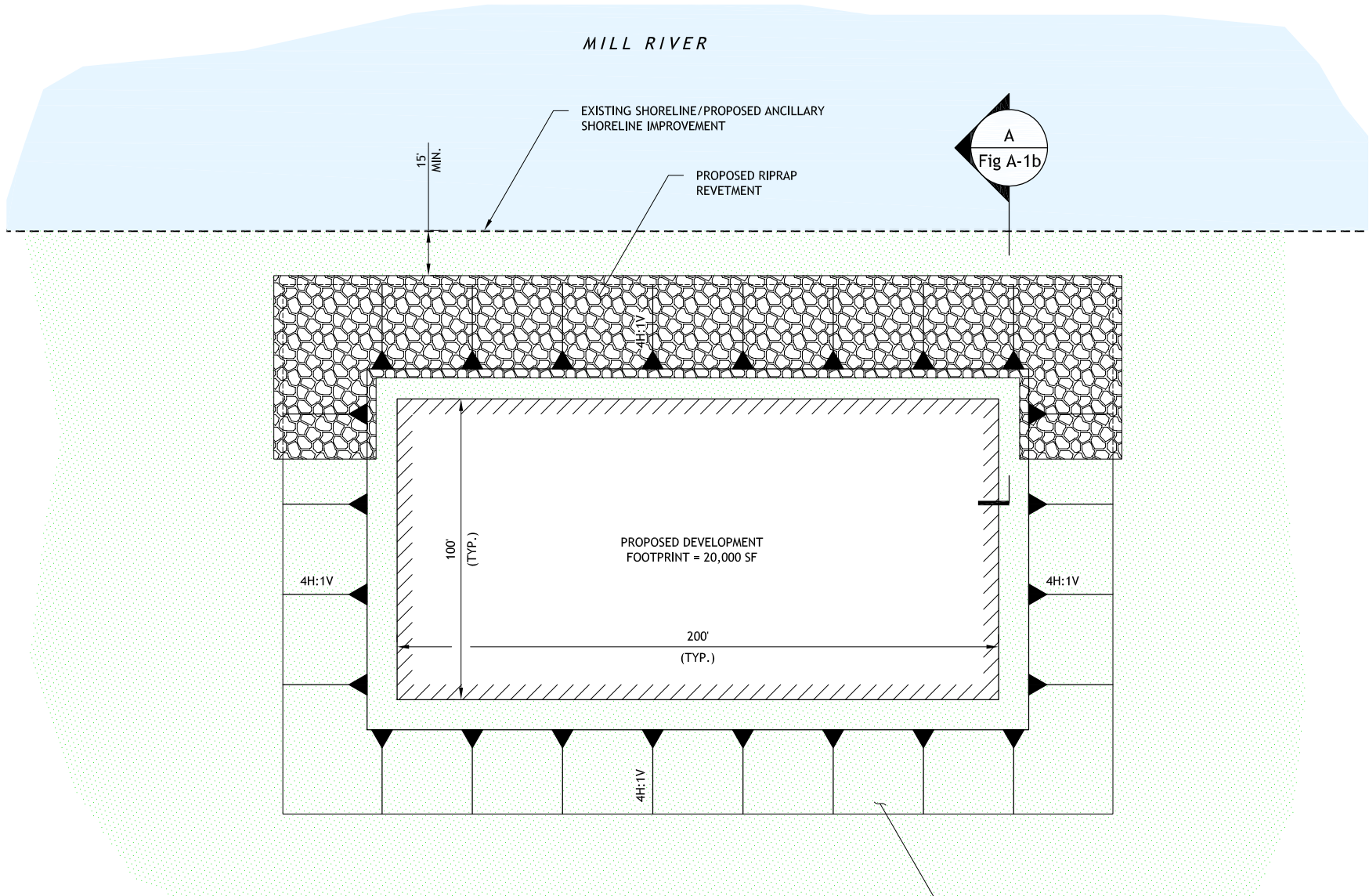
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Footnotes:

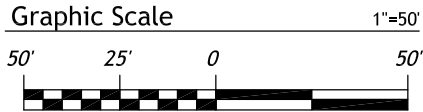
⁹ The estimated cost per SF does not include the additional costs associated with the loss of usable/rentable space at ground level or raising the electrical/mechanical structures above the DFE.

Appendix A
Budget-Level Cost Estimates

**Alternative No. 1
Raising Grade**



PLAN
SCALE: 1" = 50'



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City of New Haven
 CONNECTICUT

**MILL RIVER DISTRICT
 SHORELINE ANALYSIS
 ALTERNATIVES EVALUATION
 REPORT**
 New Haven, Connecticut

**FIGURE A-1a
 ALTERNATIVE NO. 1**

SHEET 1 of 10
 DATE:
 DEC 2016
 PROJ No.
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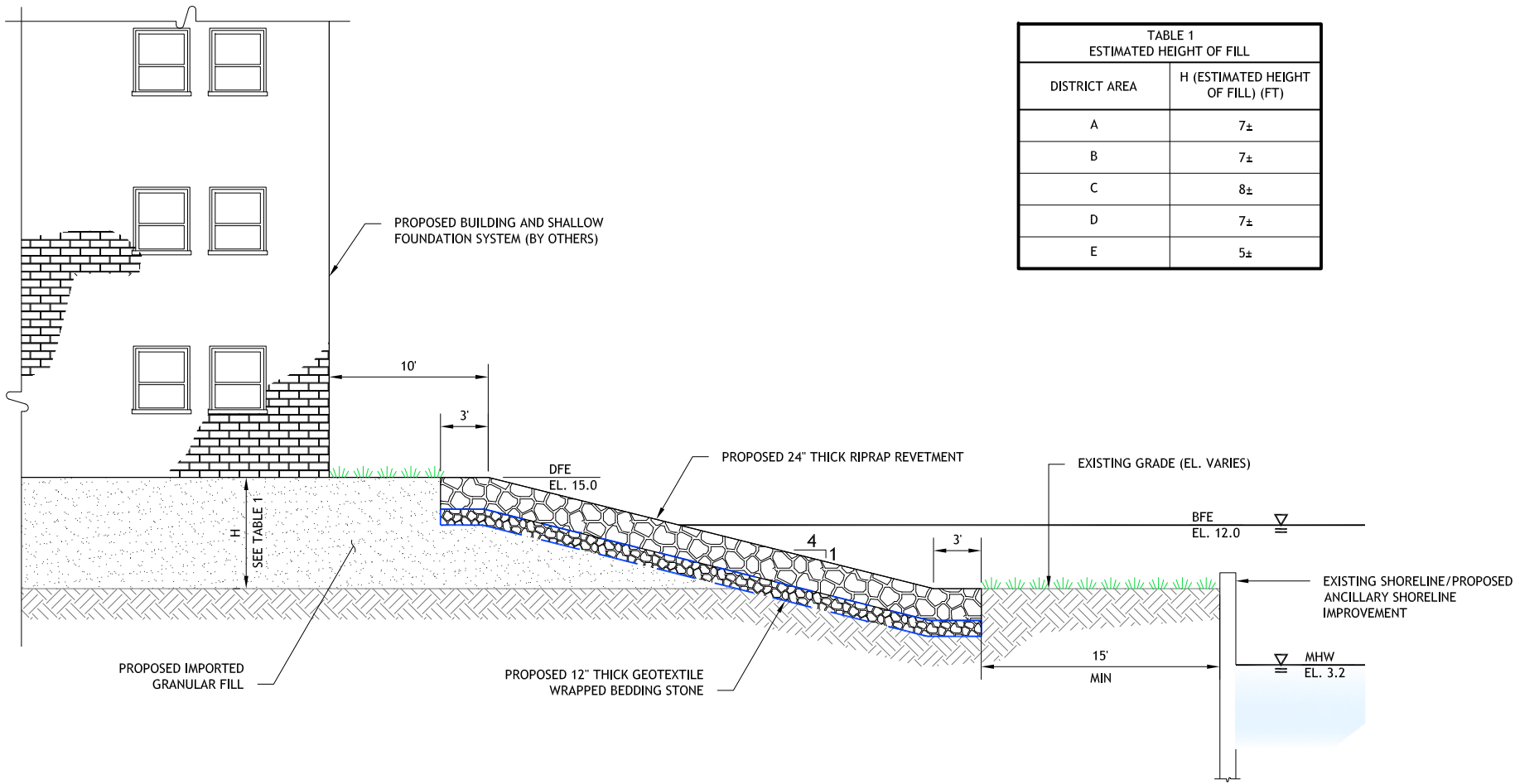


TABLE 1 ESTIMATED HEIGHT OF FILL	
DISTRICT AREA	H (ESTIMATED HEIGHT OF FILL) (FT)
A	7±
B	7±
C	8±
D	7±
E	5±

SECTION A
SCALE: 1" = 10'-0"
Fig A-1a

Table A-1.1
Budget-Level Cost Estimate
Alternative No. 1 - Raising Grade, Areas A, B, or D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Steel Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Electrical, Mechanical, and HVAC Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$18,501.26	\$18,501.26	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$27,501.26	
	Calculate Bid Unit Cost	LS	1		\$27,501.26	
2	Mobilization					
	Mobilization	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	30	\$90.00	\$2,718.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	30	\$200.00	\$6,040.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	16	\$300.00	\$4,786.89	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$13,544.89	
	Calculate Bid Unit Cost	LS	1		\$13,544.89	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Demolish and Remove Existing Structures	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Cut Down and Remove Vegetation	DAY	2	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Grub Out and Remove Stumps	DAY	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Strip and Stockpile Topsoil	CY	900	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Trucking and Disposal Allowance	TRK	90	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
6	Raising Grade					
	Prepare and Compact Subgrade	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Granular Fill Material	TON	14,600	\$18.11	\$264,442.50	Per Tilcon Connecticut x 1.15 Mark-up
	Place and Compact Granular Backfill Material	CY	7,978	\$10.00	\$79,781.42	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$351,223.92	
	Calculate Bid Unit Cost	LS	1		\$351,223.92	
7	Riprap Slope Stabilization/Protection					
	Furnish and Install Geotextile Fabric	SF	30,000	\$1.00	\$30,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap Bedding Stone	TON	800	\$29.27	\$23,414.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap Bedding Stone	DAY	8	\$3,500.00	\$28,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap	TON	1,600	\$29.61	\$47,380.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap	DAY	16	\$3,500.00	\$56,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$184,794.00	
	Calculate Bid Unit Cost	LS	1		\$184,794.00	

Table A-1.1
Budget-Level Cost Estimate
Alternative No. 1 - Raising Grade, Areas A, B, or D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	10,000	\$10.00	\$100,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	5	\$3,500.00	\$17,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Trucking and Disposal Allowance (assume soil is not contaminated)	TRK	1,000	\$200.00	\$200,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$317,500.00	
	Calculate Bid Unit Cost	LS	1		\$317,500.00	
9	Site Restoration					
	Furnish Loam	CY	360	\$20.00	\$7,200.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Place Loam	CY	360	\$5.00	\$1,800.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish and Install Seed	SF	20,000	\$0.50	\$10,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
10	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
	SUBTOTAL				\$952,564.06	Sum of Items 1-10
	Scope and Budget Contingencies				\$238,141.02	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$23,814.10	Assume @ 2.5%
	Permitting				\$33,339.74	Assume @ 3.5%
	Plans, Specifications, and Engineering				\$47,628.20	Assume @ 5.0%
	Construction Phase Services				\$95,256.41	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$1,400,000.00	Rounded to the Nearest \$100,000.00

Flood Proofing Cost Per SF of Building Footprint

\$70.00 For a Hypothetical Building Footprint of 20,000 SF

Table A-1.2
Budget-Level Cost Estimate
Alternative No. 1 - Raising Grade, Area C
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Steel Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Electrical, Mechanical, and HVAC Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$22,080.88	\$22,080.88	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$31,080.88	
	Calculate Bid Unit Cost	LS	1		\$31,080.88	
2	Mobilization					
	Mobilization	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	39	\$90.00	\$3,510.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	39	\$200.00	\$7,800.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	21	\$300.00	\$6,229.51	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$17,539.51	
	Calculate Bid Unit Cost	LS	1		\$17,539.51	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Demolish and Remove Existing Structures	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Cut Down and Remove Vegetation	DAY	2	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Grub Out and Remove Stumps	DAY	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Strip and Stockpile Topsoil	CY	1000	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Trucking and Disposal Allowance	TRK	100	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
6	Raising Grade					
	Prepare and Compact Subgrade	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Granular Fill Material	TON	19,000	\$18.11	\$344,137.50	Per Tilcon Connecticut x 1.15 Mark-up
	Place and Compact Granular Backfill Material	CY	10,383	\$10.00	\$103,825.14	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$454,962.64	
	Calculate Bid Unit Cost	LS	1		\$454,962.64	
7	Riprap Slope Stabilization/Protection					
	Furnish and Install Geotextile Fabric	SF	32,000	\$1.00	\$32,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap Bedding Stone	TON	800	\$29.27	\$23,416.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap Bedding Stone	DAY	8	\$3,500.00	\$28,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap	TON	1,600	\$29.61	\$47,376.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap	DAY	16	\$3,500.00	\$56,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$186,792.00	
	Calculate Bid Unit Cost	LS	1		\$186,792.00	

Table A-1.2
Budget-Level Cost Estimate
Alternative No. 1 - Raising Grade, Area C
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	12,000	\$10.00	\$120,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	6	\$3,500.00	\$21,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Trucking and Disposal Allowance (assume soil is not contaminated)	TRK	1,200	\$200.00	\$240,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$381,000.00	
	Calculate Bid Unit Cost	LS	1		\$381,000.00	
9	Site Restoration					
	Furnish Loam	CY	500	\$20.00	\$10,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Place Loam	CY	500	\$5.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish and Install Seed	SF	24,500	\$0.50	\$12,250.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$24,750.00	
	Calculate Bid Unit Cost	LS	1		\$24,750.00	
10	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
	SUBTOTAL				\$1,135,125.03	Sum of Items 1-10
	Scope and Budget Contingencies				\$283,781.26	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$28,378.13	Assume @ 2.5%
	Permitting				\$39,729.38	Assume @ 3.5%
	Plans, Specifications, and Engineering				\$56,756.25	Assume @ 5.0%
	Construction Phase Services				\$113,512.50	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$1,700,000.00	Rounded to the Nearest \$100,000.00

Flood Proofing Cost Per SF of Building Footprint

\$85.00 For a Hypothetical Building Footprint of 20,000 SF

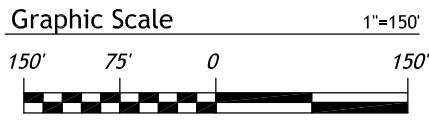
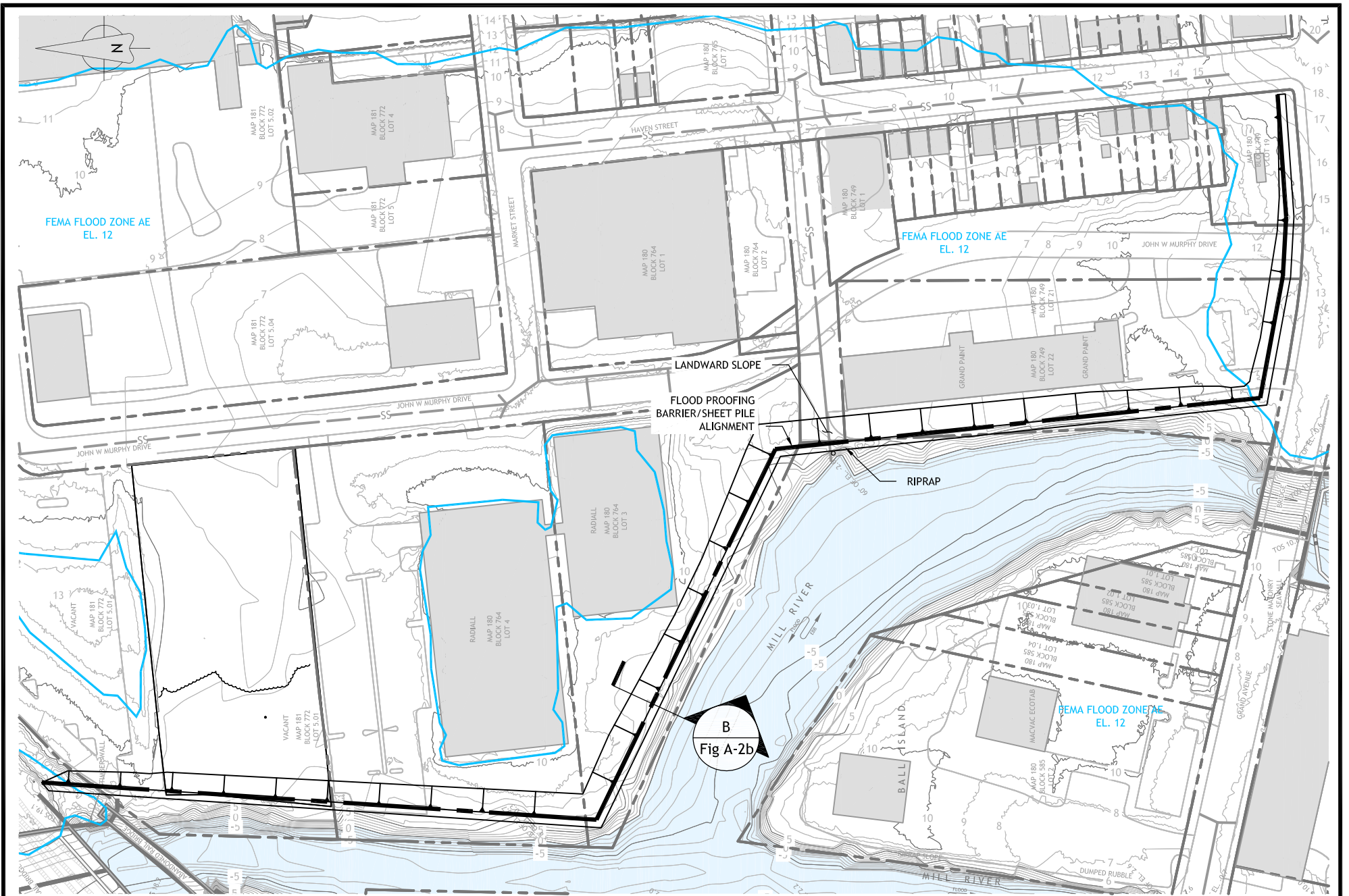
Table A-1.3
Budget-Level Cost Estimate
Alternative No. 1 - Raising Grade, Area E
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Steel Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Electrical, Mechanical, and HVAC Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$12,816.80	\$12,816.80	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$21,816.80	
	Calculate Bid Unit Cost	LS	1		\$21,816.80	
2	Mobilization					
	Mobilization	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	20	\$90.00	\$1,800.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	20	\$200.00	\$4,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	10	\$300.00	\$3,114.75	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$8,914.75	
	Calculate Bid Unit Cost	LS	1		\$8,914.75	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Demolish and Remove Existing Structures	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Cut Down and Remove Vegetation	DAY	2	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Grub Out and Remove Stumps	DAY	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Strip and Stockpile Topsoil	CY	820	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Trucking and Disposal Allowance	TRK	82	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
6	Raising Grade					
	Prepare and Compact Subgrade	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Granular Fill Material	TON	9,500	\$18.11	\$172,068.75	Per Tilcon Connecticut x 1.15 Mark-up
	Place and Compact Granular Backfill Material	CY	5,191	\$10.00	\$51,912.57	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$230,981.32	
	Calculate Bid Unit Cost	LS	1		\$230,981.32	
7	Riprap Slope Stabilization/Protection					
	Furnish and Install Geotextile Fabric	SF	21,600	\$1.00	\$21,600.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap Bedding Stone	TON	600	\$29.27	\$17,562.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap Bedding Stone	DAY	6	\$3,500.00	\$21,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap	TON	1,200	\$29.61	\$35,532.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap	DAY	12	\$3,500.00	\$42,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$137,694.00	
	Calculate Bid Unit Cost	LS	1		\$137,694.00	

Table A-1.3
 Budget-Level Cost Estimate
 Alternative No. 1 - Raising Grade, Area E
 Alternatives Evaluation Report
 City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	6,500	\$10.00	\$65,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	4	\$3,500.00	\$14,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Trucking and Disposal Allowance (assume soil is not contaminated)	TRK	650	\$200.00	\$130,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$209,000.00	
	Calculate Bid Unit Cost	LS	1		\$209,000.00	
9	Site Restoration					
	Furnish Loam	CY	300	\$20.00	\$6,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Place Loam	CY	300	\$5.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish and Install Seed	SF	15,500	\$0.50	\$7,750.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$15,250.00	
	Calculate Bid Unit Cost	LS	1		\$15,250.00	
10	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
	SUBTOTAL				\$662,656.87	Sum of Items 1-10
	Scope and Budget Contingencies				\$165,664.22	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$16,566.42	Assume @ 2.5%
	Permitting				\$23,192.99	Assume @ 3.5%
	Plans, Specifications, and Engineering				\$33,132.84	Assume @ 5.0%
	Construction Phase Services				\$66,265.69	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$1,000,000.00	Rounded to the Nearest \$100,000.00
	Flood Proofing Cost Per SF of Building Footprint				\$50.00	For a Hypothetical Building Footprint of 20,000 SF

**Alternative No. 2
Flood Proofing Barrier**



RT Group, Inc.
 Engineered from the Ground UpSM
 458 Grand Avenue, Suite 213
 New Haven, Connecticut 06513
 T 203 823 9932 F 401 294 9806

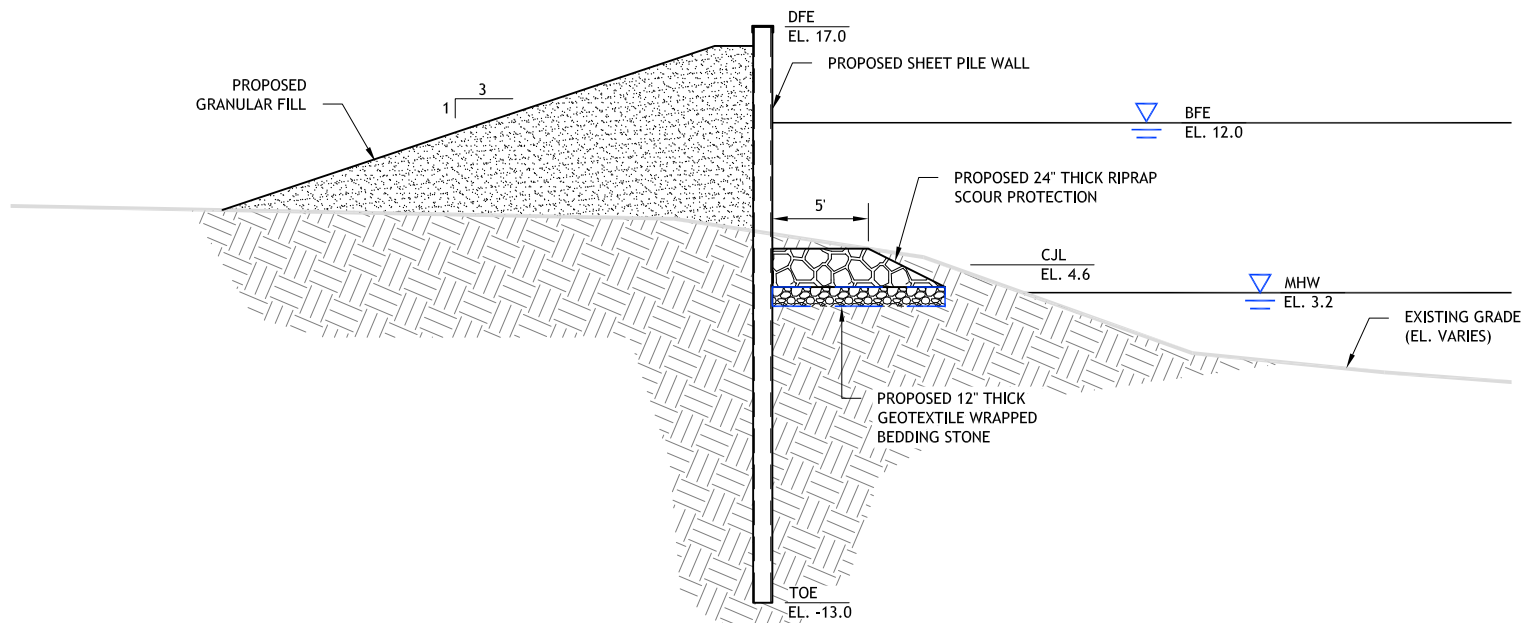
DAM SAFETY - WATERFRONT - CONSTRUCTION ENGINEERING - GEOTECHNICAL
 GEO-ENVIRONMENTAL - STRUCTURAL - CIVIL

City of New Haven
 CONNECTICUT

**MILL RIVER DISTRICT
 SHORELINE ANALYSIS**
 ALTERNATIVES EVALUATION
 REPORT
 New Haven, Connecticut

**FIGURE A-2a
 ALTERNATIVE NO. 2**

SHEET 3 of 10
 DATE DEC 2016
 PROJ No. 15103.00



SECTION B
 SCALE: 1" = 10'-0"
 Fig A-2a

Table A-2.1
Budget-Level Cost Estimate
Alternative No. 2 - Flood Proofing Barrier, Area E
Alternatives Evaluation Report
City of New Haven, CT

Bid Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Layout and Survey Control	CREW HR	40	\$200.00	\$8,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Steel Sheet Pile Layout Submittals	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Water Control Plan	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Vibration Monitoring	LS	1	\$27,065.25	\$27,065.25	Assume \$600/EA x 3 for Set-Up + \$565/Month x 3 Units x 3 Months + \$350/Week x 3 Units x 12 Weeks + \$480/Visit x 5 Visits + \$550/EA x 3 for Demob per Written Quote from GeoSonics x 1.15 for Mark-Up
	Vibration Monitoring Reporting	EA	12	\$500.00	\$6,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Schedules	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	25	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$201,683.47	\$201,683.47	Assume at 2% of Flood Proofing Alternative Costs
	As-Built Drawings	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement, Related to Flood Proofing Project Only
					\$272,748.72	
	Calculate Bid Unit Cost	LS	1		\$272,748.72	
2	Mobilization					
	Mobilization	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	48	\$90.00	\$4,338.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	48	\$200.00	\$9,640.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	18	\$300.00	\$5,400.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$19,378.00	
	Calculate Bid Unit Cost	LS	1		\$19,378.00	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	1,000	\$8.00	\$8,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$23,000.00	
	Calculate Bid Unit Cost	LS	1		\$23,000.00	
5	Clearing, Grubbing, and Stripping					
	Clear along Flood Proofing Alignment	DAY	5	\$3,500.00	\$17,500.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Strip and Stockpile Pavement	TON	260	\$25.00	\$6,500.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Trucking and Disposal Allowance	TRK	26	\$200.00	\$5,200.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Strip Existing Topsoil for Re-Use or Offsite Disposal	CY	1,100	\$15.00	\$16,500.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Remove Existing Fencing	DAY	4	\$3,500.00	\$14,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Trucking Allowance	EA	70	\$200.00	\$14,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$73,700.00	
	Calculate Bid Unit Cost	LS	1		\$73,700.00	
6	Flood Proofing Barrier					
6A	Steel Sheet Pile Wall, STA 0+00 to 16+00					
	Furnish NZ-19 Steel Sheet Piles (Grade 50)	LB	1,149,000	\$0.78	\$898,518.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Coat Sheet Piles	SF	64,800	\$5.96	\$386,013.60	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	1,149,000	\$0.04	\$44,925.90	Estimator's Judgement
	Install NZ-19 Steel Sheet Piles (Grade 50)	DAY	40	\$5,500.00	\$220,000.00	Crew Rate & Production Per Previous Projects, Assume 40 LF/DAY
	Furnish Steel Cap	LB	32,700	\$1.00	\$32,700.00	Estimator's Judgement
	Coat Steel Cap	SF	6,400	\$5.96	\$38,144.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Install Steel Cap	DAY	16	\$5,500.00	\$88,000.00	Crew Rate & Production Per Previous Projects, Assume 100 LF/DAY
					\$1,708,301.50	
	Calculate Bid Unit Cost	LF	1,600		\$1,067.69	

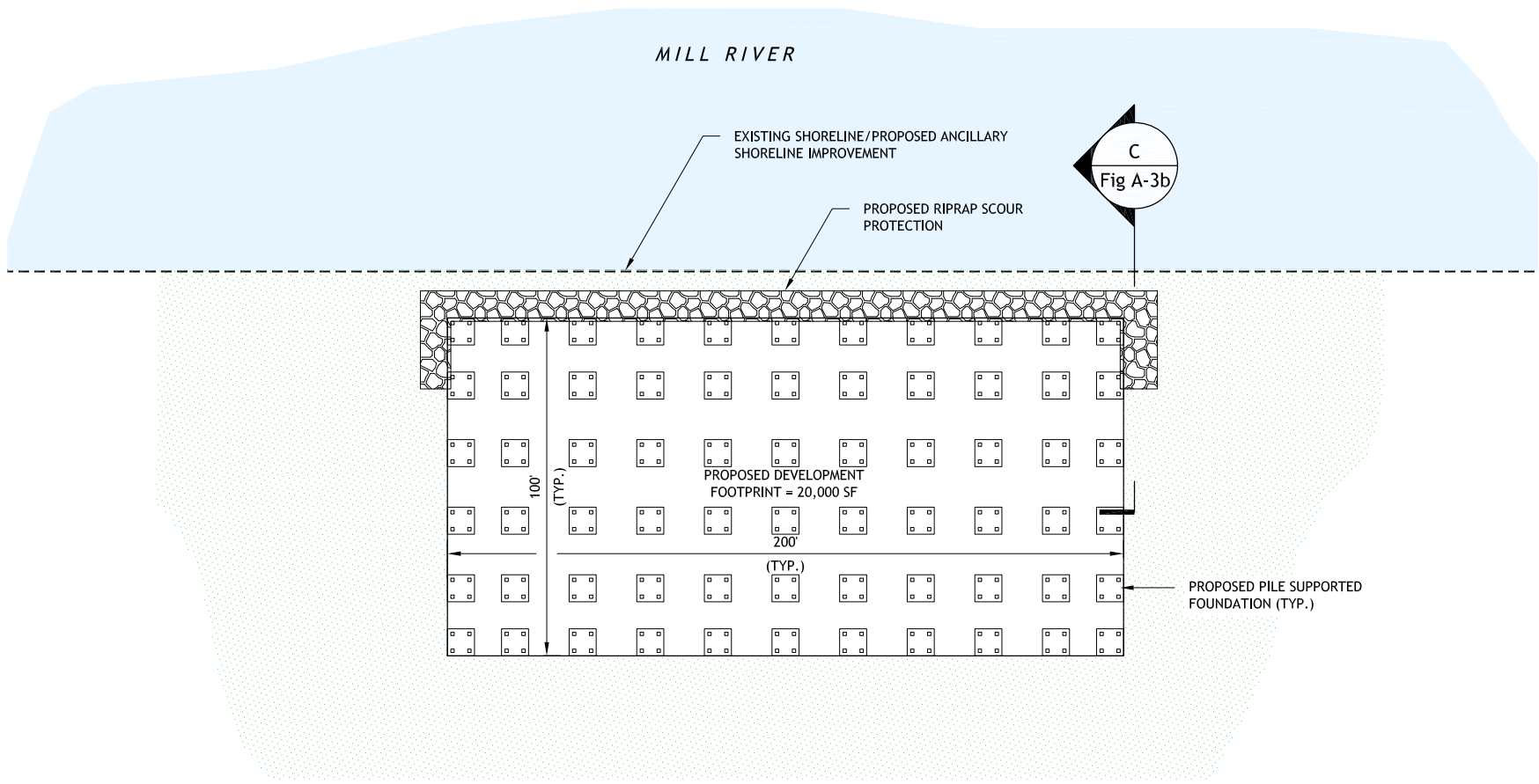
Table A-2.1
Budget-Level Cost Estimate
Alternative No. 2 - Flood Proofing Barrier, Area E
Alternatives Evaluation Report
City of New Haven, CT

Bid Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
6B	Steel Sheet Pile Wall, STA 16+00 to 20+00					
	Furnish NZ-19 Steel Sheet Piles (Grade 50)	LB	95,800	\$0.78	\$74,915.60	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Coat Sheet Piles	SF	10,800	\$5.96	\$64,335.60	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	95,800	\$0.04	\$3,745.78	Estimator's Judgement
	Install NZ-19 Steel Sheet Piles (Grade 50)	DAY	8	\$5,500.00	\$44,000.00	Crew Rate & Production Per Previous Projects, Assume 50 LF/DAY
	Furnish Steel Cap	LB	8,200	\$1.00	\$8,200.00	Estimator's Judgement
	Coat Steel Cap	SF	1,600	\$5.96	\$9,536.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Install Steel Cap	DAY	4	\$5,500.00	\$22,000.00	Crew Rate & Production Per Previous Projects, Assume 100 LF/DAY
					\$226,732.98	
	Calculate Bid Unit Cost	LF	400		\$566.83	
6C	Landward Slope					
	Bulk Excavation	CY	0	\$15.00	\$0.00	Estimator's Judgement
	Prepare and Compact Subgrade	DAY	12	\$3,500.00	\$42,000.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Furnish Granular Fill	TON	20,500	\$18.11	\$371,306.25	Assume 1-1/2" Dense Graded as Provided by Tilcon x 1.15 Mark-up
	Install Granular Fill	CY	9,000	\$10.00	\$90,000.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
					\$503,306.25	
	Calculate Bid Unit Cost	LS	1		\$503,306.25	
6D	Riprap Protection					
	Bulk Excavation	CY	2,600	\$10.00	\$26,000.00	Estimator's Judgement
	Prepare and Compact Subgrade	DAY	10	\$3,500.00	\$35,000.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Furnish and Install Geotextile Fabric	SF	48,000	\$1.00	\$48,000.00	Estimator's Judgement
	Furnish Riprap Bedding Stone	TON	1,200	\$29.27	\$35,124.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap Bedding Stone	DAY	12	\$3,500.00	\$42,000.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Furnish Riprap	TON	1,900	\$29.61	\$56,259.00	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap	DAY	19	\$3,500.00	\$66,500.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Trucking & Disposal Allowance	TRK	300	\$200.00	\$60,000.00	Estimator's Judgement
					\$368,883.00	
	Calculate Bid Unit Cost	LS	1		\$368,883.00	
7	Utility Penetrations					
	Utility Penetrations	EA	5	\$25,000.00	\$125,000.00	Estimator's Judgement
					\$125,000.00	
	Calculate Bid Unit Cost	LS	1		\$125,000.00	
8	John Murphy Drive Gate					
	John Murphy Drive Gate	EA	1	\$250,000.00	\$250,000.00	Estimator's Judgement, Concrete Abutments with Steel Gate Assumed.
					\$250,000.00	
	Calculate Bid Unit Cost	LS	1		\$250,000.00	
9	Drainage Improvements					
9A	Manholes					
	Demolish and Remove Existing Manholes	DAY	0	\$3,500.00	\$0.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Furnish New Manholes	EA	10	\$1,500.00	\$15,000.00	Estimator's Judgement
	Excavation for New Manholes	CY	500	\$50.00	\$25,000.00	Estimator's Judgement, Assume Hand-Excavation Around Exist. Utilities
	Install New Manholes	DAY	10	\$3,500.00	\$35,000.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Furnish Manhole Brick, Concrete Risers, and Mortar	LS	10	\$1,000.00	\$10,000.00	Estimator's Judgement
	Raise Manholes	DAY	0	\$3,500.00	\$0.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Furnish Gravel Borrow (Assume 1/2 of Exc. Volume)	TON	200	\$18.11	\$3,622.00	Per Tilcon Connecticut x 1.15 Mark-up
	Backfill and Compaction	CY	250	\$25.00	\$6,250.00	Estimator's Judgement
	Trucking & Disposal Allowance	TRK	50	\$200.00	\$10,000.00	Estimator's Judgement
					\$104,872.00	
	Calculate Bid Unit Cost	LS	1		\$104,872.00	

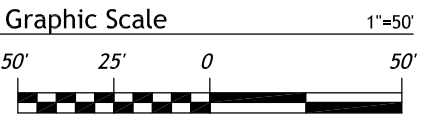
Table A-2.1
Budget-Level Cost Estimate
Alternative No. 2 - Flood Proofing Barrier, Area E
Alternatives Evaluation Report
City of New Haven, CT

Bid Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
9B	High Capacity Mobile Pumps Furnish High Capacity Mobile Pumps	EA	10	\$115,000.00	\$1,150,000.00	Written Quote from Power Prime x 1.15
	Calculate Bid Unit Cost	LS	1		\$1,150,000.00	
9C	Stormwater Treatment and Drainage Outfalls F&I Drainage Filtration System	EA	3	\$115,000.00	\$345,000.00	Estimator's Judgement
	Drainage Outfall Structures	EA	5	\$75,000.00	\$375,000.00	Estimator's Judgement
	Calculate Bid Unit Cost	LS	1		\$720,000.00	
10	Compensatory Floodplain Storage Bulk Excavation for Floodplain Storage Basin	CY	180,000	\$5.00	\$900,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	22	\$3,500.00	\$77,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Trucking and Disposal Allowance	TRK	18,000	\$200.00	\$3,600,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Calculate Bid Unit Cost	LS	1		\$4,577,000.00	
11	Site Restoration Furnish Loam	CY	1,350	\$20.00	\$27,000.00	Estimator's Judgment
	Place Loam	CY	1,350	\$10.00	\$13,500.00	Estimator's Judgment
	Hydroseed Landward Slope & Disturbed Areas	SF	75,000	\$0.50	\$37,500.00	Estimator's Judgment
	Furnish New Fencing	LF	500	\$40.00	\$20,000.00	Estimator's Judgment
	Furnish New Gates	EA	4	\$2,000.00	\$8,000.00	Estimator's Judgment
	Install New Fencing & Gates	DAY	8	\$3,500.00	\$28,000.00	Assume 1 Supervisor, 1 Operator, 2 Laborers, and Materials & Equipment
	Calculate Bid Unit Cost	LS	1		\$134,000.00	
12	Demobilization and Clean-up Demobilization and Clean-up	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
	SUBTOTAL				\$10,356,922.45	Sum of Bid Items 1-12
	Scope and Budget Contingencies				\$2,589,230.61	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$77,676.92	Assume @ 0.75%
	Permitting				\$51,784.61	Assume @ 0.50%
	Plans, Specifications, and Engineering				\$258,923.06	Assume @ 2.5%
	Construction Phase Services				\$258,923.06	Assume @ 2.5%
	TOTAL ESTIMATE (2016 USD)				\$13,600,000.00	Rounded to the Nearest \$100,000.00
	Flood Proofing Cost Per SF of Existing Building Footprint Protected				\$60.00	For a protected existing building footprint area of 228,000 SF
	Flood Proofing Cost Per LF of Barrier				\$6,800.00	For a barrier length of 2,000 LF

**Alternative No. 3
Elevated Development**



PLAN
SCALE: 1" = 50'



rtg **RT Group, Inc.**
 Engineered from the Ground UpSM
 70 Romano Vineyard Way, Suite 134
 North Kingstown, Rhode Island 02852
 T 401 438 3100 F 401 294 9806

DAM SAFETY - WATERFRONT - CONSTRUCTION ENGINEERING - GEOTECHNICAL
 GEO-ENVIRONMENTAL - STRUCTURAL - CIVIL

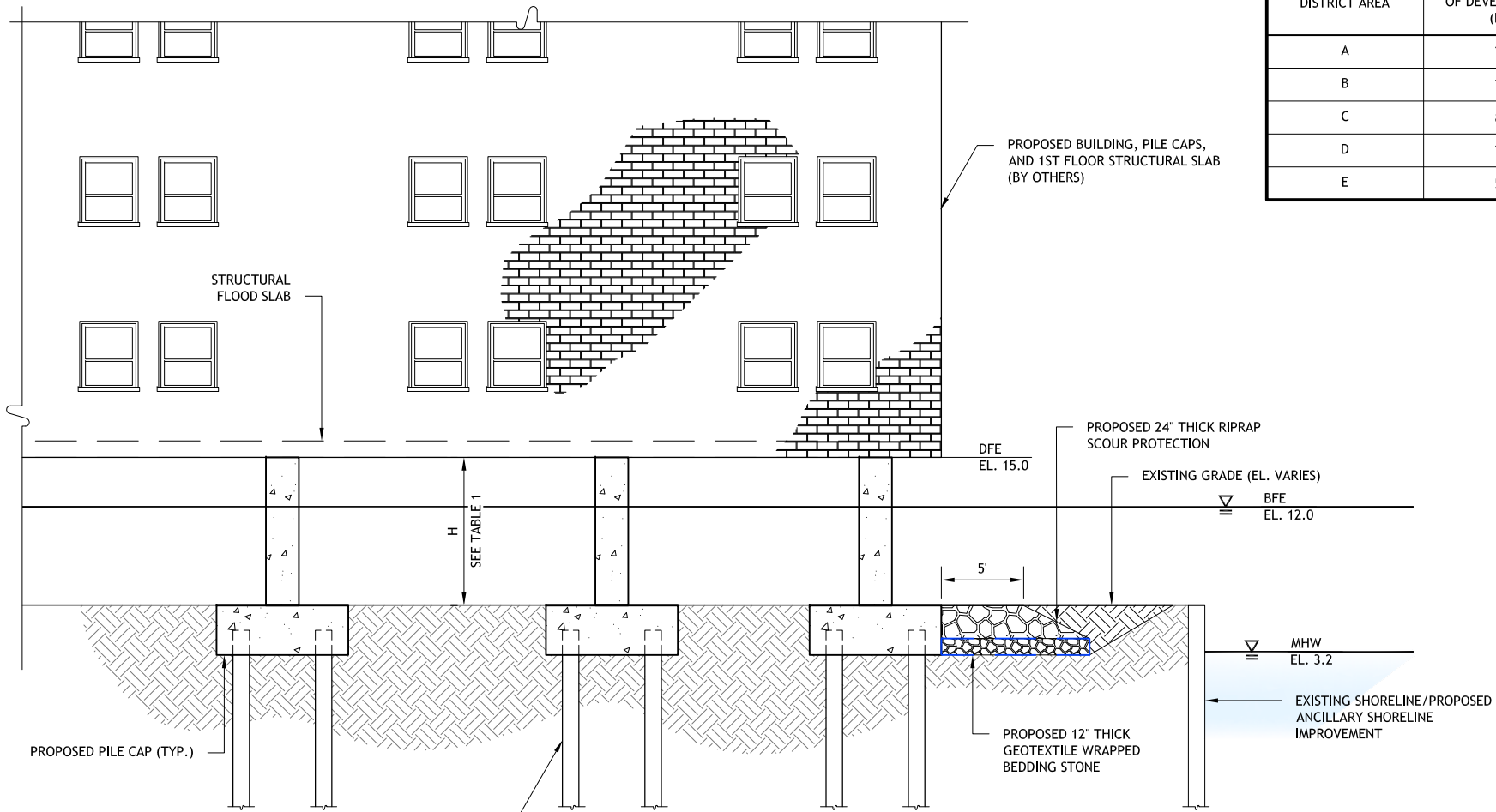
City of New Haven
 CONNECTICUT

**MILL RIVER DISTRICT
 SHORELINE ANALYSIS
 ALTERNATIVES EVALUATION
 REPORT**
 New Haven, Connecticut

**FIGURE A-3a
 ALTERNATIVE NO. 3**

SHEET 5 of 10
 DATE: DEC 2016
 PROJ No. 15103.00

TABLE 2 ESTIMATED HEIGHT OF DEVELOPMENT	
DISTRICT AREA	H (ESTIMATED HEIGHT OF DEVELOPMENT) (FT)
A	7±
B	7±
C	8±
D	7±
E	5±



SECTION C
SCALE: 1" = 10'-0"
Fig A-3a

Table A-3.1
Budget-Level Cost Estimate
Alternative No. 3 - Elevated Development, Areas A, B, or D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Steel Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Electrical, Mechanical, and HVAC Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$32,470.45	\$32,470.45	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$46,470.45	
	Calculate Bid Unit Cost	LS	1		\$46,470.45	
2	Mobilization					
	Mobilization	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	2	\$90.00	\$135.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	2	\$200.00	\$300.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	2	\$300.00	\$600.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Compressive Strength	EA	20	\$100.00	\$2,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$3,035.00	
	Calculate Bid Unit Cost	LS	1		\$3,035.00	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Demolish and Remove Existing Structures	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Cut Down and Remove Vegetation	DAY	2	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Grub Out and Remove Stumps	DAY	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Strip and Stockpile Topsoil	CY	400	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Trucking and Disposal Allowance	TRK	40	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
6	Pile Supported Foundation					
	Excavate for Pile Caps	CY	950	\$10.00	\$9,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Granular Fill Material for Leveling Pad	TON	250	\$18.11	\$4,527.50	Per Tilcon Connecticut x 1.15 Mark-up
	Place and Compact Granular Backfill Material	CY	140	\$10.00	\$1,400.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish HP12x53 Piles (4 Piles/Cap x 66 Caps x 65-foot-long)	LF	17,160	\$30.08	\$516,172.80	Written Quote from Raymond Piling x 1.15 for Mark-Up
	Furnish Champion Splice	EA	0	\$115.00	\$0.00	Written Quote from Raymond Piling x 1.15 for Mark-Up
	Install Champion Splice	EA	0	\$400.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Install H-Piles	LF	17,160	\$50.00	\$858,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Perform Static Pile Load Test	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	PDA Testing on 10% of Production Piles	DAY	4	\$2,300.00	\$9,200.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	CAPWAPs	EA	26	\$287.50	\$7,475.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Form and Pour Pile Caps	CY	470	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Form and Pour Main Columns at Caps to Support Building	CY	70	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Form and Pour 1st Floor Beams and Structural Slab	CY	600	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$1,456,275.30	
	Calculate Bid Unit Cost	LS	1		\$1,456,275.30	

Table A-3.1
Budget-Level Cost Estimate
Alternative No. 3 - Elevated Development, Areas A, B, or D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
7	Riprap Scour Protection					
	Excavate for Riprap Scour Protection	CY	310	\$10.00	\$3,100.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Prepare and Compact Subgrade	DAY	1	\$3,500.00	\$3,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish and Install Geotextile Fabric	SF	5,800	\$1.00	\$5,800.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap Bedding Stone	TON	150	\$29.27	\$4,390.50	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap Bedding Stone	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap	TON	227	\$29.61	\$6,721.47	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
				\$37,511.97		
	Calculate Bid Unit Cost	LS	1		\$37,511.97	
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	70	\$10.00	\$700.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$7,700.00	
	Calculate Bid Unit Cost	LS	1		\$7,700.00	
9	Site Restoration					
	Furnish Loam	CY	0	\$20.00	\$0.00	Assume part of overall Project Development Costs
	Place Loam	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
	Furnish and Install Seed	SF	0	\$0.50	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
10	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
SUBTOTAL					\$1,669,992.72	Sum of Items 1-10
	Scope and Budget Contingencies			\$417,498.18	Scope and Budget Contingencies @ 25%	
	Subsurface Investigation			\$41,749.82	Assume @ 2.5%	
	Permitting			\$41,749.82	Assume @ 2.5%	
	Plans, Specifications, and Engineering			\$83,499.64	Assume @ 5.0%	
	Construction Phase Services			\$166,999.27	Assume @ 10.0%	
TOTAL ESTIMATE (2016 USD)					\$2,500,000.00	Rounded to the Nearest \$100,000.00

Flood Proofing Cost Per SF of Building Footprint

\$125.00 For a Hypothetical Building Footprint of 20,000 SF

Table A-3.2
Budget-Level Cost Estimate
Alternative No. 3 - Elevated Development, Area C
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Steel Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Electrical, Mechanical, and HVAC Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$32,474.22	\$32,474.22	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$46,474.22	
	Calculate Bid Unit Cost	LS	1		\$46,474.22	
2	Mobilization					
	Mobilization	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	2	\$90.00	\$135.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	2	\$200.00	\$300.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	2	\$300.00	\$600.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Compressive Strength	EA	20	\$100.00	\$2,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$3,035.00	
	Calculate Bid Unit Cost	LS	1		\$3,035.00	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Assume part of overall Project Development Costs
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Demolish and Remove Existing Structures	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Cut Down and Remove Vegetation	DAY	2	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Grub Out and Remove Stumps	DAY	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Strip and Stockpile Topsoil	CY	400	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Trucking and Disposal Allowance	TRK	40	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
6	Pile Supported Foundation					
	Excavate for Pile Caps	CY	950	\$10.00	\$9,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Granular Fill Material for Leveling Pad	TON	250	\$18.11	\$4,527.50	Per Tilcon Connecticut x 1.15 Mark-up
	Place and Compact Granular Backfill Material	CY	140	\$10.00	\$1,400.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish HP12x53 Piles (4 Piles/Cap x 66 Caps x 65-feet-long)	LF	17,160	\$30.08	\$516,172.80	Written Quote from Raymond Piling x 1.15 for Mark-Up
	Furnish Champion Splice	EA	0	\$115.00	\$0.00	Written Quote from Raymond Piling x 1.15 for Mark-Up
	Install Champion Splice	EA	0	\$400.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Install H-Piles	LF	17,160	\$50.00	\$858,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Perform Static Pile Load Test	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	PDA Testing on 10% of Production Piles	DAY	4	\$2,300.00	\$9,200.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	CAPWAPs	EA	26	\$287.50	\$7,475.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Form and Pour Pile Caps	CY	470	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Form and Pour Main Columns at Caps to Support Building	CY	80	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Form and Pour 1st Floor Beams and Structural Slab	CY	600	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$1,456,275.30	
	Calculate Bid Unit Cost	LS	1		\$1,456,275.30	

Table A-3.2
Budget-Level Cost Estimate
Alternative No. 3 - Elevated Development, Area C
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
7	Riprap Scour Protection					
	Excavate for Riprap Scour Protection	CY	310	\$10.00	\$3,100.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Prepare and Compact Subgrade	DAY	1	\$3,500.00	\$3,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish and Install Geotextile Fabric	SF	5,800	\$1.00	\$5,800.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap Bedding Stone	TON	150	\$29.27	\$4,390.50	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap Bedding Stone	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap	TON	230	\$29.61	\$6,810.30	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$37,600.80	
	Calculate Bid Unit Cost	LS	1		\$37,600.80	
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	80	\$10.00	\$800.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$7,800.00	
	Calculate Bid Unit Cost	LS	1		\$7,800.00	
9	Site Restoration					
	Furnish Loam	CY	0	\$20.00	\$0.00	Assume part of overall Project Development Costs
	Place Loam	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
	Furnish and Install Seed	SF	0	\$0.50	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
10	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
	SUBTOTAL				\$1,670,185.32	Sum of Items 1-10
	Scope and Budget Contingencies				\$417,546.33	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$41,754.63	Assume @ 2.5%
	Permitting				\$41,754.63	Assume @ 2.5%
	Plans, Specifications, and Engineering				\$100,211.12	Assume @ 6.0%
	Construction Phase Services				\$167,018.53	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$2,500,000.00	Rounded to the Nearest \$100,000.00

Flood Proofing Cost Per SF of Building Footprint

\$125.00 For a Hypothetical Building Footprint of 20,000 SF

Table A-3.3
Budget-Level Cost Estimate
Alternative No. 3 - Elevated Development, Area E
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Steel Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Electrical, Mechanical, and HVAC Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$32,386.13	\$32,386.13	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$43,886.13	
	Calculate Bid Unit Cost	LS	1		\$43,886.13	
2	Mobilization					
	Mobilization	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	2	\$90.00	\$135.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	2	\$200.00	\$300.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	0.28	\$300.00	\$84.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Compressive Strength	EA	20	\$100.00	\$2,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$2,519.00	
	Calculate Bid Unit Cost	LS	1		\$2,519.00	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Assume part of overall Project Development Costs
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Demolish and Remove Existing Structures	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Cut Down and Remove Vegetation	DAY	2	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Grub Out and Remove Stumps	DAY	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Strip and Stockpile Topsoil	CY	400	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Trucking and Disposal Allowance	TRK	40	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
6	Pile Supported Foundation					
	Excavate for Pile Caps	CY	950	\$10.00	\$9,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Granular Fill Material for Leveling Pad	TON	250	\$18.11	\$4,527.50	Per Tilcon Connecticut x 1.15 Mark-up
	Place and Compact Granular Backfill Material	CY	140	\$10.00	\$1,400.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish HP12x53 Piles (4 Piles/Cap x 66 Caps x 65-feet-long)	LF	17,160	\$30.08	\$516,172.80	Written Quote from Raymond Piling x 1.15 for Mark-Up
	Furnish Champion Splice	EA	0	\$115.00	\$0.00	Written Quote from Raymond Piling x 1.15 for Mark-Up
	Install Champion Splice	EA	0	\$400.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Install H-Piles	LF	17,160	\$50.00	\$858,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Perform Static Pile Load Test	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	PDA Testing on 10% of Production Piles	DAY	4	\$2,300.00	\$9,200.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	CAPWAPs	EA	26	\$287.50	\$7,475.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Form and Pour Pile Caps	CY	470	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Form and Pour Main Columns at Caps to Support Building	CY	50	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Form and Pour 1st Floor Beams and Structural Slab	CY	600	\$0.00	\$0.00	Assume part of overall Project Development Costs
					\$1,456,275.30	
	Calculate Bid Unit Cost	LS	1		\$1,456,275.30	

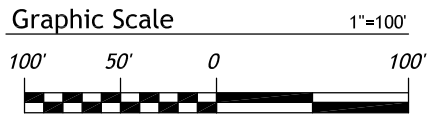
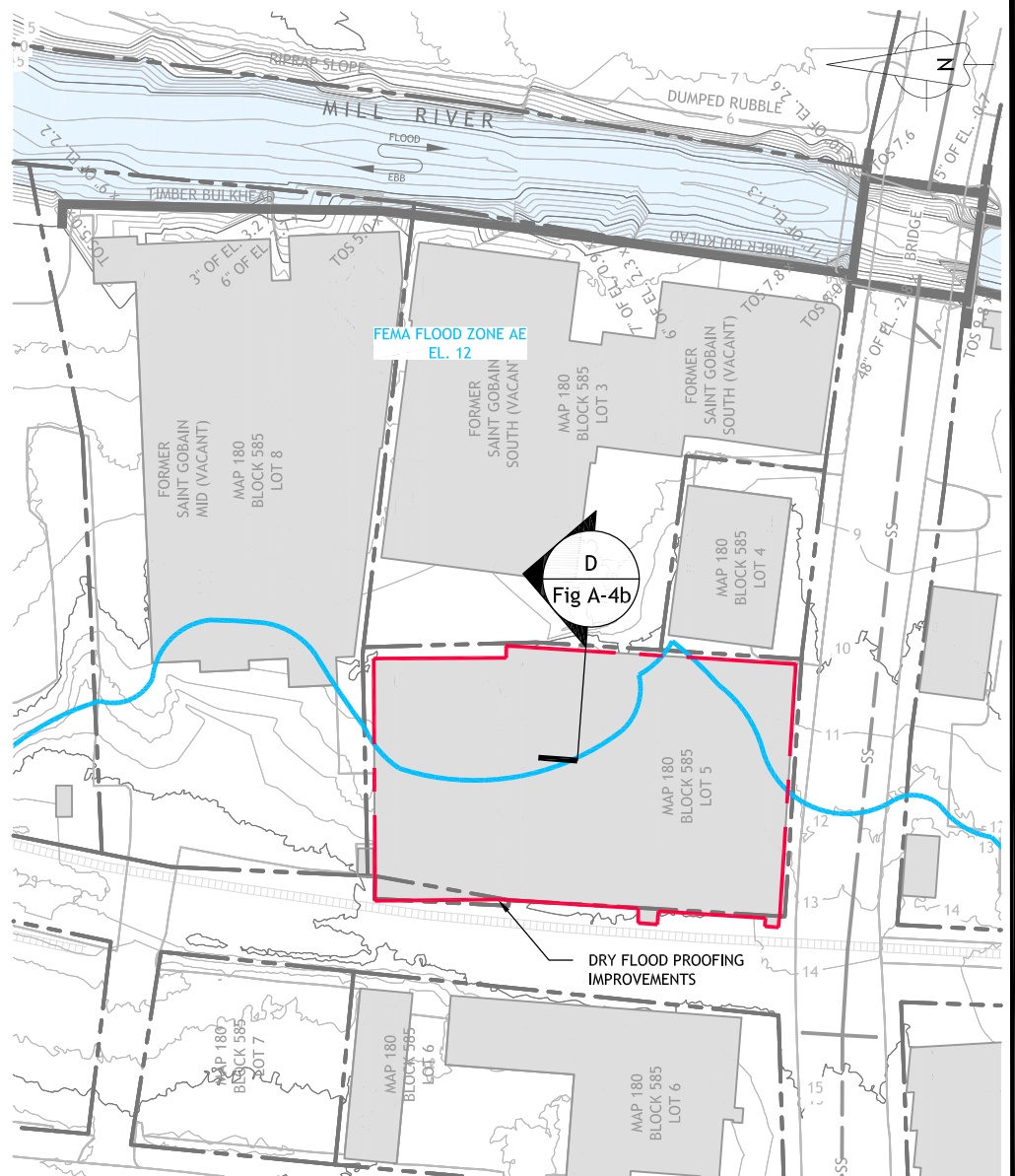
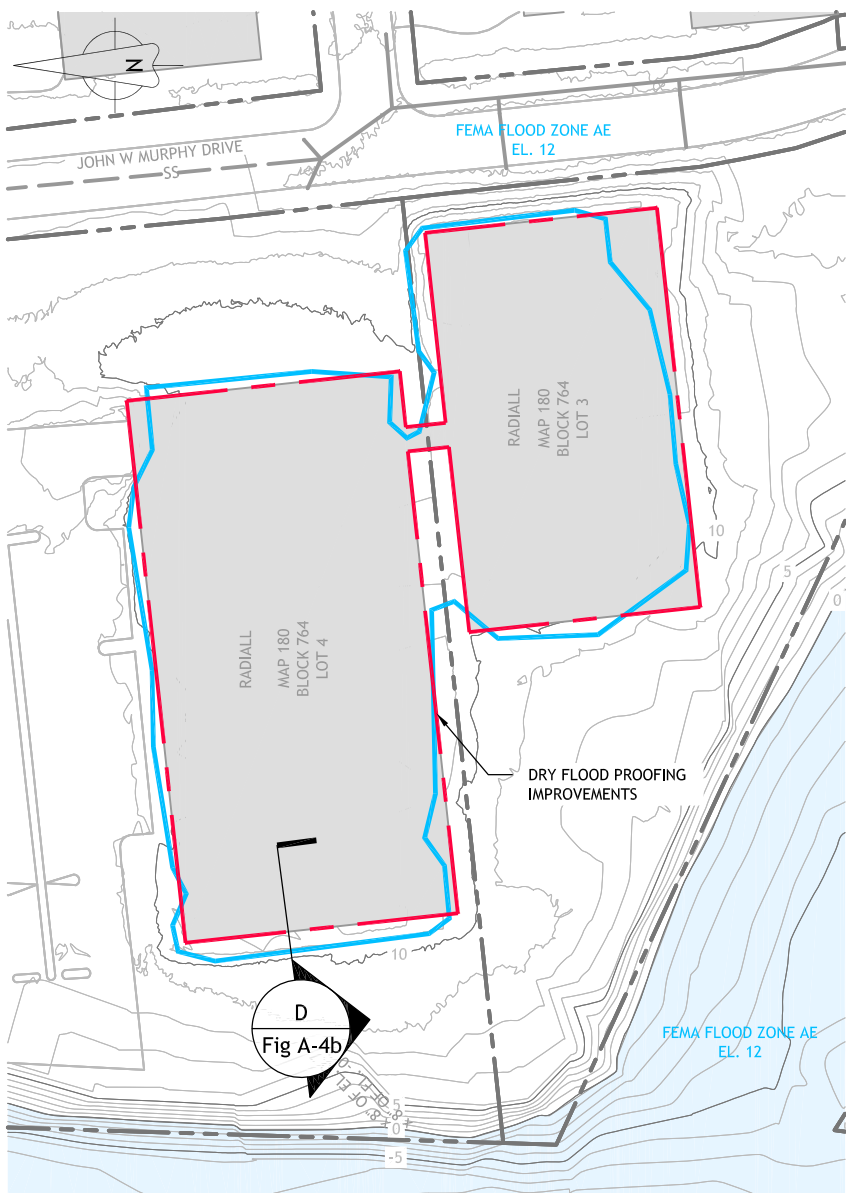
Table A-3.3
Budget-Level Cost Estimate
Alternative No. 3 - Elevated Development, Area E
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
7	Riprap Scour Protection					
	Excavate for Riprap Scour Protection	CY	310	\$10.00	\$3,100.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Prepare and Compact Subgrade	DAY	1	\$3,500.00	\$3,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish and Install Geotextile Fabric	SF	5,800	\$1.00	\$5,800.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap Bedding Stone	TON	150	\$29.27	\$4,390.50	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap Bedding Stone	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Furnish Riprap	TON	227	\$29.61	\$6,721.47	Per Tilcon Connecticut x 1.15 Mark-up
	Install Riprap	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$37,511.97	
	Calculate Bid Unit Cost	LS	1		\$37,511.97	
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	50	\$10.00	\$500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	1	\$3,500.00	\$3,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$4,000.00	
	Calculate Bid Unit Cost	LS	1		\$4,000.00	
9	Site Restoration					
	Furnish Loam	CY	0	\$20.00	\$0.00	Assume part of overall Project Development Costs
	Place Loam	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
	Furnish and Install Seed	SF	0	\$0.50	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
10	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
	SUBTOTAL				\$1,663,192.40	Sum of Items 1-10
	Scope and Budget Contingencies				\$415,798.10	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$41,579.81	Assume @ 2.5%
	Permitting				\$41,579.81	Assume @ 2.5%
	Plans, Specifications, and Engineering				\$99,791.54	Assume @ 6.0%
	Construction Phase Services				\$166,319.24	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$2,500,000.00	Rounded to the Nearest \$100,000.00

Flood Proofing Cost Per SF of Building Footprint

\$125.00 For a Hypothetical Building Footprint of 20,000 SF

**Alternative No. 4
Dry Flood Proofing**



rtg **RT Group, Inc.**
 Engineered from the Ground UpSM
 458 Grand Avenue, Suite 213
 New Haven, Connecticut 06513
 T 203 823 9932 F 401 294 9806

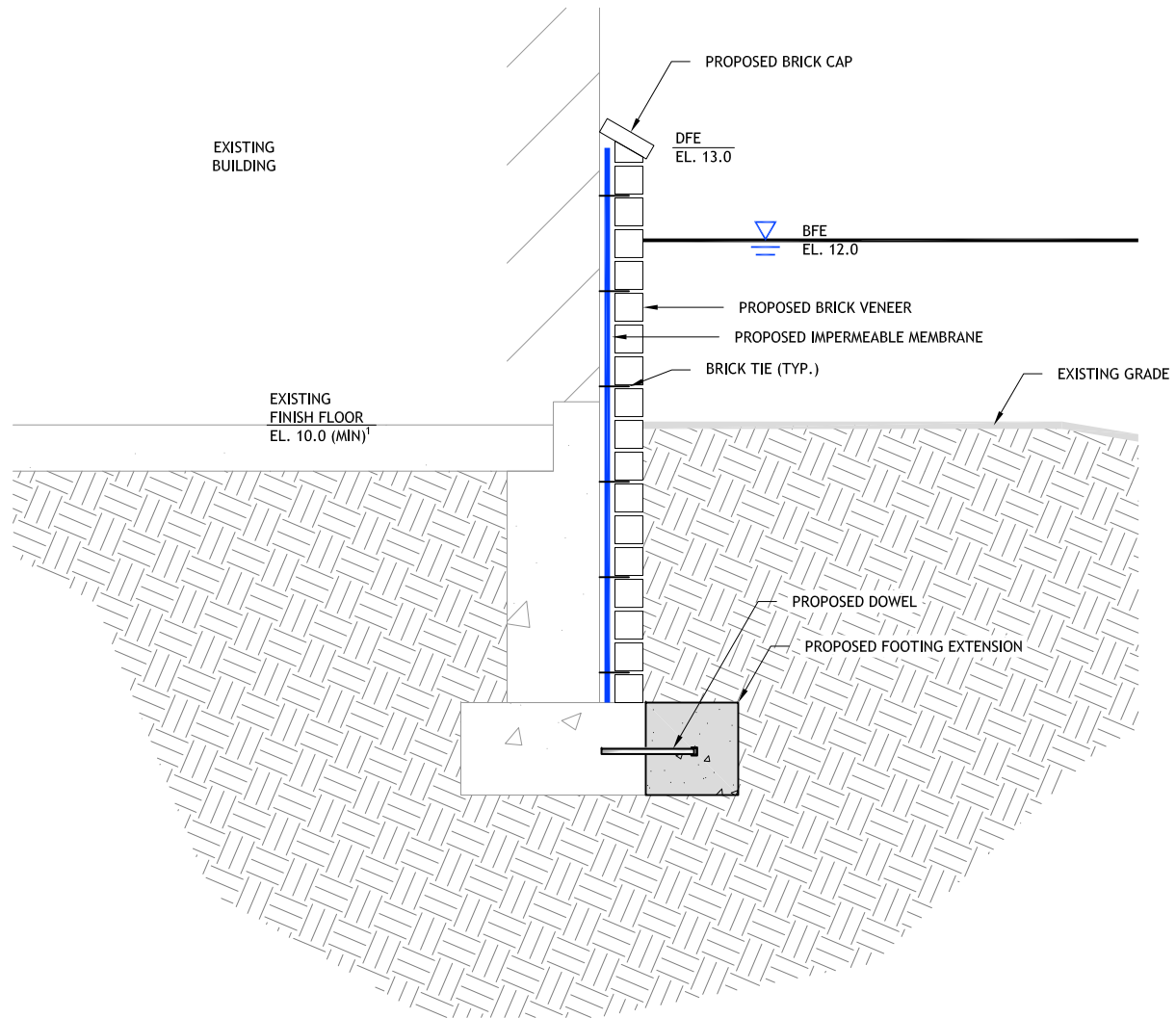
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 GEO-ENVIRONMENTAL - STRUCTURAL - CIVIL

City of New Haven
 CONNECTICUT

**MILL RIVER DISTRICT
 SHORELINE ANALYSIS**
 ALTERNATIVES EVALUATION
 REPORT
 New Haven, Connecticut

**FIGURE A-4a
 ALTERNATIVE NO. 4**

SHEET 7 of 10
 DATE DEC 2016
 PROJ No. 15103.00



NOTES:

1. FEMA RECOMMENDS THAT DRY FLOOD PROOFING ONLY BE CONSIDERED FOR UP TO 3 FEET OF ANTICIPATED FLOODING (MAX) DUE TO THE HIGH EXTERNAL HYDROSTATIC PRESSURES APPLIED TO THE BUILDING FROM FLOOD WATERS.
2. THE EXISTING BUILDING FOUNDATION SHOWN WAS ASSUMED FOR THE PURPOSES OF ESTIMATING QUANTITIES.

SECTION D
SCALE: 1" = 2'-0" Fig A-4a



RT Group, Inc.
Engineered from the Ground UpSM
70 Romano Vineyard Way, Suite 134
North Kingstown, Rhode Island 02852
T 401 438 3100 F 401 294 9806

DAM SAFETY · WATERFRONT · CONSTRUCTION ENGINEERING · GEOTECHNICAL
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City of New Haven
CONNECTICUT



**MILL RIVER DISTRICT
SHORELINE ANALYSIS
ALTERNATIVES EVALUATION
REPORT**
New Haven, Connecticut

**FIGURE A-4b
ALTERNATIVE NO. 4**

SHEET 8 of 10
DATE
DEC 2016
PROJ No.
15103.00

Table A-4.1
Budget-Level Cost Estimate
Alternative No. 4 - Dry Flood Proofing, Area B
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Rebar Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	4	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$6,594.23	\$6,594.23	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$18,594.23	
	Calculate Bid Unit Cost	LS	1		\$18,594.23	
2	Mobilization					
	Mobilization	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	0	\$90.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	0	\$200.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Compressive Strength	EA	6	\$100.00	\$600.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$600.00	
	Calculate Bid Unit Cost	LS	1		\$600.00	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Strip and Stockpile Existing Topsoil	CY	120	\$10.00	\$1,200.00	Estimator's Judgement
					\$1,200.00	
	Calculate Bid Unit Cost	LS	1		\$1,200.00	
6	Dry Flood Proofing					
	Excavate Down to Base of Membrane	CY	530	\$10.00	\$5,300.00	Excavate down to base of footing
	Drill and Grout Dowels for Foundation Extension	EA	750	\$50.00	\$37,500.00	Assume 12" o.c.
	Form and Pour Foundation Extension	CY	30	\$750.00	\$22,500.00	Assume 12" square
	F&I Polyethylene Membrane	SF	4,500	\$3.04	\$13,701.75	Per R.S. Means 2010 Escalated to 2016 \$
	F&I Brick Veneer	SF	4,500	\$18.75	\$84,359.79	Per R.S. Means 2010 Escalated to 2016 \$
	F&I Brick Veneer Ties into Existing Foundation	SF	4,500	\$1.00	\$4,500.00	Estimator's Judgement
	Backfill and Compaction	CY	530	\$25.00	\$13,250.00	Estimator's Judgement, Onsite Material Assumed
	F&I Opening Seals	EA	6	\$2,500.00	\$15,000.00	Estimator's Judgement
	F&I Check Valves in Existing Utilities	EA	2	\$5,000.00	\$10,000.00	Estimator's Judgement
					\$206,111.54	
	Calculate Bid Unit Cost	LS	1		\$206,111.54	
7	Site Restoration					
	Place Topsoil	CY	120	\$15.00	\$1,800.00	Estimator's Judgement, Onsite Material Assumed
	F&I Seed	SF	5,000	\$0.50	\$2,500.00	Estimator's Judgement
	Restore Paved Areas	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
					\$19,300.00	
	Calculate Bid Unit Cost	LS	1		\$19,300.00	

Table A-4.1
Budget-Level Cost Estimate
Alternative No. 4 - Dry Flood Proofing, Area B
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	2,000	\$10.00	\$20,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	1	\$3,500.00	\$3,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Trucking and Disposal Allowance (assume soil is not contaminated)	TRK	200	\$200.00	\$40,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$63,500.00	
	Calculate Bid Unit Cost	LS	1		\$63,500.00	
9	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$10,000.00	
	Calculate Bid Unit Cost	LS	1		\$10,000.00	
	SUBTOTAL				\$348,305.78	Sum of Items 1-8
	Scope and Budget Contingencies				\$87,076.44	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$0.00	Assume @ 0.0%
	Permitting				\$20,898.35	Assume @ 6.0%
	Plans, Specifications, and Engineering				\$26,122.93	Assume @ 7.5%
	Construction Phase Services				\$34,830.58	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$600,000.00	Rounded to the Nearest \$100,000.00
	Flood Proofing Cost Per SF of Building Footprint				\$20.00	For a Building Footprint of 29,700 SF
	Flood Proofing Cost Per LF of Building Perimeter				\$800.00	For a Building Perimeter of 750 LF

Table A-4.2
Budget-Level Cost Estimate
Alternative No. 4 - Dry Flood Proofing, Area E
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Steel Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	4	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$14,102.63	\$14,102.63	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$26,102.63	
	Calculate Bid Unit Cost	LS	1		\$26,102.63	
2	Mobilization					
	Mobilization	LS	1	\$20,000.00	\$20,000.00	Estimator's Judgment, Related to Flood Proofing Alternative Only
					\$20,000.00	
	Calculate Bid Unit Cost	LS	1		\$20,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	0	\$90.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Moisture Density Relationship	EA	0	\$200.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Dry-Density and As-Placed Moisture Content	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Concrete Compressive Strength	EA	6	\$100.00	\$600.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$600.00	
	Calculate Bid Unit Cost	LS	1		\$600.00	
4	Erosion and Sedimentation Controls					
	Silt Fence/Baled Hay Erosion Check	LF	500	\$8.00	\$4,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Construction Entrance	EA	1	\$15,000.00	\$15,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$19,000.00	
	Calculate Bid Unit Cost	LS	1		\$19,000.00	
5	Demolition, Clearing, and Removal					
	Strip and Stockpile Existing Topsoil	CY	230	\$10.00	\$2,300.00	Assume part of overall Project Development Costs
					\$2,300.00	
	Calculate Bid Unit Cost	LS	1		\$2,300.00	
6	Dry Flood Proofing					
	Excavate Down to Base of Membrane	CY	1,060	\$10.00	\$10,600.00	Excavate down to 1 foot below floor slab (El. 9 +/-)
	Drill and Grout Dowels for Foundation Extension	EA	1,530	\$50.00	\$76,500.00	Assume 12" o.c.
	Form and Pour Foundation Extension	CY	60	\$750.00	\$45,000.00	Assume 12" square
	F&I Polyethylene Membrane	SF	9,200	\$3.04	\$28,012.47	Per R.S. Means 2010 Escalated to 2016 \$
	F&I Brick Veneer	SF	9,200	\$18.75	\$172,468.91	Per R.S. Means 2010 Escalated to 2016 \$
	F&I Brick Veneer Ties into Existing Foundation	SF	9,200	\$1.00	\$9,200.00	Estimator's Judgement
	Backfill and Compaction	CY	1,060	\$25.00	\$26,500.00	Estimator's Judgement, Onsite Material Assumed
	F&I Opening Seals	EA	10	\$2,500.00	\$25,000.00	Estimator's Judgement
	F&I Check Valves in Existing Utilities	EA	2	\$5,000.00	\$10,000.00	Estimator's Judgement
					\$403,281.38	
	Calculate Bid Unit Cost	LS	1		\$403,281.38	
7	Site Restoration					
	Place Topsoil	CY	230	\$15.00	\$3,450.00	Estimator's Judgement, Onsite Material Assumed
	F&I Seed	SF	10,000	\$0.50	\$5,000.00	Estimator's Judgement
	Restore Paved Areas	LS	1	\$3,000.00	\$3,000.00	Estimator's Judgement
					\$11,450.00	
	Calculate Bid Unit Cost	LS	1		\$11,450.00	

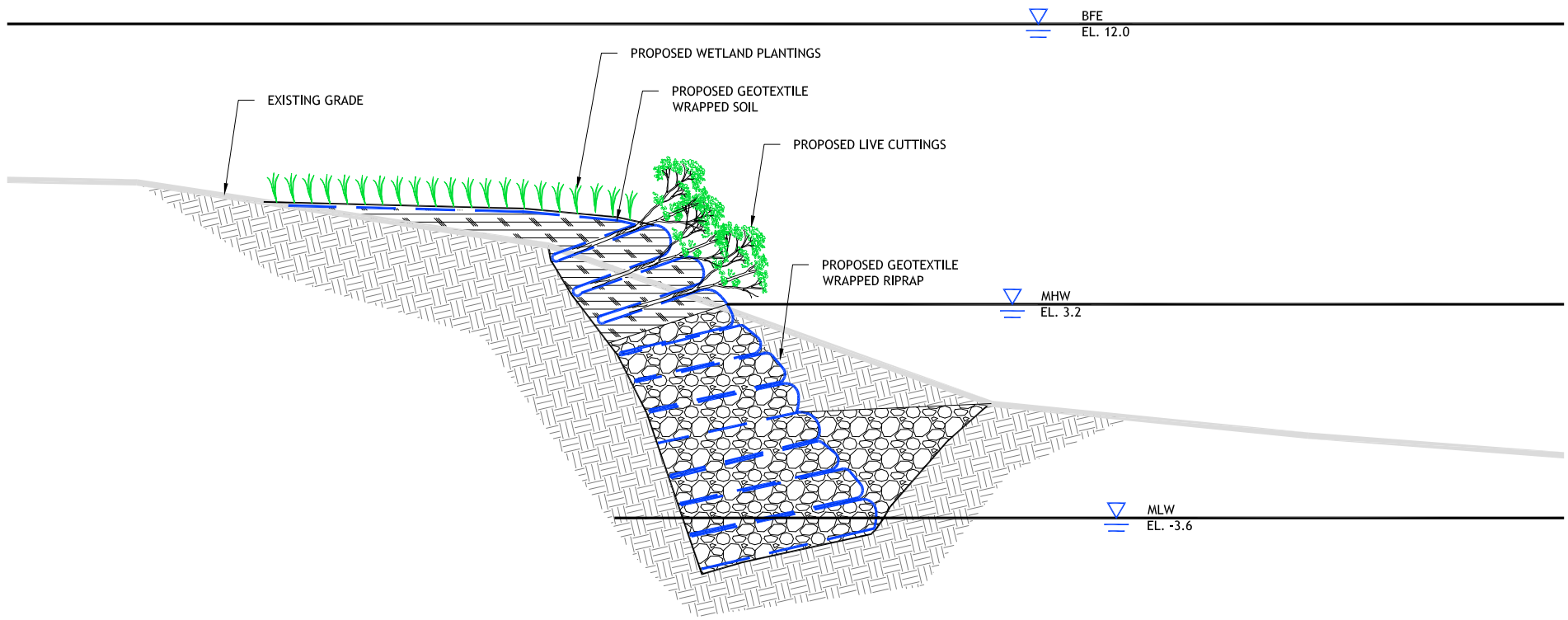
Table A-4.2
Budget-Level Cost Estimate
Alternative No. 4 - Dry Flood Proofing, Area E
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
8	Compensatory Floodplain Storage					
	Excavate Floodplain Storage Basin	CY	7,500	\$10.00	\$75,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Grade and Shape Basin	DAY	1	\$3,500.00	\$3,500.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
	Trucking and Disposal Allowance (assume soil is not contaminated)	TRK	750	\$200.00	\$150,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$228,500.00	
	Calculate Bid Unit Cost	LS	1		\$228,500.00	
9	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$20,000.00	\$20,000.00	Estimator's Judgement, Related to Flood Proofing Alternative Only
					\$20,000.00	
	Calculate Bid Unit Cost	LS	1		\$20,000.00	
	SUBTOTAL				\$731,234.01	Sum of Items 1-8
	Scope and Budget Contingencies				\$182,808.50	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$0.00	Assume @ 0.0%
	Permitting				\$43,874.04	Assume @ 6.0%
	Plans, Specifications, and Engineering				\$54,842.55	Assume @ 7.5%
	Construction Phase Services				\$73,123.40	Assume @ 10%
	TOTAL ESTIMATE (2016 USD)				\$1,100,000.00	Rounded to the Nearest \$100,000.00

Flood Proofing Cost Per SF of Building Footprint
Flood Proofing Cost Per LF of Building Perimeter

\$20.00 For a Building Footprint of 65,700 SF
\$720.00 For a Building Perimeter of 1,530 LF

**Potential Ancillary Improvements
Living Shoreline Treatment**



SECTION
SCALE: 1" = 5'-0"



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City of New Haven
CONNECTICUT



**MILL RIVER DISTRICT
SHORELINE ANALYSIS**
ALTERNATIVES EVALUATION
REPORT
New Haven, Connecticut

**FIGURE A-5
VEGETATED GEOGRID
SHORELINE TREATMENT**

SHEET 9 of 10
DATE DEC 2016
PROJ No. 15103.00

Table A-5.1
Budget-Level Construction Cost Estimate
Ancillary Improvements - Vegetated Geogrid Shoreline Treatment, Area A
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$5,772.00	\$5,772.00	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$14,772.00	
	Calculate Bid Unit Cost	LS	1		\$14,772.00	
2	Mobilization					
	Mobilization	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
					\$15,000.00	
	Calculate Bid Unit Cost	LS	1		\$15,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	0	\$90.00	\$0.00	Estimator's Judgement
	Moisture Density Relationship	EA	0	\$200.00	\$0.00	Estimator's Judgement
	Dry-Density and As-Placed Moisture Content	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
4	Erosion and Sedimentation Controls					
	Floating Turbidity Barrier	LF	600	\$40.00	\$24,000.00	Estimator's Judgement
	Construction Entrance	EA	1	\$0.00	\$0.00	Estimator's Judgement
					\$24,000.00	
	Calculate Bid Unit Cost	LS	1		\$24,000.00	
5	Demolition, Clearing, and Removal					
	Strip and Stockpile Topsoil	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$5,000.00	
	Calculate Bid Unit Cost	LS	1		\$5,000.00	
6	Vegetated Geogrid Shoreline Treatment					
	Excavate for Improvements	CY	1,440	\$10.00	\$14,400.00	Estimator's Judgement
	F&I High Organic Matter Soil Amendment	ACRE	0.2	\$20,000.00	\$4,000.00	Estimator's Judgement
	F&I Plantings	ACRE	0.2	\$16,000.00	\$3,200.00	Estimator's Judgement
	F&I Geotextile Fabric	SF	78,000	\$1.00	\$78,000.00	Estimator's Judgement
	Furnish Riprap	TON	2,000	\$30.00	\$60,000.00	Estimator's Judgement
	Install Riprap	DAY	20	\$3,500.00	\$70,000.00	Estimator's Judgement
					\$229,600.00	
	Calculate Bid Unit Cost	LS	1		\$229,600.00	
7	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
					\$15,000.00	
	Calculate Bid Unit Cost	LS	1		\$15,000.00	
	SUBTOTAL				\$303,372.00	Sum of Items 1-7
	Scope and Budget Contingencies				\$75,843.00	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$15,168.60	Assume @ 5.0%
	Permitting				\$30,337.20	Assume @ 10.0%
	Plans, Specifications, and Engineering				\$30,337.20	Assume @ 10.0%
	Construction Phase Services				\$30,337.20	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$500,000.00	Rounded to the Nearest \$100,000.00

Living Shoreline Cost Per LF of Shoreline

\$840.00 For a Shoreline Length of 600 LF

Table A-5.2
Budget-Level Construction Cost Estimate
Ancillary Improvements - Vegetated Geogrid Shoreline Treatment, Area B
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$4,964.00	\$4,964.00	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$13,964.00	
	Calculate Bid Unit Cost	LS	1		\$13,964.00	
2	Mobilization					
	Mobilization	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
					\$15,000.00	
	Calculate Bid Unit Cost	LS	1		\$15,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	0	\$90.00	\$0.00	Estimator's Judgement
	Moisture Density Relationship	EA	0	\$200.00	\$0.00	Estimator's Judgement
	Dry-Density and As-Placed Moisture Content	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
4	Erosion and Sedimentation Controls					
	Floating Turbidity Barrier	LF	500	\$40.00	\$20,000.00	Estimator's Judgement
	Construction Entrance	EA	1	\$0.00	\$0.00	Estimator's Judgement
					\$20,000.00	
	Calculate Bid Unit Cost	LS	1		\$20,000.00	
5	Demolition, Clearing, and Removal					
	Strip and Stockpile Topsoil	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$5,000.00	
	Calculate Bid Unit Cost	LS	1		\$5,000.00	
6	Vegetated Geogrid Shoreline Treatment					
	Excavate for Improvements	CY	1,200	\$10.00	\$12,000.00	Estimator's Judgement
	F&I High Organic Matter Soil Amendment	ACRE	0.2	\$20,000.00	\$4,000.00	Estimator's Judgement
	F&I Plantings	ACRE	0.2	\$16,000.00	\$3,200.00	Estimator's Judgement
	F&I Geotextile	SF	65,000	\$1.00	\$65,000.00	
	Furnish Riprap	TON	1,650	\$30.00	\$49,500.00	Estimator's Judgement
	Install Riprap	DAY	17	\$3,500.00	\$59,500.00	Estimator's Judgement
					\$193,200.00	
	Calculate Bid Unit Cost	LS	1		\$193,200.00	
7	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
					\$15,000.00	
	Calculate Bid Unit Cost	LS	1		\$15,000.00	
	SUBTOTAL				\$262,164.00	Sum of Items 1-7
	Scope and Budget Contingencies				\$65,541.00	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$13,108.20	Assume @ 5.0%
	Permitting				\$13,108.20	Assume @ 5.0%
	Plans, Specifications, and Engineering				\$26,216.40	Assume @10.0%
	Construction Phase Services				\$26,216.40	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$500,000.00	Rounded to the Nearest \$100,000.00

Living Shoreline Cost Per LF of Shoreline

\$1,000.00 For a Shoreline Length of 500 LF

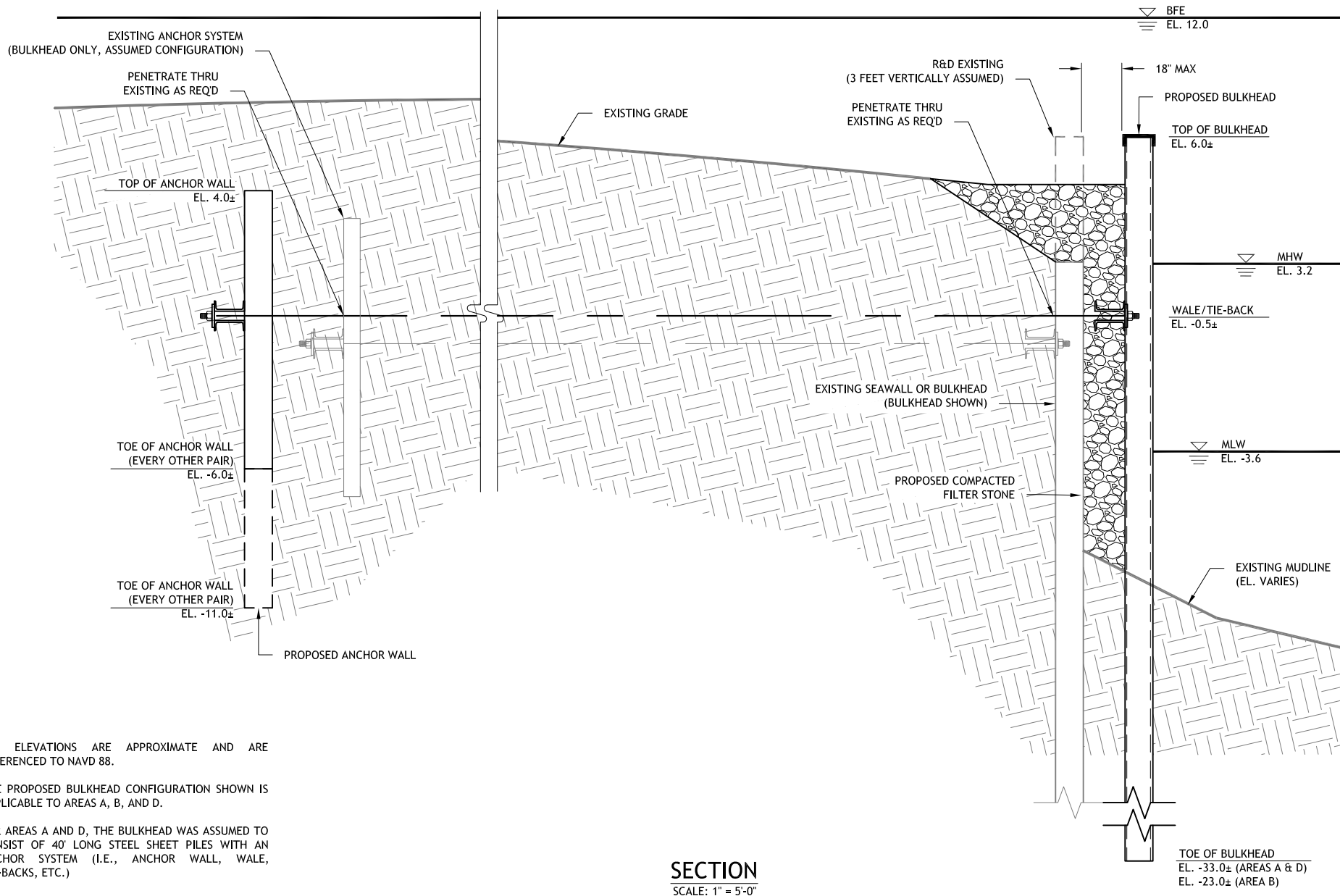
Table A-5.3
Budget-Level Construction Cost Estimate
Ancillary Improvements - Vegetated Geogrid Treatment, Area E
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Site Restoration Submittals	LS	1	\$1,500.00	\$1,500.00	Estimator's Judgement
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control (QC) Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Meetings	EA	8	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Performance & Payment Bonds	LS	1	\$13,592.00	\$13,592.00	Assume at 2% of Flood Proofing Alternative Costs
	Record Drawings	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$22,592.00	
	Calculate Bid Unit Cost	LS	1		\$22,592.00	
2	Mobilization					
	Mobilization	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
					\$15,000.00	
	Calculate Bid Unit Cost	LS	1		\$15,000.00	
3	Quality Control					
	Grain Size through No. 200 Sieve	EA	0	\$90.00	\$0.00	Estimator's Judgement
	Moisture Density Relationship	EA	0	\$200.00	\$0.00	Estimator's Judgement
	Dry-Density and As-Placed Moisture Content	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
4	Erosion and Sedimentation Controls					
	Floating Turbidity Barrier	LF	800	\$40.00	\$32,000.00	Estimator's Judgement
	Construction Entrance	EA	1	\$0.00	\$0.00	Estimator's Judgement
					\$32,000.00	
	Calculate Bid Unit Cost	LS	1		\$32,000.00	
5	Demolition, Clearing, and Removal					
	Strip and Stockpile Topsoil	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$5,000.00	
	Calculate Bid Unit Cost	LS	1		\$5,000.00	
6	Vegetated Geogrid Shoreline Treatment					
	Excavate for Improvements	CY	3,850	\$10.00	\$38,500.00	Estimator's Judgement
	F&I High Organic Matter Soil Amendment	ACRE	0.6	\$20,000.00	\$12,000.00	Estimator's Judgement
	F&I Plantings	ACRE	0.6	\$16,000.00	\$9,600.00	Estimator's Judgement
	F&I Geotextile	SF	208,000	\$1.00	\$208,000.00	Estimator's Judgement
	Furnish Riprap	TON	5,300	\$30.00	\$159,000.00	Estimator's Judgement
	Install Riprap	DAY	53	\$3,500.00	\$185,500.00	Estimator's Judgement
					\$612,600.00	
	Calculate Bid Unit Cost	LS	1		\$612,600.00	
7	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
					\$15,000.00	
	Calculate Bid Unit Cost	LS	1		\$15,000.00	
	SUBTOTAL				\$702,192.00	Sum of Items 1-7
	Scope and Budget Contingencies				\$175,548.00	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$24,576.72	Assume @ 3.5%
	Permitting				\$35,109.60	Assume @ 5.0%
	Plans, Specifications, and Engineering				\$66,708.24	Assume @ 9.5%
	Construction Phase Services				\$70,219.20	Assume @ 10.0%
	TOTAL ESTIMATE (2016 USD)				\$1,100,000.00	Rounded to the Nearest \$100,000.00

Living Shoreline Cost Per LF of Shoreline

\$690.00 For a Shoreline Length of 1,600 LF

Potential Ancillary Improvements
Oversheeting



NOTES:

1. ALL ELEVATIONS ARE APPROXIMATE AND ARE REFERENCED TO NAVD 88.
2. THE PROPOSED BULKHEAD CONFIGURATION SHOWN IS APPLICABLE TO AREAS A, B, AND D.
3. FOR AREAS A AND D, THE BULKHEAD WAS ASSUMED TO CONSIST OF 40' LONG STEEL SHEET PILES WITH AN ANCHOR SYSTEM (I.E., ANCHOR WALL, WALE, TIE-BACKS, ETC.)
4. FOR AREA B, THE BULKHEAD WAS ASSUMED TO CONSIST OF CANTILEVERED (I.E., NO ANCHOR SYSTEM) 30' LONG STEEL SHEET PILES.
5. IT IS EXPECTED THAT THE PROPOSED BULKHEADS WILL BE INSTALLED SEAWARD OF SEVERAL EXISTING SHORELINE STRUCTURES INCLUDING STEEL SHEET PILE BULKHEADS, TIMBER BULKHEADS, AND STONE MASONRY SEAWALLS (STEEL SHEET PILE BULKHEAD SHOWN ON THIS SHEET).

SECTION
SCALE: 1" = 5'-0"

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**MILL RIVER DISTRICT
SHORELINE ANALYSIS
ALTERNATIVES EVALUATION
REPORT**
New Haven, Connecticut

**FIGURE A-6
OVERSHEETING**

SHEET 10 of 10
DATE DEC 2016
PROJ No. 15103.00

Table A-6.1
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area A
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Performance and Payment Bonds	LS	1	\$48,498.15	\$48,498.15	Assume at 2% of Flood Proofing Alternative Costs
	Survey Control/Survey Verification	CREW HR	40	\$200.00	\$8,000.00	Estimator's Judgement for 2-man Survey Crew
	Steel Sheet Pile Submittals	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement, PE Stamp Required
	Water Control Plan	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, PE Stamp Required
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Concrete Submittals	LS	0	\$3,500.00	\$0.00	Estimator's Judgement
	Steel Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	End Seal Submittal	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, PE Stamp Required
	Cathodic Protection Submittal	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
	Misc. Metals Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Schedules	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Temporary Security Fencing	LF	750	\$32.00	\$24,000.00	Estimator's Judgement
	Meetings	EA	26	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$122,998.15	
	Calculate Bid Unit Cost	LS	1		\$122,998.15	
2	Mobilization					
	Mobilization	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
3	Quality Control					
3A	Grain Size Through No. 200 Sieve	EA	7	\$90.00	\$630.00	Estimator's Judgement
3B	Moisture Density Relationship	EA	7	\$200.00	\$1,400.00	Estimator's Judgement
3C	Dry Density and As-Placed Moisture	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement
3D	Concrete Compression Test	EA	0	\$100.00	\$0.00	Estimator's Judgement
	Calculate Total of Bid Items				\$2,030.00	
4	Erosion and Sediment Controls					
	Silt Fence and Baled Hay Erosion Check	LF	750	\$8.00	\$6,000.00	Estimator's Judgement
	Construction Entrance	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
	Floating Turbidity Barrier	LF	650	\$40.00	\$26,000.00	Estimator's Judgement
					\$47,000.00	
	Calculate Bid Unit Cost	LS	1		\$47,000.00	
5	Demolition & Removal					
5A	Demolish and Remove Existing Bulkhead & Utilities					
	STA 0+00 to 10+00					
	Demolish and Remove Existing Concrete Cap	CY	0	\$75.00	\$0.00	Estimator's Judgement
	Remove Top of Existing Seawall (upper 3 feet assumed)	DAY	20	\$3,500.00	\$70,000.00	Estimator's Judgement
	Remove and Dispose of Abandoned Utilities	LS	0	\$50,000.00	\$0.00	Assume part of overall Project Development Costs
	Seal the Ends of Storm Sewers to be Abandoned	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement
	Load Demolition Debris	TON	1,000	\$10.00	\$10,000.00	Estimator's Judgement, Assumes Non-Contaminated
	Trucking Allowance to Landfill	TRK	100	\$200.00	\$20,000.00	Estimator's Judgement, Assumes Non-Contaminated
	Landfill Tipping Fees	TON	1,000	\$50.00	\$50,000.00	Estimator's Judgement
					\$160,000.00	
	Calculate Bid Unit Cost	LS	1		\$160,000.00	
5B	Extract Timber Piles above MLW Using Vib. Hammer	DAY	2	\$4,500.00	\$9,000.00	Assume Work Barge, Crew, and Equipment, Assume 20 per Day
					\$9,000.00	
	Calculate Bid Unit Cost	EA	40		\$225.00	
5C	Extract Timber Piles below MLW Using Vib. Hammer	DAY	1	\$6,500.00	\$6,500.00	Assume 3-Man Dive Crew, Work Barge, and Equipment, Assume 20 per Day

Table A-6.1
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area A
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
	Calculate Bid Unit Cost	EA	20		\$6,500.00 \$325.00	
5D	Remove Underwater Obstructions	DAY	2	\$6,500.00	\$13,000.00	Estimator's Judgement
	Calculate Bid Unit Cost	DAY	2		\$13,000.00 \$6,500.00	
	Calculate Total of Demolition & Removal Bid Items				\$188,500.00	
6	Bulkhead and Anchor Wall System					
6A	New Steel Sheet Pile Bulkhead, STA 0+00 to STA 6+30					
	Furnish NZ-19 Steel Sheet Piles (40-foot-long)	LB	604,800	\$0.78	\$471,744.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	604,800	\$0.04	\$23,587.20	Estimator's Judgement
	Coat Sheet Piles (front and back)	SF	25,200	\$5.96	\$150,192.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Additional Transportation to/from Coating Facility	TON	302	\$35.00	\$10,584.00	Estimator's Judgement
	Pre-Excavate along Existing Bulkhead	CY	0	\$10.00	\$0.00	Estimator's Judgement
	Load Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Estimator's Judgement, Includes 1.3 Swell Factor
	Transport Excavated Soil to Storage Area	TRK	0	\$100.00	\$0.00	Estimator's Judgement
	Install Sheet Piles	DAY	16	\$6,500.00	\$104,000.00	Crew Rate & Production Rate Per Previous Projects (40 LF/DAY)
	Furnish Double Channel Steel Wale	LB	63,000	\$1.00	\$63,000.00	Assume 630 LF x 100 LB/LF
	Coat Double Channel Steel Wale	SF	4,410	\$5.96	\$26,283.60	Assume 630 LF x 7.0 SF/LF
	Additional Transportation to/from Coating Facility	TON	32	\$50.00	\$1,575.00	Estimator's Judgement
	Furnish and Install Wale Chairs	EA	25	\$350.00	\$8,750.00	Estimator's Judgement
	Furnish Bolts, Nuts, Plates	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement
	Install Double Channel Steel Wale, Including Bolts, Nuts, Plates	LB	63,000	\$1.25	\$78,750.00	Estimator's Judgement
	End Seals	EA	2	\$12,500.00	\$25,000.00	Estimator's Judgement
	Cut-Off Excess NZ-19 Sheet Piles	DAY	13	\$2,100.00	\$27,300.00	Assume Super., 2 Laborers, and Equipment, Assume 50 LF/DAY
	Video Dive Inspection of Installed Steel Sheet Piles	DAY	1.0	\$4,500.00	\$4,500.00	Assume 3-Man Dive Crew, Work Barge, and Equipment
					\$1,005,265.80	
	Calculate Bid Unit Cost	LF	630		\$1,595.66	
6B	New Steel Sheet Pile Anchor Wall					
	Furnish NZ-19 Steel Sheet Piles (13.5-foot-long on average)	LB	204,120	\$0.78	\$159,213.60	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	204,120	\$0.04	\$7,960.68	Estimator's Judgement
	Coat Sheet Piles	SF	0	\$5.96	\$0.00	Assume uncoated
	Additional Transportation to/from Coating Facility	TON	0	\$35.00	\$0.00	Estimator's Judgement
	Pre-Excavate along Anchor Wall Alignment	CY	1,100	\$5.00	\$5,500.00	Estimator's Judgement, assumes a 5-foot-deep trench
	Dewatering and Sedimentation Controls	DAY	30	\$500.00	\$15,000.00	Estimator's Judgement
	Load Pre-Excavated Soil	CY	1,430	\$5.00	\$7,150.00	Estimator's Judgement, Includes 1.3 Swell Factor
	Trucking Allowance	TRK	230	\$200.00	\$46,000.00	Estimator's Judgement
	Install Sheet Piles	DAY	11	\$4,500.00	\$49,500.00	Crew Rate & Production Rate Per Previous Projects (60 LF/DAY)
	Furnish Double Channel Steel Wale	LB	63,000	\$1.00	\$63,000.00	Assume 630 LF x 100 LB/LF
	Coat Double Channel Steel Wale	SF	4,410	\$5.96	\$26,283.60	Assume 630 LF x 7.0 SF/LF
	Additional Transportation to/from Coating Facility	TON	32	\$50.00	\$1,575.00	Estimator's Judgement
	Furnish and Install Wale Chairs	EA	25	\$350.00	\$8,750.00	Estimator's Judgement
	Furnish Bolts, Nuts, and Plates	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement
	Install Double Channel Steel Wale, Including Bolts, Nuts, Plates	LB	63,000	\$1.25	\$78,750.00	Estimator's Judgement
	Flowable Fill	CY	0	\$200.00	\$0.00	Not Required
					\$478,682.88	
	Calculate Bid Unit Cost	LF	630		\$759.81	
6C	Pile Spudding					
	Survey Crew	DAY	2	\$1,750.00	\$3,500.00	Provide 2-Man Survey Crew w/ Equipment and Materials
	Complete Pile Spudding	DAY	2	\$5,980.00	\$11,960.00	Per June 2013 Pile Spudding completed by SDS x 1.15 for escalation/mark-up
					\$15,460.00	
	Calculate Bid Unit Cost	DAY	2		\$7,730.00	

Table A-6.1
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area A
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
7	Tie Rods					
	Excavate Trenches For Tie Rods	CY	5,100	\$10.00	\$51,000.00	Assume 1.5 CY/LF x 62.5 LF on Average x 54 Locations
	Dewatering and Sedimentation Controls	DAY	18	\$500.00	\$9,000.00	Estimator's Judgement, Assume 3 per Day
	Stockpile Excavated Material Immediately Adjacent to Trenches	CY	5,100	\$1.00	\$5,100.00	Estimator's Judgement
	Selectively Cut and Remove Portions of Existing Anchor Wall	DAY	10	\$3,500.00	\$35,000.00	Estimator's Judgement
	Furnish Epoxy Coated Tie Rods	EA	54	\$1,531.40	\$82,695.60	Written Quote from DSI Int. x 1.15 for Mark-Up
	Install Tie Rods	DAY	18	\$3,500.00	\$63,000.00	Estimator's Judgement
	Backfill and Compact Excavated Material Around Tie Rods	CY	5,100	\$5.00	\$25,500.00	Estimator's Judgement
				\$271,295.60		
	Calculate Bid Unit Cost	LS	1		\$271,295.60	
8	Filter Stone					
	Furnish Crushed Stone	TON	1,400	\$29.27	\$40,978.00	Per Tilcon Connecticut x 1.15 Mark-up
	Backfill Between Existing & New Sheets with Crushed Stone	TON	1,400	\$10.00	\$14,000.00	Estimator's Judgement
	Vibrate Crushed Stone during Placement (Vib. Pile 4.1' o/c)	DAY	11	\$4,500.00	\$49,500.00	Assume Work Barge and Equipment, Assume 60 LF/DAY
					\$104,478.00	
	Calculate Bid Unit Cost	TON	1,400		\$74.63	
9	Surface Restoration					
	Load Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
	Trans. Excavated Soil from Storage Area	TRK	0	\$100.00	\$0.00	Assume part of overall Project Development Costs
	Place and Compact Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
	Furnish and Install Geotextile Fabric	SF	0	\$1.00	\$0.00	Assume part of overall Project Development Costs
	Furnish Recycled Concrete	TON	0	\$13.80	\$0.00	Assume part of overall Project Development Costs
	Place and Compact Recycled Concrete	TON	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
10	Steel Bulkhead Cap, STA 0+00 to STA 6+30					
	Furnish Steel Cap Components (Plate)	LB	12,860	\$0.54	\$6,950.83	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up (20.5 plf)
	Furnish Misc. Materials & Equipment (welding rod, etc.)	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgment
	Coat Steel Cap Components	SF	2,520	\$5.96	\$15,019.20	Assume 630 LF x 4 SF/LF
	Additional Transportation to/from Coating Facility	TON	6	\$35.00	\$225.05	Estimator's Judgment
	Fabricate Steel Channel Cap Components (Plate)	DAY	10	\$2,500.00	\$25,000.00	Estimator's Judgment
	Install Steel Channel Cap	DAY	9	\$4,500.00	\$40,500.00	Assume Work Barge, Crew, and Equipment, Assume 75 LF/DAY
					\$95,195.08	
	Calculate Bid Unit Cost	LF	630		\$151.10	
11	Cathodic Protection					
	Furnish Anodes	EA	52	\$275.00	\$14,300.00	Estimator's Judgment
	Shipping FOB to New Haven	TRK	2	\$4,500.00	\$9,000.00	Estimator's Judgment
	Install Anodes	DAY	7	\$4,500.00	\$31,500.00	Assume 3 Man Dive Crew, Work Barge, Equipment, and Materials (8 per Day)
	Furnish and Install Test Stations	EA	5	\$2,500.00	\$12,500.00	Estimator's Judgment
	Cathodic Protection Engineer	LS	1	\$0.00	\$0.00	Covered Under Bid Item 2
	Video Dive Inspection of Installed Anodes	DAY	1	\$3,200.00	\$3,200.00	Assume 3 Man Dive Crew
	Coating Touch-Up Allowance Around Welded Pipe Cores	DAY	2	\$4,500.00	\$9,000.00	Assume 3 Man Dive Crew, Work Barge, Equipment, and Materials (24 per Day)
				\$79,500.00		
	Calculate Bid Unit Cost	EA	52		\$1,528.85	
12	Standby Time					
	Standby Time	DAY	5	\$7,500.00	\$37,500.00	Estimator's Judgment
					\$37,500.00	
	Calculate Bid Unit Cost	DAY	5		\$7,500.00	
13	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	

Table A-6.1
 Budget-Level Cost Estimate
 Ancillary Improvements - Oversheeting, Area A
 Alternatives Evaluation Report
 City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
	SUBTOTAL				\$2,547,905.51	Sum of Base Bid Items 1 through 13
	Scope and Budget Contingencies				\$636,976.38	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$50,958.11	Assume @ 2.0%, Related to Flood Proofing Alternative Only
	Permitting				\$38,218.58	Assume @ 1.5%, Related to Flood Proofing Alternative Only
	Plans, Specifications, and Engineering				\$127,395.28	Assume @ 5.0%, Related to Flood Proofing Alternative Only
	Construction Phase Services				\$191,092.91	Assume @ 7.5%, Related to Flood Proofing Alternative Only
	TOTAL ESTIMATE (2016 USD)				\$3,600,000.00	Rounded to the Nearest \$100,000.00
	Oversheeting Cost Per LF of Bulkhead				\$5,720.00	For a Bulkhead length of 630 LF

Table A-6.2
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area B
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Performance and Payment Bonds	LS	1	\$16,454.26	\$16,454.26	Assume at 2% of Flood Proofing Alternative Costs
	Survey Control/Survey Verification	CREW HR	40	\$200.00	\$8,000.00	Estimator's Judgement for 2-man Survey Crew
	Steel Sheet Pile Submittals	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement, PE Stamp Required
	Water Control Plan	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, PE Stamp Required
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Concrete Submittals	LS	0	\$3,500.00	\$0.00	Estimator's Judgement
	Steel Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	End Seal Submittal	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, PE Stamp Required
	Cathodic Protection Submittal	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
	Misc. Metals Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Schedules	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Temporary Security Fencing	LF	550	\$32.00	\$17,600.00	Estimator's Judgement
	Meetings	EA	26	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$84,554.26	
	Calculate Bid Unit Cost	LS	1		\$84,554.26	
2	Mobilization					
	Mobilization	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
3	Quality Control					
3A	Grain Size Through No. 200 Sieve	EA	3	\$90.00	\$270.00	Estimator's Judgement
3B	Moisture Density Relationship	EA	0	\$200.00	\$0.00	Estimator's Judgement
3C	Dry Density and As-Placed Moisture	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement
3D	Concrete Compression Test	EA	0	\$100.00	\$0.00	Estimator's Judgement
	Calculate Total of Bid Items				\$270.00	
4	Erosion and Sediment Controls					
	Silt Fence and Baled Hay Erosion Check	LF	550	\$8.00	\$4,400.00	Estimator's Judgement
	Construction Entrance	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
	Floating Turbidity Barrier	LF	450	\$40.00	\$18,000.00	Estimator's Judgement
					\$37,400.00	
	Calculate Bid Unit Cost	LS	1		\$37,400.00	
5	Demolition & Removal					
5A	Demolish and Remove Existing Bulkhead & Utilities					
	STA 0+00 to 4+30					
	Demolish and Remove Existing Concrete Cap	CY	0	\$75.00	\$0.00	Estimator's Judgement
	Remove Top of Existing Timber Bulkhead (upper 3 feet assumed)	DAY	0	\$3,500.00	\$0.00	Estimator's Judgement
	Remove and Dispose of Abandoned Utilities	LS	0	\$50,000.00	\$0.00	Assume part of overall Project Development Costs
	Seal the Ends of Storm Sewers to be Abandoned	LS	0	\$10,000.00	\$0.00	Estimator's Judgement
	Load Demolition Debris	TON	0	\$10.00	\$0.00	Estimator's Judgement, Assumes Non-Contaminated
	Trucking Allowance to Landfill	TRK	0	\$200.00	\$0.00	Estimator's Judgement, Assumes Non-Contaminated
	Landfill Tipping Fees	TON	0	\$50.00	\$0.00	Estimator's Judgement
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
5B	Extract Timber Piles above MLW Using Vib. Hammer	DAY	0	\$4,500.00	\$0.00	Assume Work Barge, Crew, and Equipment, Assume 20 per Day
					\$0.00	
	Calculate Bid Unit Cost	EA	1		\$0.00	
5C	Extract Timber Piles below MLW Using Vib. Hammer	DAY	0	\$6,500.00	\$0.00	Assume 3-Man Dive Crew, Work Barge, and Equipment, Assume 20 per Day

Table A-6.2
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area B
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
	Calculate Bid Unit Cost	EA	1		\$0.00	
					\$0.00	
5D	Remove Underwater Obstructions (Riprap)	DAY	2	\$6,500.00	\$13,000.00	Estimator's Judgement
	Calculate Bid Unit Cost	DAY	2		\$13,000.00	
					\$6,500.00	
	Calculate Total of Demolition & Removal Bid Items				\$13,000.00	
6	Bulkhead and Anchor Wall System					
6A	New Steel Sheet Pile Bulkhead, STA 0+00 to STA 4+30					
	Furnish NZ-19 Steel Sheet Piles (Cantilever, 30-foot-long)	LB	309,600	\$0.78	\$241,488.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	309,600	\$0.04	\$12,074.40	Estimator's Judgement
	Coat Sheet Piles (front and back)	SF	12,900	\$5.96	\$76,884.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Additional Transportation to/from Coating Facility	TON	155	\$35.00	\$5,418.00	Estimator's Judgement
	Pre-Excavate along Existing Bulkhead	CY	0	\$10.00	\$0.00	Estimator's Judgement
	Load Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Estimator's Judgement, Includes 1.3 Swell Factor
	Transport Excavated Soil to Storage Area	TRK	0	\$100.00	\$0.00	Estimator's Judgement
	Install Sheet Piles	DAY	9	\$6,500.00	\$58,500.00	Crew Rate & Production Rate Per Previous Projects (50 LF/DAY)
	Furnish Double Channel Steel Wale	LB	0	\$1.00	\$0.00	Cantilever Wall, Not Req'd
	Coat Double Channel Steel Wale	SF	0	\$5.96	\$0.00	Cantilever Wall, Not Req'd
	Additional Transportation to/from Coating Facility	TON	0	\$50.00	\$0.00	Cantilever Wall, Not Req'd
	Furnish and Install Wale Chairs	EA	0	\$350.00	\$0.00	Cantilever Wall, Not Req'd
	Furnish Bolts, Nuts, Plates	LS	0	\$10,000.00	\$0.00	Cantilever Wall, Not Req'd
	Install Double Channel Steel Wale, Including Bolts, Nuts, Plates	LB	0	\$1.25	\$0.00	Cantilever Wall, Not Req'd
	End Seals	EA	2	\$12,500.00	\$25,000.00	Estimator's Judgement
	Cut-Off Excess NZ-19 Sheet Piles	DAY	9	\$2,100.00	\$18,900.00	Assume Super., 2 Laborers, and Equipment, Assume 50 LF/DAY
	Video Dive Inspection of Installed Steel Sheet Piles	DAY	1.0	\$4,500.00	\$4,500.00	Assume 3-Man Dive Crew, Work Barge, and Equipment
					\$442,764.40	
	Calculate Bid Unit Cost	LF	430		\$1,029.68	
6B	New Steel Sheet Pile Anchor Wall					
	Furnish NZ-19 Steel Sheet Piles (10-foot-long on average)	LB	0	\$0.78	\$0.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	0	\$0.04	\$0.00	Estimator's Judgement
	Coat Sheet Piles	SF	0	\$5.96	\$0.00	Assume uncoated
	Additional Transportation to/from Coating Facility	TON	0	\$35.00	\$0.00	Estimator's Judgement
	Pre-Excavate along Anchor Wall Alignment	CY	0	\$5.00	\$0.00	Estimator's Judgement, assumes a 5-foot-deep trench
	Dewatering and Sedimentation Controls	DAY	0	\$500.00	\$0.00	Estimator's Judgement
	Load Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Estimator's Judgement, Includes 1.3 Swell Factor
	Trucking Allowance	TRK	0	\$200.00	\$0.00	Estimator's Judgement
	Install Sheet Piles	DAY	0	\$4,500.00	\$0.00	Crew Rate & Production Rate Per Previous Projects (60 LF/DAY)
	Furnish Double Channel Steel Wale	LB	0	\$1.00	\$0.00	Assume 430 LF x 100 LB/LF
	Coat Double Channel Steel Wale	SF	0	\$5.96	\$0.00	Assume 430 LF x 7.0 SF/LF
	Additional Transportation to/from Coating Facility	TON	0	\$50.00	\$0.00	Estimator's Judgement
	Furnish and Install Wale Chairs	EA	0	\$350.00	\$0.00	Estimator's Judgement
	Furnish Bolts, Nuts, and Plates	LS	0	\$10,000.00	\$0.00	Estimator's Judgement
	Install Double Channel Steel Wale, Including Bolts, Nuts, Plates	LB	0	\$1.25	\$0.00	Estimator's Judgement
	Flowable Fill	CY	0	\$200.00	\$0.00	Not Required
					\$0.00	
	Calculate Bid Unit Cost	LF	430		\$0.00	Cantilever Wall, Not Req'd
6C	Pile Spudding					
	Survey Crew	DAY	1	\$1,750.00	\$1,750.00	Provide 2-Man Survey Crew w/ Equipment and Materials
	Complete Pile Spudding	DAY	1	\$5,980.00	\$5,980.00	Per June 2013 Pile Spudding completed by SDS x 1.15 for escalation/mark-up
					\$7,730.00	
	Calculate Bid Unit Cost	DAY	1		\$7,730.00	

Table A-6.2
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area B
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments	
7	Tie Rods						
		Excavate Trenches For Tie Rods	CY	0	\$10.00	\$0.00	Assume 1.5 CY/LF x 62.5 LF on Average x 36 Locations
		Dewatering and Sedimentation Controls	DAY	0	\$500.00	\$0.00	Estimator's Judgement, Assume 3 per Day
		Stockpile Excavated Material Immediately Adjacent to Trenches	CY	0	\$1.00	\$0.00	Estimator's Judgement
		Selectively Cut and Remove Portions of Existing Anchor Wall	DAY	0	\$3,500.00	\$0.00	Estimator's Judgement
		Furnish Epoxy Coated Tie Rods	EA	0	\$1,531.40	\$0.00	Written Quote from DSI Int. x 1.15 for Mark-Up
		Install Tie Rods	DAY	0	\$3,500.00	\$0.00	Estimator's Judgement
		Backfill and Compact Excavated Material Around Tie Rods	CY	0	\$5.00	\$0.00	Estimator's Judgement
					\$0.00		
	Calculate Bid Unit Cost	LS	1		\$0.00	Cantilever Wall, Not Req'd	
8	Filter Stone						
		Furnish Crushed Stone	TON	440	\$29.27	\$12,878.80	Per Tilcon Connecticut x 1.15 Mark-up
		Backfill Between Existing & New Sheets with Crushed Stone	TON	440	\$10.00	\$4,400.00	Estimator's Judgement
		Vibrate Crushed Stone during Placement (Vib. Pile 4.1' o/c)	DAY	8	\$4,500.00	\$36,000.00	Assume Work Barge and Equipment, Assume 60 LF/DAY
						\$53,278.80	
	Calculate Bid Unit Cost	TON	440		\$121.09		
9	Surface Restoration						
		Load Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
		Trans. Excavated Soil from Storage Area	TRK	0	\$100.00	\$0.00	Assume part of overall Project Development Costs
		Place and Compact Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
		Furnish and Install Geotextile Fabric	SF	0	\$1.00	\$0.00	Assume part of overall Project Development Costs
		Furnish Recycled Concrete	TON	0	\$13.80	\$0.00	Assume part of overall Project Development Costs
		Place and Compact Recycled Concrete	TON	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
						\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00		
10	Steel Bulkhead Cap, STA 0+00 to STA 4+30						
		Furnish Steel Cap Components (Plate)	LB	8,815	\$0.54	\$4,764.51	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up (20.5 p/lf)
		Furnish Misc. Materials & Equipment (welding rod, etc.)	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgment
		Coat Steel Cap Components	SF	1,720	\$5.96	\$10,251.20	Assume 430 LF x 4 SF/LF
		Additional Transportation to/from Coating Facility	TON	4	\$35.00	\$154.26	Estimator's Judgment
		Fabricate Steel Channel Cap Components (Plate)	DAY	7	\$2,500.00	\$17,500.00	Estimator's Judgment
		Install Steel Channel Cap	DAY	6	\$4,500.00	\$27,000.00	Assume Work Barge, Crew, and Equipment, Assume 75 LF/DAY
						\$67,169.97	
	Calculate Bid Unit Cost	LF	630		\$106.62		
11	Cathodic Protection						
		Furnish Anodes	EA	36	\$275.00	\$9,900.00	Estimator's Judgment
		Shipping FOB to New Haven	TRK	2	\$4,500.00	\$9,000.00	Estimator's Judgment
		Install Anodes	DAY	5	\$4,500.00	\$22,500.00	Assume 3 Man Dive Crew, Work Barge, Equipment, and Materials (8 per Day)
		Furnish and Install Test Stations	EA	4	\$2,500.00	\$10,000.00	Estimator's Judgment
		Cathodic Protection Engineer	LS	1	\$0.00	\$0.00	Covered Under Bid Item 2
		Video Dive Inspection of Installed Anodes	DAY	1	\$3,200.00	\$3,200.00	Assume 3 Man Dive Crew
		Coating Touch-Up Allowance Around Welded Pipe Cores	DAY	2	\$4,500.00	\$9,000.00	Assume 3 Man Dive Crew, Work Barge, Equipment, and Materials (24 per Day)
					\$63,600.00		
	Calculate Bid Unit Cost	EA	52		\$1,223.08		
12	Standby Time						
		Standby Time	DAY	5	\$7,500.00	\$37,500.00	Estimator's Judgment
						\$37,500.00	
	Calculate Bid Unit Cost	DAY	5		\$7,500.00		
13	Demobilization and Clean-up						
		Demobilization and Clean-up	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement
						\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00		

Table A-6.2
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area B
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
	SUBTOTAL				\$907,267.43	Sum of Base Bid Items 1 through 13
	Scope and Budget Contingencies				\$226,816.86	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$27,218.02	Assume @ 3.0%, Related to Flood Proofing Alternative Only
	Permitting				\$31,754.36	Assume @ 3.5%, Related to Flood Proofing Alternative Only
	Plans, Specifications, and Engineering				\$68,045.06	Assume @ 7.5%, Related to Flood Proofing Alternative Only
	Construction Phase Services				\$90,726.74	Assume @ 10.0%, Related to Flood Proofing Alternative Only
	TOTAL ESTIMATE (2016 USD)				\$1,400,000.00	Rounded to the Nearest \$100,000.00
	Oversheeting Cost Per LF of Bulkhead				\$3,260.00	For a Bulkhead length of 430 LF

Table A-6.3
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
1	General Requirements					
	Performance and Payment Bonds	LS	1	\$92,496.42	\$92,496.42	Assume at 2% of Flood Proofing Alternative Costs
	Survey Control/Survey Verification	CREW HR	40	\$200.00	\$8,000.00	Estimator's Judgement for 2-man Survey Crew
	Steel Sheet Pile Submittals	LS	1	\$10,000.00	\$10,000.00	Estimator's Judgement, PE Stamp Required
	Water Control Plan	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, PE Stamp Required
	Earth Material Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Concrete Submittals	LS	0	\$3,500.00	\$0.00	Estimator's Judgement
	Steel Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	End Seal Submittal	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgement, PE Stamp Required
	Cathodic Protection Submittal	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
	Misc. Metals Submittals	LS	1	\$2,500.00	\$2,500.00	Estimator's Judgement
	Safety Activity Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Quality Control Plan	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Schedules	LS	1	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Temporary Security Fencing	LF	1,500	\$32.00	\$48,000.00	Estimator's Judgement
	Meetings	EA	40	\$0.00	\$0.00	Assume part of overall Project Development Costs
	Closeout Related Submittals	LS	1	\$5,000.00	\$5,000.00	Estimator's Judgement
					\$190,996.42	
	Calculate Bid Unit Cost	LS	1		\$190,996.42	
2	Mobilization					
	Mobilization	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	
3	Quality Control					
3A	Grain Size Through No. 200 Sieve	EA	7	\$90.00	\$630.00	Estimator's Judgement
3B	Moisture Density Relationship	EA	7	\$200.00	\$1,400.00	Estimator's Judgement
3C	Dry Density and As-Placed Moisture	1/2 DAY	0	\$300.00	\$0.00	Estimator's Judgement
3D	Concrete Compression Test	EA	0	\$100.00	\$0.00	Estimator's Judgement
	Calculate Total of Bid Items				\$2,030.00	
4	Erosion and Sediment Controls					
	Silt Fence and Baled Hay Erosion Check	LF	1,500	\$8.00	\$12,000.00	Estimator's Judgement
	Construction Entrance	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
	Floating Turbidity Barrier	LF	650	\$40.00	\$26,000.00	Estimator's Judgement, assumed reuse for different phases
					\$53,000.00	
	Calculate Bid Unit Cost	LS	1		\$53,000.00	
5	Demolition & Removal					
5A	Demo and Remove Existing Bulkhead/Seawall/Pier & Utilities					
	STA 0+00 to 13+30					
	Demolish and Remove Existing Steel Cap	DAY	2	\$3,500.00	\$7,000.00	Estimator's Judgement (Approx. 840 LF)
	Remove Top of Existing Seawall	DAY	3	\$3,500.00	\$10,500.00	Estimator's Judgement (Upper 3 feet assumed for approx. 240 LF)
	Remove and Dispose of Abandoned Utilities	LS	0	\$50,000.00	\$0.00	Assume part of overall Project Development Costs
	Seal the Ends of Storm Sewers to be Abandoned	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
	Demolish the Existing Pier	DAY	5	\$4,500.00	\$22,500.00	Estimator's Judgement (Approx 250 LF)
	Load Demolition Debris	TON	1,000	\$10.00	\$10,000.00	Estimator's Judgement, Assumes Non-Contaminated
	Trucking Allowance to Landfill	TRK	100	\$200.00	\$20,000.00	Estimator's Judgement, Assumes Non-Contaminated
	Landfill Tipping Fees	TON	1,000	\$50.00	\$50,000.00	Estimator's Judgement
					\$135,000.00	
	Calculate Bid Unit Cost	LS	1		\$135,000.00	
5B	Extract Timber Piles above MLW Using Vib. Hammer	DAY	2	\$4,500.00	\$9,000.00	Assume Work Barge, Crew, and Equipment, Assume 20 per Day
					\$9,000.00	
	Calculate Bid Unit Cost	EA	40		\$225.00	

Table A-6.3
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
5C	Extract Timber Piles below MLW Using Vib. Hammer	DAY	1	\$6,500.00	\$6,500.00	Assume 3-Man Dive Crew, Work Barge, and Equipment, Assume 20 per Day
	Calculate Bid Unit Cost	EA	20		\$6,500.00 \$325.00	
5D	Remove Underwater Obstructions	DAY	2	\$6,500.00	\$13,000.00	Estimator's Judgement
	Calculate Bid Unit Cost	DAY	2		\$13,000.00 \$6,500.00	
	Calculate Total of Demolition & Removal Bid Items				\$163,500.00	
6	Bulkhead and Anchor Wall System					
6A	New Steel Sheet Pile Bulkhead, STA 0+00 to STA 13+30					
	Furnish NZ-19 Steel Sheet Piles (40-foot-long)	LB	1,276,800	\$0.78	\$995,904.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	1,276,800	\$0.04	\$49,795.20	Estimator's Judgement
	Coat Sheet Piles (front and back)	SF	53,200	\$5.96	\$317,072.00	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Additional Transportation to/from Coating Facility	TON	638	\$35.00	\$22,344.00	Estimator's Judgement
	Pre-Excavate along Existing Bulkhead	CY	0	\$10.00	\$0.00	Estimator's Judgement
	Load Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Estimator's Judgement, Includes 1.3 Swell Factor
	Transport Excavated Soil to Storage Area	TRK	0	\$100.00	\$0.00	Estimator's Judgement
	Install Sheet Piles	DAY	34	\$6,500.00	\$221,000.00	Crew Rate & Production Rate Per Previous Projects (40 LF/DAY)
	Furnish Double Channel Steel Wale	LB	133,000	\$1.00	\$133,000.00	Assume 1.330 LF x 100 LB/LF
	Coat Double Channel Steel Wale	SF	9,310	\$5.96	\$55,487.60	Assume 1.330 LF x 7.0 SF/LF
	Additional Transportation to/from Coating Facility	TON	67	\$50.00	\$3,325.00	Estimator's Judgement
	Furnish and Install Wale Chairs	EA	54	\$350.00	\$18,900.00	Estimator's Judgement
	Furnish Bolts, Nuts, Plates	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
	Install Double Channel Steel Wale, Including Bolts, Nuts, Plates	LB	133,000	\$1.25	\$166,250.00	Estimator's Judgement
	End Seals	EA	2	\$12,500.00	\$25,000.00	Estimator's Judgement
	Cut-Off Excess NZ-19 Sheet Piles	DAY	27	\$2,100.00	\$56,700.00	Assume Super., 2 Laborers, and Equipment, Assume 50 LF/DAY
	Video Dive Inspection of Installed Steel Sheet Piles	DAY	2.0	\$4,500.00	\$9,000.00	Assume 3-Man Dive Crew, Work Barge, and Equipment
	Calculate Bid Unit Cost	LF	1,330		\$2,088,777.80 \$1,570.51	
6B	New Steel Sheet Pile Anchor Wall					
	Furnish NZ-19 Steel Sheet Piles (13.5-foot-long on average)	LB	430,920	\$0.78	\$336,117.60	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up
	Steel Price Volatility Factor	LB	430,920	\$0.04	\$16,805.88	Estimator's Judgement
	Coat Sheet Piles	SF	0	\$5.96	\$0.00	Assume uncoated
	Additional Transportation to/from Coating Facility	TON	0	\$35.00	\$0.00	Estimator's Judgement
	Pre-Excavate along Anchor Wall Alignment	CY	2,400	\$5.00	\$12,000.00	Estimator's Judgement, assumes a 5-foot-deep trench
	Dewatering and Sedimentation Controls	DAY	60	\$500.00	\$30,000.00	Estimator's Judgement
	Load Pre-Excavated Soil	CY	3,120	\$5.00	\$15,600.00	Estimator's Judgement, Includes 1.3 Swell Factor
	Trucking Allowance	TRK	560	\$200.00	\$112,000.00	Estimator's Judgement
	Install Sheet Piles	DAY	23	\$4,500.00	\$103,500.00	Crew Rate & Production Rate Per Previous Projects (60 LF/DAY)
	Furnish Double Channel Steel Wale	LB	133,000	\$1.00	\$133,000.00	Assume 630 LF x 100 LB/LF
	Coat Double Channel Steel Wale	SF	9,310	\$5.96	\$55,487.60	Assume 630 LF x 7.0 SF/LF
	Additional Transportation to/from Coating Facility	TON	67	\$50.00	\$3,325.00	Estimator's Judgement
	Furnish and Install Wale Chairs	EA	54	\$350.00	\$18,900.00	Estimator's Judgement
	Furnish Bolts, Nuts, and Plates	LS	1	\$15,000.00	\$15,000.00	Estimator's Judgement
	Install Double Channel Steel Wale, Including Bolts, Nuts, Plates	LB	133,000	\$1.25	\$166,250.00	Estimator's Judgement
	Flowable Fill	CY	0	\$200.00	\$0.00	Not Required
	Calculate Bid Unit Cost	LF	1,330		\$1,017,986.08 \$765.40	
6C	Pile Spudding					
	Survey Crew	DAY	4	\$1,750.00	\$7,000.00	Provide 2-Man Survey Crew w/ Equipment and Materials
	Complete Pile Spudding	DAY	4	\$5,980.00	\$23,920.00	Per June 2013 Pile Spudding completed by SDS x 1.15 for escalation/mark-up
	Calculate Bid Unit Cost	DAY	4		\$30,920.00 \$7,730.00	

Table A-6.3
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
7	Tie Rods					
	Excavate Trenches For Tie Rods	CY	10,200	\$10.00	\$102,000.00	Assume 1.5 CY/LF x 62.5 LF on Average x 108 Locations
	Dewatering and Sedimentation Controls	DAY	34	\$500.00	\$17,000.00	Estimator's Judgement, Assume 3 per Day
	Stockpile Excavated Material Immediately Adjacent to Trenches	CY	10,200	\$1.00	\$10,200.00	Estimator's Judgement
	Selectively Cut and Remove Portions of Existing Anchor Wall	DAY	20	\$3,500.00	\$70,000.00	Estimator's Judgement
	Furnish Epoxy Coated Tie Rods	EA	108	\$1,531.40	\$165,391.20	Written Quote from DSI Int. x 1.15 for Mark-Up
	Install Tie Rods	DAY	36	\$3,500.00	\$126,000.00	Estimator's Judgement
	Backfill and Compact Excavated Material Around Tie Rods	CY	10,200	\$5.00	\$51,000.00	Estimator's Judgement
					\$541,591.20	
	Calculate Bid Unit Cost	LS	1		\$541,591.20	
8	Filter Stone					
	Furnish Crushed Stone	TON	3,500	\$29.27	\$102,445.00	Per Tilcon Connecticut x 1.15 Mark-up
	Backfill Between Existing & New Sheets with Crushed Stone	TON	3,500	\$10.00	\$35,000.00	Estimator's Judgement
	Vibrate Crushed Stone during Placement (Vib. Pile 4.1' o/c)	DAY	22	\$4,500.00	\$99,000.00	Assume Work Barge and Equipment, Assume 60 LF/DAY
					\$236,445.00	
	Calculate Bid Unit Cost	TON	3,500		\$67.56	
9	Surface Restoration					
	Load Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
	Trans. Excavated Soil from Storage Area	TRK	0	\$100.00	\$0.00	Assume part of overall Project Development Costs
	Place and Compact Pre-Excavated Soil	CY	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
	Furnish and Install Geotextile Fabric	SF	0	\$1.00	\$0.00	Assume part of overall Project Development Costs
	Furnish Recycled Concrete	TON	0	\$13.80	\$0.00	Assume part of overall Project Development Costs
	Place and Compact Recycled Concrete	TON	0	\$5.00	\$0.00	Assume part of overall Project Development Costs
					\$0.00	
	Calculate Bid Unit Cost	LS	1		\$0.00	
10	Steel Bulkhead Cap, STA 0+00 to STA 13+30					
	Furnish Steel Cap Components (Plate)	LB	27,265	\$0.54	\$14,736.73	Written Quote dated 8/30/2016 from Raymond Piling x 1.15 Mark-up (20.5 plf)
	Furnish Misc. Materials & Equipment (welding rod, etc.)	LS	1	\$7,500.00	\$7,500.00	Estimator's Judgment
	Coat Steel Cap Components	SF	5,320	\$5.96	\$31,707.20	Assume 1,330 LF x 4 SF/LF
	Additional Transportation to/from Coating Facility	TON	14	\$35.00	\$477.14	Estimator's Judgment
	Fabricate Steel Channel Cap Components (Plate)	DAY	20	\$2,500.00	\$50,000.00	Estimator's Judgment
	Install Steel Channel Cap	DAY	18	\$4,500.00	\$81,000.00	Assume Work Barge, Crew, and Equipment, Assume 75 LF/DAY
					\$185,421.07	
	Calculate Bid Unit Cost	LF	1,330		\$139.41	
11	Cathodic Protection					
	Furnish Anodes	EA	110	\$275.00	\$30,250.00	Estimator's Judgment
	Shipping FOB to New Haven	TRK	4	\$4,500.00	\$18,000.00	Estimator's Judgment
	Install Anodes	DAY	15	\$4,500.00	\$67,500.00	Assume 3 Man Dive Crew, Work Barge, Equipment, and Materials (8 per Day)
	Furnish and Install Test Stations	EA	11	\$2,500.00	\$27,500.00	Estimator's Judgment
	Cathodic Protection Engineer	LS	1	\$0.00	\$0.00	Covered Under Bid Item 2
	Video Dive Inspection of Installed Anodes	DAY	2	\$3,200.00	\$6,400.00	Assume 3 Man Dive Crew
	Coating Touch-Up Allowance Around Welded Pipe Cores	DAY	4	\$4,500.00	\$18,000.00	Assume 3 Man Dive Crew, Work Barge, Equipment, and Materials (24 per Day)
				\$167,650.00		
	Calculate Bid Unit Cost	EA	52		\$3,224.04	
12	Standby Time					
	Standby Time	DAY	5	\$7,500.00	\$37,500.00	Estimator's Judgment
					\$37,500.00	
	Calculate Bid Unit Cost	DAY	5		\$7,500.00	
13	Demobilization and Clean-up					
	Demobilization and Clean-up	LS	1	\$50,000.00	\$50,000.00	Estimator's Judgement
					\$50,000.00	
	Calculate Bid Unit Cost	LS	1		\$50,000.00	

Table A-6.3
Budget-Level Cost Estimate
Ancillary Improvements - Oversheeting, Area D
Alternatives Evaluation Report
City of New Haven, CT

Item	Description	Unit of Payment	Estimated Quantity	Unit Price	Extended Total	Comments
	SUBTOTAL				\$4,815,817.57	Sum of Base Bid Items 1 through 13
	Scope and Budget Contingencies				\$1,203,954.39	Scope and Budget Contingencies @ 25%
	Subsurface Investigation				\$72,237.26	Assume @ 1.5%, Related to Flood Proofing Alternative Only
	Permitting				\$48,158.18	Assume @ 1.0%, Related to Flood Proofing Alternative Only
	Plans, Specifications, and Engineering				\$168,553.62	Assume @ 3.5%, Related to Flood Proofing Alternative Only
	Construction Phase Services				\$216,711.79	Assume @ 4.5%, Related to Flood Proofing Alternative Only
	TOTAL ESTIMATE (2016 USD)				\$6,600,000.00	Rounded to the Nearest \$100,000.00
	Oversheeting Cost Per LF of Bulkhead				\$4,970.00	For a Bulkhead length of 1,330 LF



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