New Bedford Harbor Superfund Site

U.S. Army Corps of Engineers New England District

Draft Final Intertidal Work Plan for Parcel 25-34A, East Zone 1 Revision 2

ACE-J23-35BG2000-M1-0117

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New Bedford Harbor Superfund Site

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Document history and status

Revision	Date	Description	By	Review	Approved

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Tables

Appendix

Acronyms and Abbreviations

cy	cubic yards
EPA	U.S. Environmental Protection Agency
ft	foot/feet
GPS	global positioning system
mg/kg	milligrams per kilogram
NAE	U.S. Army Corps of Engineers, New England District
NBHSS	New Bedford Harbor Superfund Site
PCB	polychlorinated biphenyl
PECC	pre-excavation confirmatory congener
ROD	Record of Decision
RTK	real time kinematic
sf	square feet
TCL	target cleanup level
TSCA	Toxic Substances Control Act

1.0 Introduction

This Work Plan for Parcel 25-34A provides information concerning shoreline remediation and restoration pursuant to the New Bedford Harbor Superfund Site (NBHSS), including maps and figures of the excavation area, equipment access plans, sample locations, and existing and proposed wetland cover and topography. The *Draft Final Generic Upper Harbor Intertidal Work Plan Revision 1* (Generic Work Plan; Jacobs 2019a) describes the means and methods for intertidal excavation, material stabilization, drainage water management, transport and disposal of polychlorinated biphenyl (PCB)-contaminated intertidal sediments, restoration of excavated areas and post-remediation monitoring and maintenance. This parcel-specific Work Plan provides additional detail and documents deviations from the procedures in the Generic Work Plan.

As described herein, certain areas of the sediment and soil on the parcel contain PCB contamination that exceeds the established target cleanup levels (TCLs) for intertidal sediment. The PCB TCLs are provided in the 1998 U.S. Environmental Protection Agency (EPA) Record of Decision (ROD) for the NBHSS (EPA 1998). The TCL for sediment and soil in saltmarshes and shoreline areas with little or no public access is 50 milligrams per kilogram (mg/kg), which is a not-to-exceed value. The TCL for Upper Harbor mudflats and subtidal areas is 10 mg/kg, which must be attained as an average on an Upper Harbor-wide basis. Sediment and soil with PCB concentrations in exceedance of the TCLs will be removed and disposed of in an off-site Toxic Substances Control Act (TSCA) permitted landfill. Following contaminated sediment removal, areas that originally supported vegetative cover will be backfilled with clean topsoil and restored with a similar vegetation type and, to the extent practicable, restored to the original elevation.

2.0 Parcel Description

Parcel 25-34A is located within the intertidal management area referred to as East Zone 1 on the eastern shore of the Acushnet River in Acushnet, MA where the river widens to become the New Bedford Upper Harbor. A site location map showing the parcel location and the limit of planned excavation within the parcel is provided in Figure 2-1. The parcel is comprised of undeveloped land on the western portion and commercial development in the eastern portion. The undeveloped portion consists of vegetative cover, primarily clusters of trees, shrubs, saltgrass and the invasive grass, *Phragmites australis*. Overhead high-voltage power lines bisect the parcel near the western boundary. The parcel is bounded to the north by Parcel 25-31, to the east by residential properties along South Main Street, and to the south by Parcel 25-34. The western side of the parcel is bounded by New Bedford Upper Harbor. Remediation of contaminated sediments will take place along the undeveloped shoreline between Parcel 25-31 and Parcel 25-34.

The existing wetland vegetation was surveyed by Jacobs in 2017. The mapped survey results and the outline of the excavation area are provided in Figure 2-2. The shoreline of this parcel includes mudflats, low marsh, high marsh, and *Phragmites*. Sediment and soil samples collected during the site investigation/characterization phase were analyzed for total PCBs. The analytical results summarized in Table 2-1 were used to support remediation planning. The sample locations used to delineate the extent of PCB contamination within the Parcel 25-34A area are shown in Figure 2-3.

3.0 Excavation

3.1 Site Preparation

Access to the portions of the parcel requiring remediation will be via South Main Street, as coordinated with the property owner and pursuant to an access agreement obtained by EPA. Temporary roads will be built to create equipment access to the remediation areas. A construction site plan showing the excavation areas, staging area, containment area and temporary access roads is provided as Figure 3-1. The conceptual layout of the staging area is shown in Figure 3-2. The dimensions and final location of the staging area may be altered based on field conditions.

Prior to any site clearing or grubbing necessary to build the access road to the excavation areas, mature, non-invasive tree and shrub species will be marked in the field and preserved when possible during construction. A native tree and shrub inventory is included as Appendix A. Other vegetation will be cleared from the site as necessary to permit access road construction and remedial excavation. Disturbance of the property will be minimized to the extent practicable.

3.2 Excavation Plan

Using PCB data collected through multiple rounds of sampling, a 3-dimensional excavation model was developed as depicted in the Parcel 25-34A Excavation Plan in Figure 3-3. The cut depth, areal extent of contamination and pre-excavation surface elevations for the excavation area within Parcel 25-34A are shown in Figure 3-3a (northern portion) and Figure 3-3b (southern portion). The total area to be excavated is approximately 59,600 square feet (sf) and has a corresponding volume of 2,452 cubic yards (cy). An additional 883 cy of uncontaminated soil also will be excavated to achieve the restoration design described in Section 7.0.

A barge-mounted dredge was used to remove the majority of the mudflat sediments adjacent to Parcel 25-31. The landward extent of dredging is shown in Figures 3-3, 3-3a and 3-3b. Mudflat sediment that is not removed with the dredge will be removed with an amphibious excavator. The amphibious excavator will remove contaminated sediment in the mudflat, saltmarsh and upland areas. If *Phragmites* roots come up as a single mass that is thicker than the cut depth, the entire mass will be removed. Following excavation, the area will be smoothed with the excavator as needed to create an even surface prior to placement of backfill.

3.3 Post Excavation Compliance

Confirmation of compliance with the TCLs will be based on pre-excavation confirmatory congener (PECC) sampling and collection of post-excavation survey data to demonstrate that the excavation achieved the horizontal and vertical design limits. The PECC sample locations shown in Figure 3-4 include excavation sidewall and floor locations where PCB congener concentrations were previously determined to be below the TCL. PECC sample locations for saltmarsh areas are spaced at approximate 100-foot (ft) intervals along the excavation sidewall and in an approximate 100-ft grid pattern on the excavation floor. PECC sample results are shown in Table 2-1. PECC locations are not needed on the western side of the excavation because it will be subtidal after excavation. Post-excavation confirmatory samples for mudflats that are subtidal after excavation will be collected as part of the subtidal confirmatory sampling program.

Design elevation compliance measurements at the PECC locations will be made using a real-time kinematic (RTK) global positioning system (GPS) with vertical and horizontal accuracies of less than 0.1 ft. Compaction by heavy equipment after excavation will be avoided until target elevations are confirmed by RTK survey. A survey control table will be developed to document the pre- and post-excavation compliance measurements. Additional removal will be performed if a post-excavation elevation survey indicates that a PECC location was not excavated to the target elevation. Additional removal will be performed as described in Section 4.5 of the Generic Work Plan.

If the PECC approach is proven to be ineffective at East Zone 1 Parcels 25-24 and 25-31, then post-excavation confirmatory samples will be collected at the PECC locations, and the excavation will not be backfilled until it is confirmed to be clean. Confirmatory samples will be analyzed for PCB congeners with a 5-day turnaround time for the analysis.

4.0 Backfill

Upon verification that compliance with the TCLs has been met based on post-excavation elevation survey data, the excavation in previously vegetated areas will be backfilled with clean manufactured topsoil. The topsoil will meet the quality requirements identified in the *Draft Final Topsoil Acceptance Plan* (Jacobs 2019b). Topsoil backfill will consist of 6 to 12 inches of topsoil to support vegetation regrowth and achieve the restoration design provided in Section 7.0. Where excavation depth exceeds 1 ft, a 3-inch minus clean gravel substrate will be placed to within 1 ft of the target grade and topsoil will be placed on top of the substrate to bring the surface to the target elevation. A specification for the gravel backfill is provided in the Generic Work Plan. The gravel substrate and topsoil will be delivered to the restoration areas by over-the-road dump trucks and offloaded into stockpiles near the excavation area. A clean, decontaminated all-terrain dump truck or tracked excavator will transport the topsoil for spreading. Post-backfill saltmarsh topography will match the restoration surface described in Section 7.0 with a tolerance of +/- 0.3 ft except in areas previously colonized by *Phragmites,* where the surface may be lower than the planned restoration surface if additional *Phragmites* root mat is removed during excavation. The surface may be restored to an elevation of 0.1 to 0.2 ft. above the planned grade to allow for natural soil compaction. During the restoration process, the elevation of the placed topsoil will be checked periodically with the GPS Rover and with the excavator bucket. Elevation measurements will be taken after each area is backfilled, prior to relocating the excavator. Excavated mudflats will not be backfilled except where needed to provide drainage or slope stability.

5.0 Schedule

The durations of the remedial activities included in this Work Plan are listed below. A more detailed construction planning schedule will be developed prior to field activities and will be attached to this Work Plan as Appendix C.

Activity	Anticipated Duration
Excavation	1.5 months
Restoration	1.25 months
After Action Report	3 months

6.0 Air Monitoring

The evaluation of existing PCB congener data (Table 2-1) indicates that the maximum concentration at Parcel 25-34A is 7,020 mg/kg. As stipulated in the *NBHSS Draft Final Ambient Air Monitoring Plan for Remediation Activities Revision 2* (Ambient Air Monitoring Plan; Jacobs 2018a), particulate monitoring during excavation will be conducted when the excavator is within 25 ft of a location with a PCB concentration of greater than 500 mg/kg. Particulate and airborne PCB monitoring will be conducted in accordance with the guidelines provided in the Ambient Air Monitoring Plan.

7.0 Restoration

All excavated areas except mudflats will be backfilled, regraded, and revegetated to best replicate the pre-remediation conditions and restrict the reestablishment of invasive species. A pre-construction tree and shrub inventory of plants within the excavation area and access road area is included in Appendix A. The pre-construction wetland cover conditions shown on Figure 2-2 include extensive stands of the non-native invasive grass *Phragmites*. The restoration surface has been designed to be lower than the current elevations on the seaward side of the parcel where possible to increase tidal inundation and discourage *Phragmites* recolonization. Engineered swales also were added to the design to increase tidal inundation. *Phragmites* that occurs within the excavation area will be removed and disposed of with the excavated sediment and replaced with the appropriate wetland species for the restored, slightly lower elevation. Restored vegetation types within the remediation area are shown in plan view in Figure 7-1. A conceptual as-built cross section is provided in Figure 7-2 and construction cross sections are provided in Appendix B. The existing and proposed post-restoration acreage of each cover type is included in Table 7-1. Tree and shrub species identified for restoration are included in Table 7-2 and in the Shrub Area Plantings notes included in Figure 7-1.

Coir fiber rolls will be installed to dissipate wave energy at the base of the low marsh slope as shown on Figures 7-1 and 7-2 such that the top of the log is approximately at final grade. Connecting edges of the rolls will be secured together with twine or another suitable tie. All coir rolls will be staked in place with 2-inch hardwood stakes with approximate 2 ft spacing. Planting of trees, shrubs and 2-inch bare-root salt grass plugs will be conducted after excavation and backfill in accordance with favorable weather conditions and within the planting season from approximately April 15 to June 30 or in the early fall. Salt grass plants will be obtained from a nursery that that can provide plugs grown from a Northeastern U.S. genotype seed stock.

Herbivory deterrents will be used to protect the seedlings during the establishment period. A combination fence and rope grid system similar to the one installed at the Pierce Mill Cove intertidal restoration area will be constructed (Jacobs 2018b). If unforeseen conditions are identified that could affect the ability of the restoration to achieve the success standards adopted for the program, appropriate adaptive management measures will be developed and implemented in coordination with the U.S. Army Corps of Engineers, New England District (NAE) and EPA.

Although a portion of the *Phragmites* root mat may remain at depth after excavation, no measures will be taken to remove or treat the residual roots and rhizomes because complete removal would require significant over-excavation and the likely presence of water in the excavation precludes other approaches such as burning root stock or broad application of herbicides. No mechanical removal of *Phragmites* is proposed outside of excavation boundaries. All remaining areas of *Phragmites* within 30 ft of the restored marsh will be treated with herbicide in

accordance with the guidelines in the Generic Work Plan to promote a *Phragmites* free buffer. At the conclusion of all restoration activities, final vegetation and topographic surveys will be conducted to document the as-built elevation and vegetative cover conditions.

8.0 References

U.S. Environmental Protection Agency (EPA). 1998 (September). *Record of Decision for the Upper and Lower Harbor Operable Unit, New Bedford Harbor Superfund Site*. USEPA Region 1 – New England.

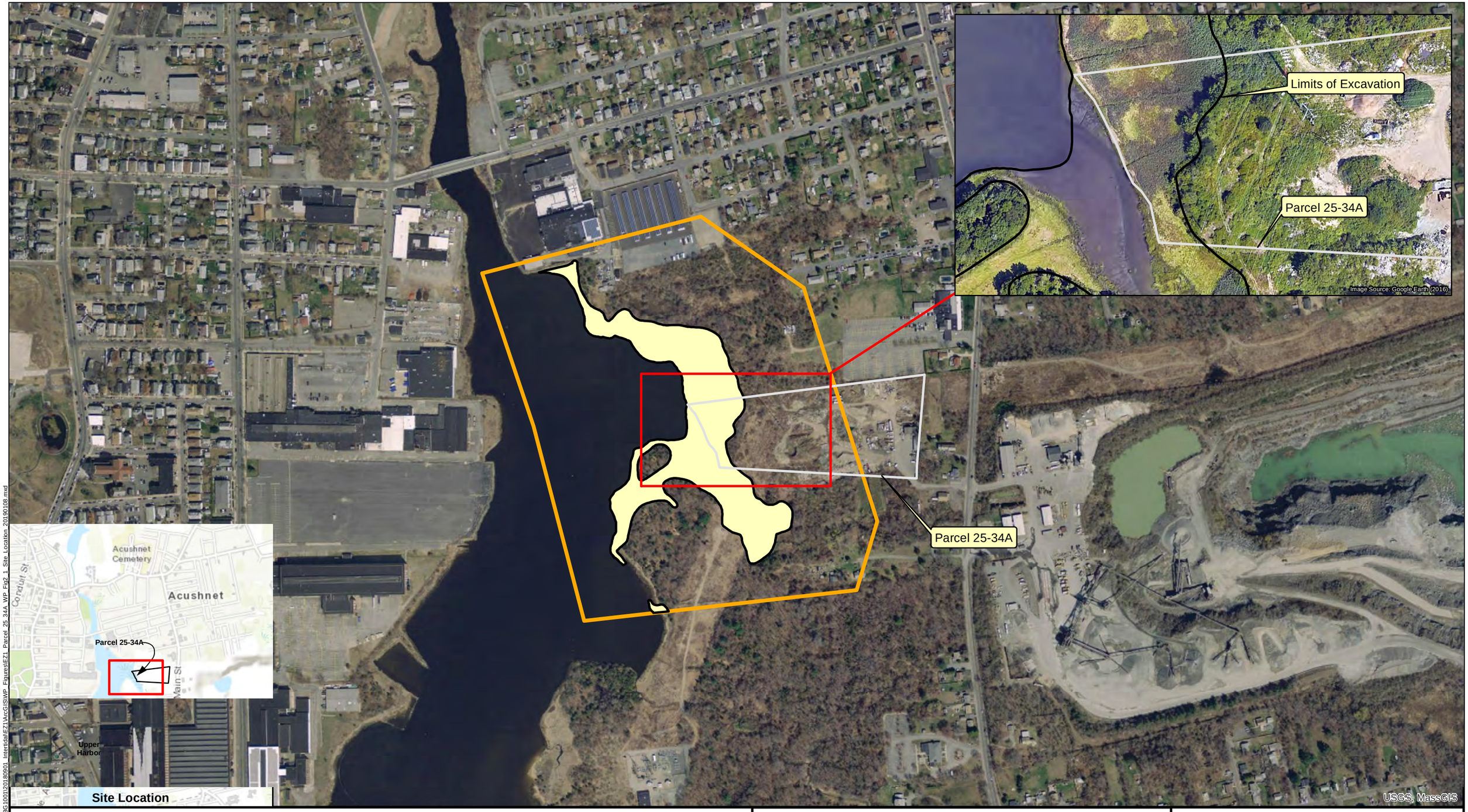
Jacobs. 2019a (May). *Draft Final Rev1 Generic Upper Harbor Intertidal Work Plan Revision 1*. ACE J23 35BG2000 M1-0109.

——— 2019b (January). *Draft Final Topsoil Acceptance Plan*. ACE J23 35BG2000 M1-0076.

——— 2018a (April). *Draft Final Ambient Air Monitoring Plan for Remediation Activities Revision 2*. ACE-J23-35BG2000-M17-0016.

——— 2018b (November). *NBHSS Draft Final Pierce Mill Cove Herbivory Control Plan.* ACE-J23-35BG2000-M17-0040.

Figures



Legend

- Proposed Limits of Excavation
- Parcel Boundary
- East Zone 1 Management Area

Elevation Data NAVD88 ft

0 400 800 Feet

Basemap Data Source: MassGIS, ESRI

January 2019

Intertidal Eastern Zone 1
Parcel 25-34A
Site Location and Features

New Bedford Harbor Superfund Site

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Figure 2-1

Path: C:\Users\scottga\Documents\NBH3SBG1001\20180901_IntertidalEZ1\ArcGIS\WP_Figures\EZ1_Parcel_25_34A_WP_Fig2_1_Site_Location_20190108.mxd

Notes:

Existing vegetative cover was surveyed by Nearview, LLC (October 2017).

25-31

25-34A

25-34

0

0

0

USGS, MassGIS

Legend

- Mean Higher High Water
- Mean Lower Low Water
- 1-foot Contour
- 0-1' Excavation Depth
- 1-2' Excavation Depth
- 2-3' Excavation Depth
- Parcel Boundary
- Phragmites
- Scrub-Shrub Marsh
- High Marsh
- Low Marsh
- Mudflat

0 50 100 Feet

January 2019

Basemap Data Source: MassGIS

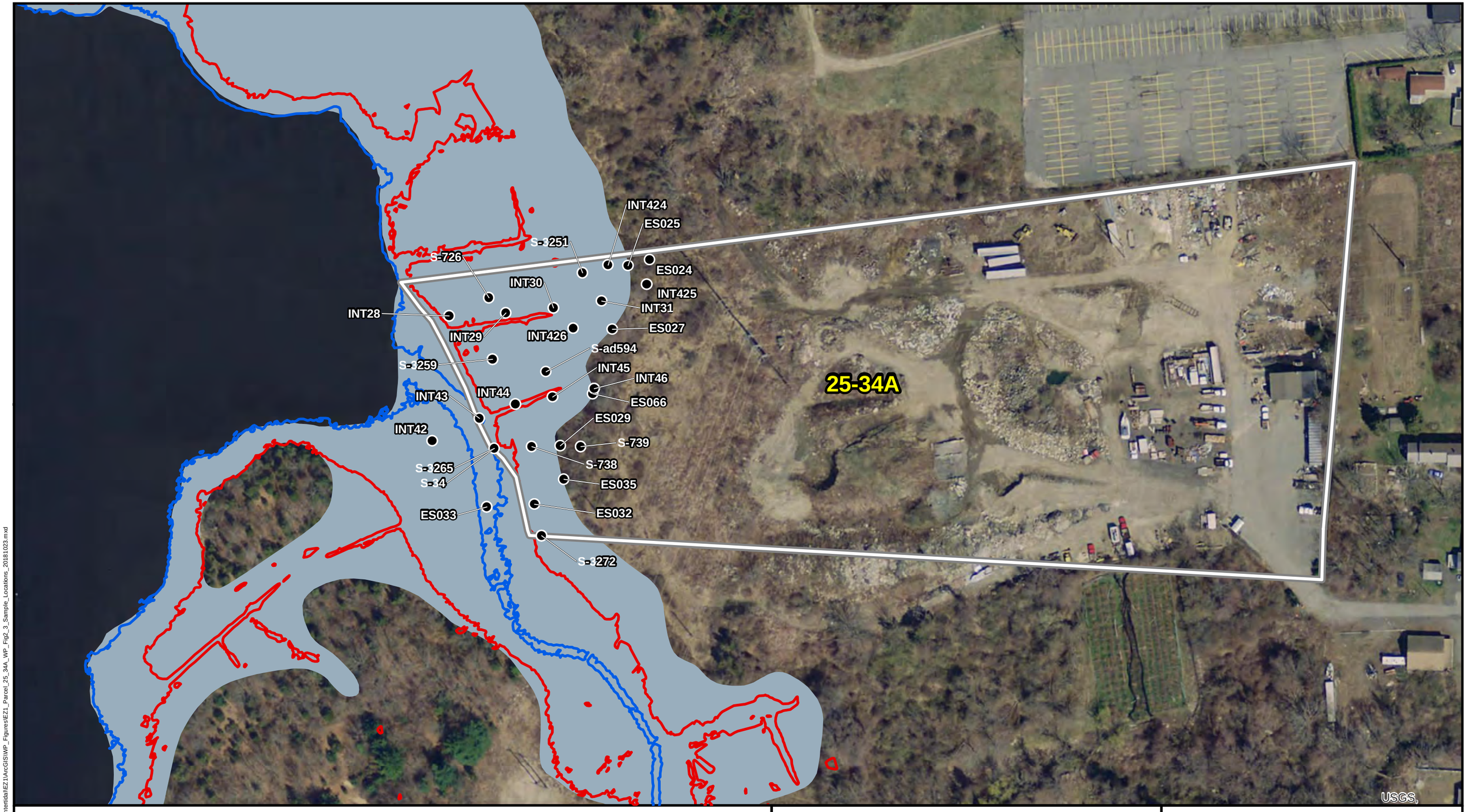
Vertical Datum NAVD88

Upper Harbor East Zone 1, Parcel 25-34A
Existing Vegetation and Topography

New Bedford Harbor Superfund Site

JACOBS

Figure 2-2



Legend

- Sample Location
- Proposed Limits of Excavation
- Parcel Boundary
- MHHW (1.99 ft)
- MLLW (-1.97 ft)

0 100 200 Feet

Basemap Data Source:
MassGIS, ESRI

November 2018

Intertidal East Zone 1
Parcel 25-34A
Sampling Locations with Excavation Footprint
(0-1 ft Depth Interval)

New Bedford Harbor Superfund Site

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Figure 2-3

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Slocum St
Tittleist Dr
Hope St
Rock St
Prouteau St
25-24
Temporary Gravel Access Road
25-31
Temporary Gravel Access Road
Approximate Frac Tank Discharge Point
East Zone 1
25-34A
Staging Area, Containment Cell and Load Out Area
S Main St
25-34
Lecuyer Ln
25-36
25-43

Legend

- Proposed Limits of Excavation
- Proposed Staging Area / Containment Cell
- 15ft Temporary Gravel Access Road
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Parcel Boundary

N

Aerial Photography MassGIS 2013-2014

0 110 220 Feet

1:2,640

Pre-Excavation MHHW and MLLW Elevations NAVD88 ft. (Green Seal, May, 2018)

JACOBS

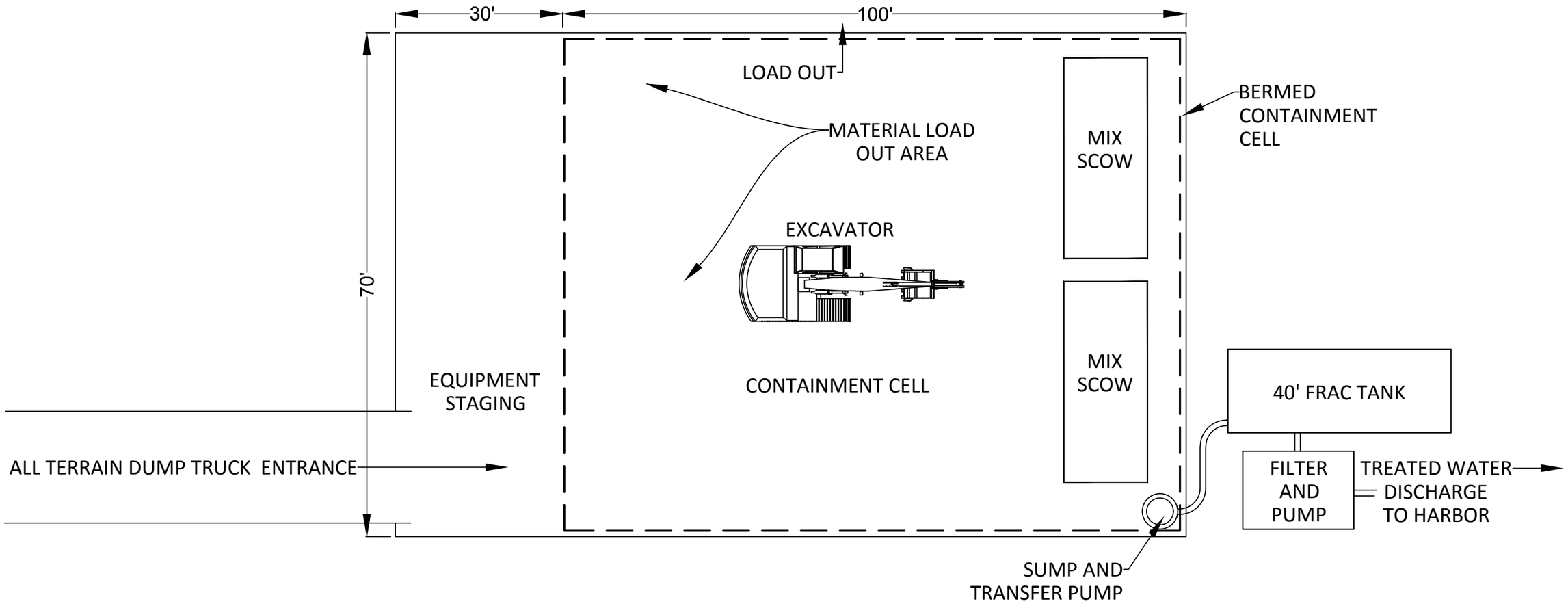
Intertidal East Zone 1 Construction Site Plan

New Bedford Harbor Superfund Site

February 2019 | Figure 3-1

Path: C:\Users\scottnal\Documents\NBH\35BG.1001\20180901_IntertidalEZ1\ArcGIS\WP_Figures\EZ1_WP_Fig3_1_Construction_Site_Plan_15ft_Road_20190224.mxd

ROADWAY FOR LOAD OUT - 30 CY DUMP TRAILER



Not To Scale

JACOBS™

Conceptual Staging and Containment Layout
(Subject to Field Adjustments)
East Zone 1
New Bedford Harbor Superfund Site

November 2018 | Figure 3-2

last modified: 10/22/18 printed: 10/24/18 by sc Y:\NBH\Projects\35BG100\120180901_Interlida\EZ1\AutoCAD\Fig3_5_EZ1_Typical Laydown Area (Staging and Containment).dwg

See Figure 3-2a

25-31

25-34A

25-34

See Figure 3-2b

25-34

USGS, MassGIS

Legend

- Inland Reach of Dredge
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Parcel Boundary

Feet of Sediment to Remove

4.5	3	1.5
4	2.5	1
3.5	2	

2.1 Pre-Excavation Elevations NAVD88 ft. (Green Seal, May, 2018)

Pre-Excavation MHHW and MLLW Elevations NAVD88 ft. (Green Seal, May, 2018)

0 50 100 Feet

N

Basemap Data Source: MassGIS, ESRI

July 2019

Intertidal East Zone 1
Parcel 25-34A
Excavation Plan
Showing Cut Depths and
Pre-Excavation Elevations

New Bedford Harbor Superfund Site

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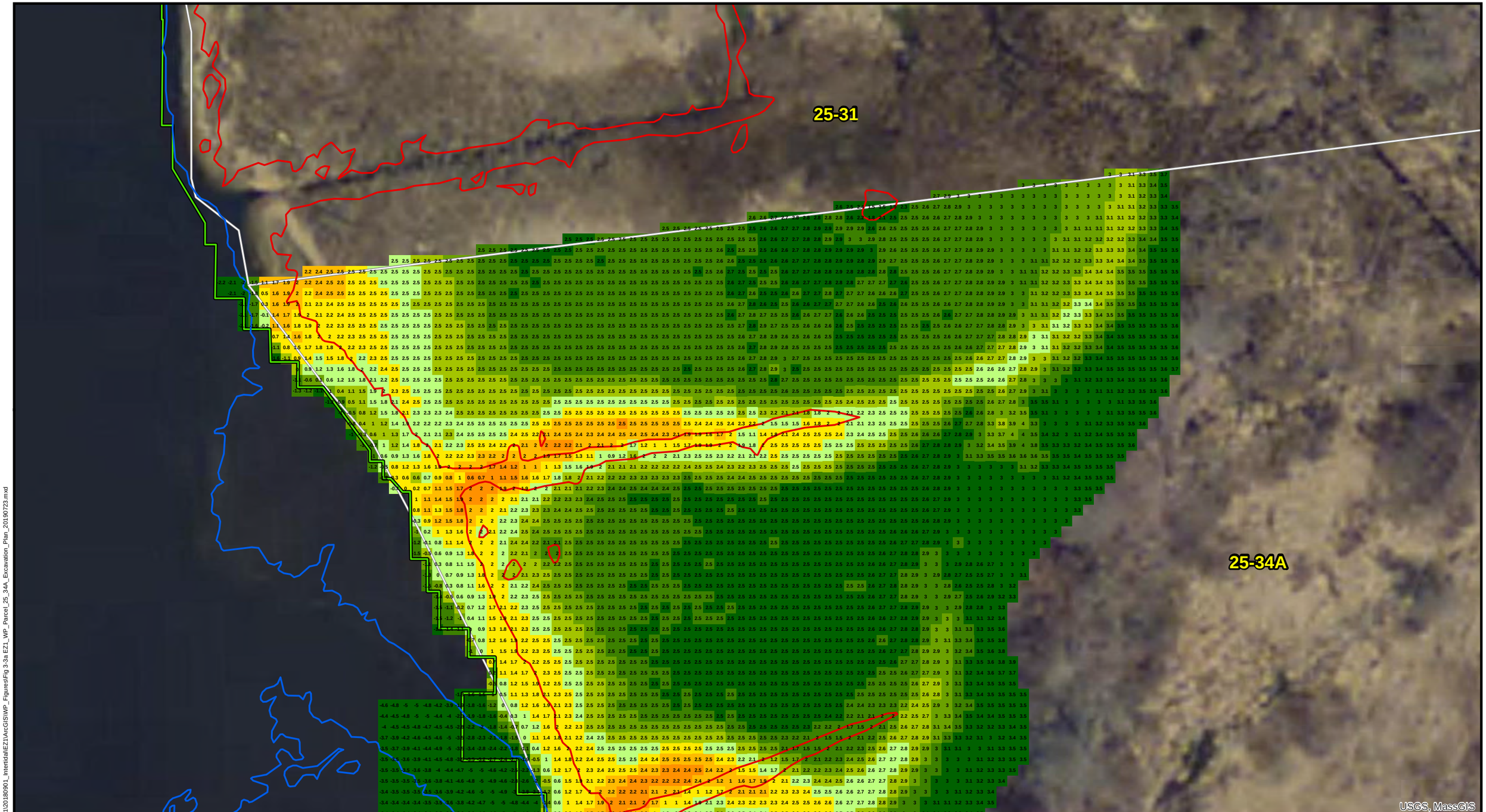
Figure 3-3

Path: C:\Users\scottga\Documents\NBH\35BG\100\120180901_Intertidal\EZ1\ArcGIS\WP_Figures\Fig 3-3 EZ1_WP_Parcel_25_34A_Excavation_Plan_20190723.mxd



Legend

- Inland Reach of Dredge
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Parcel Boundary

Feet of Sediment to Remove

4.5	3	1.5
4	2.5	1
3.5	2	

2.1 Pre-Excavation Elevations NAVD88 ft. (Green Seal, May, 2018)

Pre-Excavation MHHW and MLLW Elevations NAVD88 ft. (Green Seal, May, 2018)

0 50 Feet

Basemap Data Source: MassGIS, ESRI

July 2019

Intertidal East Zone 1
Northern Portion of Parcel 25-34A
Excavation Plan
Showing Cut Depths and Pre-Excavation Elevations

New Bedford Harbor Superfund Site

JACOBS

Figure 3-3a

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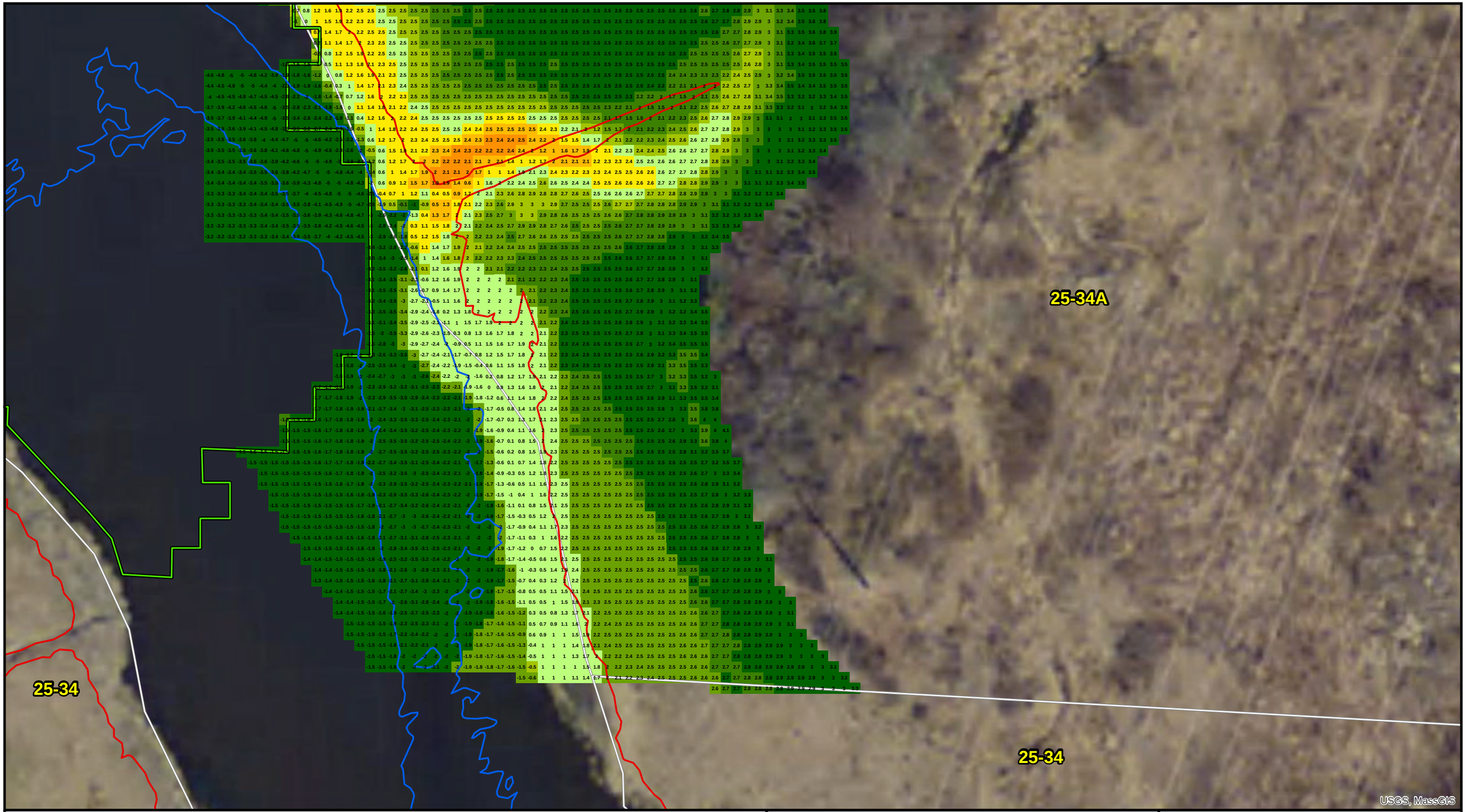

Legend

- Inland Reach of Dredge
- MHHW (1.99 ft.)
- MLLW (-1.97 ft.)
- Parcel Boundary

Feet of Sediment to Remove

4.5	3	1.5
4	2.5	1
3.5	2	

2.1 Pre-Excavation Elevations NAVD88 ft. (Green Seal, May, 2018)

Pre-Excavation MHHW and MLLW Elevations NAVD88 ft. (Green Seal, May, 2018)

0 50 Feet

Basemap Data Source: MassGIS, ESRI

September 2019

Intertidal East Zone 1
Southern Portion of Parcel 25-34A
Excavation Plan
Showing Cut Depths and Pre-Excavation Elevations

New Bedford Harbor Superfund Site

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Figure 3-3b

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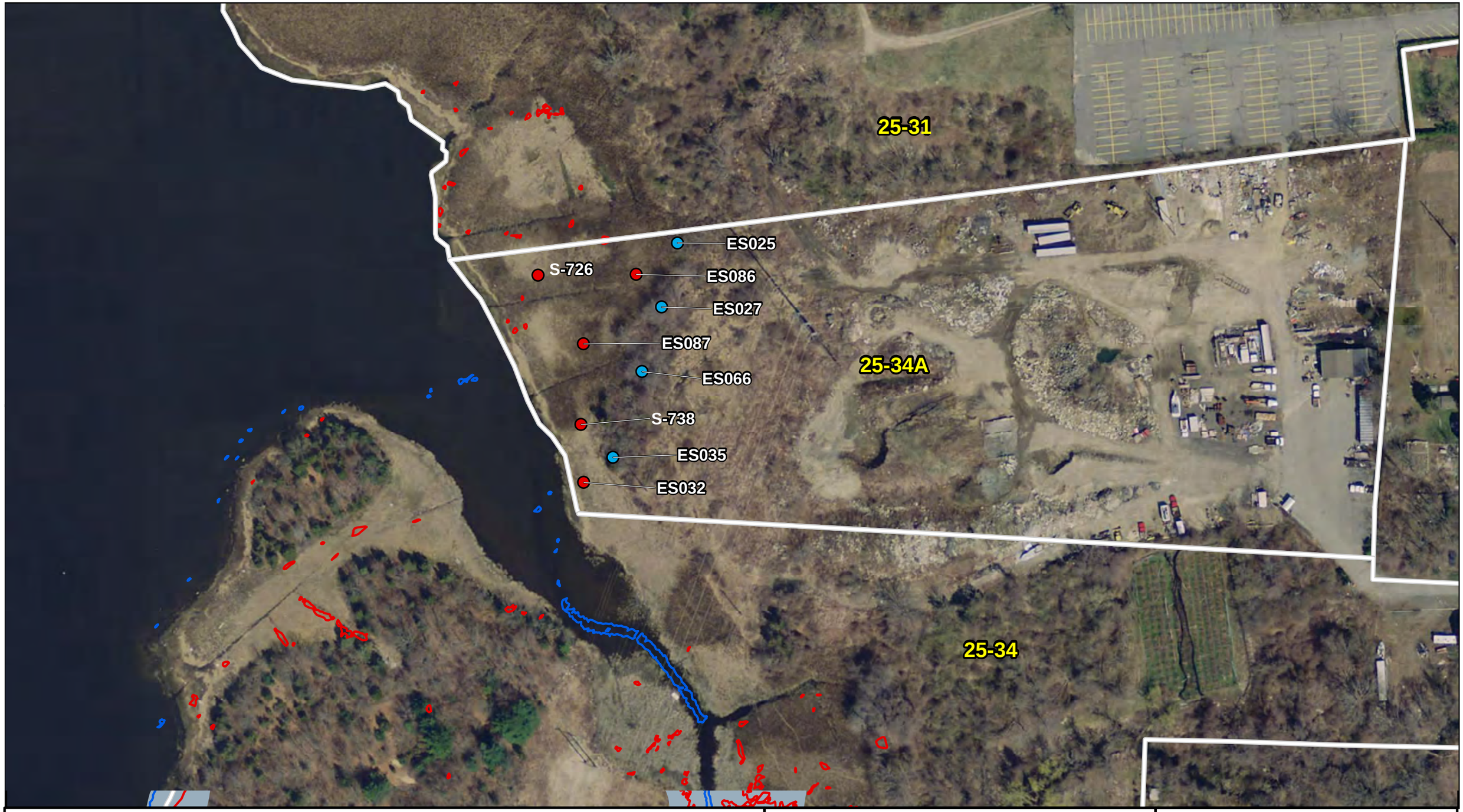


Legend

- Sidewall Confirmatory Sample Location
- Floor Confirmatory Sample Locations
- Property Parcel Line
- MHHW (1.99 ft)
- MLLW (-1.97 ft)
- Proposed Limits of Excavation

0 100 200 Feet

Basemap Data Source:
MassGIS, ESRI

November 2018

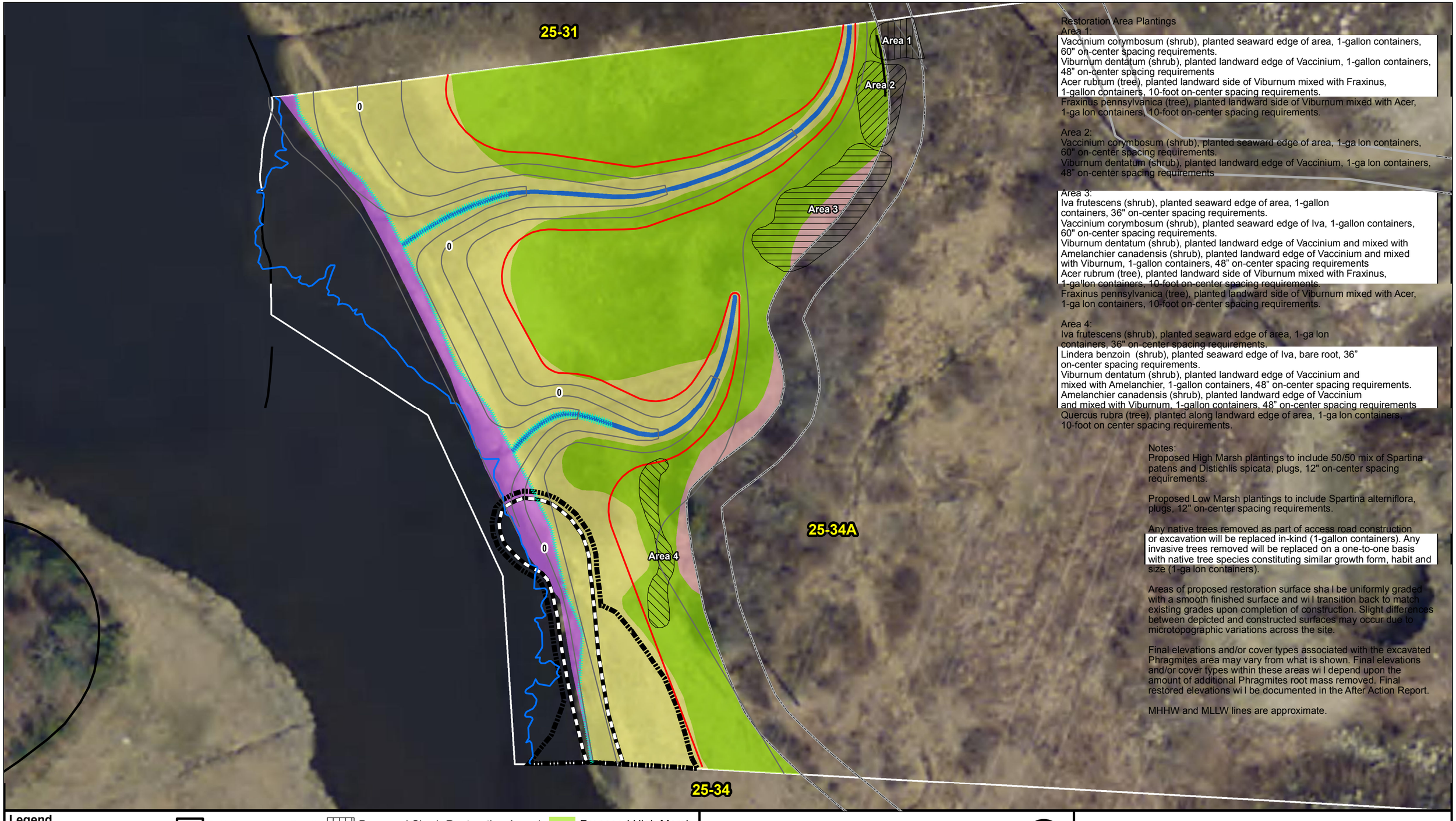
Intertidal East Zone 1
Parcel 25-34A
Confirmatory Sample Locations

New Bedford Harbor Superfund Site

JACOBS

Figure 3-4

Path: C:\Users\scottga\Documents\NBH\35BG1001\20180901_IntertidalEZ1\ArcGIS\WP_Figures\EZ1_Parcel_25_34A_WP_Fig3_3_Confirmatory_Sample_Locations_20181023.mxd



Restoration Area Plantings

Area 1:
Vaccinium corymbosum (shrub), planted seaward edge of area, 1-gallon containers, 60" on-center spacing requirements.
Viburnum dentatum (shrub), planted landward edge of Vaccinium, 1-gallon containers, 48" on-center spacing requirements
Acer rubrum (tree), planted landward side of Viburnum mixed with Fraxinus, 1-gallon containers, 10-foot on-center spacing requirements.
Fraxinus pennsylvanica (tree), planted landward side of Viburnum mixed with Acer, 1-ga lon containers, 10-foot on-center spacing requirements.

Area 2:
Vaccinium corymbosum (shrub), planted seaward edge of area, 1-ga lon containers, 60" on-center spacing requirements.
Viburnum dentatum (shrub), planted landward edge of Vaccinium, 1-ga lon containers, 48" on-center spacing requirements

Area 3:
Iva frutescens (shrub), planted seaward edge of area, 1-gallon containers, 36" on-center spacing requirements.
Vaccinium corymbosum (shrub), planted seaward edge of Iva, 1-gallon containers, 60" on-center spacing requirements.
Viburnum dentatum (shrub), planted landward edge of Vaccinium and mixed with Amelanchier canadensis (shrub), planted landward edge of Vaccinium and mixed with Viburnum, 1-gallon containers, 48" on-center spacing requirements
Acer rubrum (tree), planted landward side of Viburnum mixed with Fraxinus, 1-gallon containers, 10-foot on-center spacing requirements.
Fraxinus pennsylvanica (tree), planted landward side of Viburnum mixed with Acer, 1-ga lon containers, 10-foot on-center spacing requirements.

Area 4:
Iva frutescens (shrub), planted seaward edge of area, 1-ga lon containers, 36" on-center spacing requirements.
Lindera benzoin (shrub), planted seaward edge of Iva, bare root, 36" on-center spacing requirements.
Viburnum dentatum (shrub), planted landward edge of Vaccinium and mixed with Amelanchier, 1-gallon containers, 48" on-center spacing requirements.
Amelanchier canadensis (shrub), planted landward edge of Vaccinium and mixed with Viburnum, 1-gallon containers, 48" on-center spacing requirements
Quercus rubra (tree), planted along landward edge of area, 1-ga lon containers, 10-foot on center spacing requirements.

Notes:
Proposed High Marsh plantings to include 50/50 mix of Spartina patens and Distichlis spicata, plugs, 12" on-center spacing requirements.

Proposed Low Marsh plantings to include Spartina alterniflora, plugs, 12" on-center spacing requirements.

Any native trees removed as part of access road construction or excavation will be replaced in-kind (1-gallon containers). Any invasive trees removed will be replaced on a one-to-one basis with native tree species constituting similar growth form, habit and size (1-ga lon containers).

Areas of proposed restoration surface sha l be uniformly graded with a smooth finished surface and wi l transition back to match existing grades upon completion of construction. Slight differences between depicted and constructed surfaces may occur due to microtopographic variations across the site.

Final elevations and/or cover types associated with the excavated Phragmites area may vary from what is shown. Final elevations and/or cover types within these areas wi l depend upon the amount of additional Phragmites root mass removed. Final restored elevations wi l be documented in the After Action Report.

MHHW and MLLW lines are approximate.

Legend

- Proposed Access Road
- Proposed Coir Log
- Mean Higher High Water
- Mean Lower Low Water
- 0-1' Excavation Depth
- 1-2' Excavation Depth
- 2-3' Excavation Depth
- Parcel Boundary
- Proposed Shrub Restoration Area 1
- Proposed Shrub Restoration Area 2
- Proposed Shrub Restoration Area 3
- Proposed Shrub Restoration Area 4
- Proposed 1-foot Contours
- Proposed High Marsh
- Mudflat / Subtidal (Minimal Backfill as Needed for Drainage or Slope Stability)
- Proposed Low Marsh
- Proposed Stream
- Proposed Upland

0 50 100 Feet

April 2019

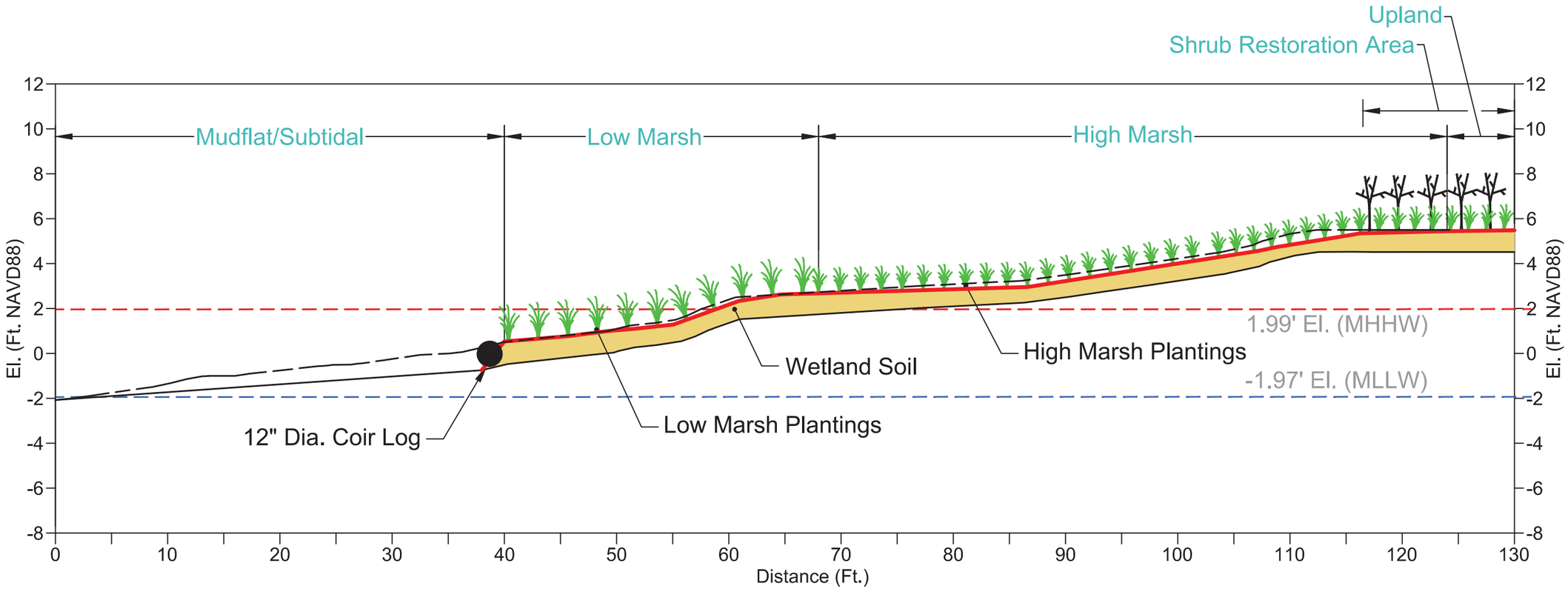
Basemap Data Source: MassGIS

Vertical Datum: NAVD88

Upper Harbor East Zone 1 Parcel 25-34A
Proposed Wetland Cover Types and Topography
New Bedford Harbor Superfund Site

JACOBS

Figure 7 - 1



Legend

- Pre-Construction Surface
- Bottom of Excavaton
- Post-Construction Surface
- (MHHW) Mean Higher High Water
- (MLLW) Mean Lower Low Water

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Upper Harbor East Zone 1
Conceptual Cross Section
New Bedford Harbor Superfund Site

11/02/18 25-24 & 24-31.dwg

Figure 7-2

Tables

Table 2-1
Parcel 25-34A Pre-Excavation PCB Characterization Sample Results

Parcel	Type	Sample ID	Station ID	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Date	Description	Total PCB (mg/kg)	Final Qualifier
25-34A	Saltmarsh	S-ES024-18FSP4-00-10	ES024	0.0	1.0	3/9/2018	Total 209 PCB cong (excl non-detects)	1.28	
25-34A	Saltmarsh	S-ES025-18FSP4-00-10	ES025	0.0	1.0	3/9/2018	Total 209 PCB cong (excl non-detects)	4	
25-34A	Saltmarsh	S-ES027-18FSP4-00-10	ES027	0.0	1.0	3/9/2018	Total 209 PCB cong (excl non-detects)	1.18	
25-34A	Saltmarsh	S-ES029-18FSP4-00-10	ES029	0.0	1.0	3/19/2018	Total 209 PCB cong (excl non-detects)	2.49	
25-34A	Saltmarsh	S-ES029R-18FSP4-00-10-REP	ES029R	0.0	1.0	3/19/2018	Total 209 PCB cong (excl non-detects)	0.875	
25-34A	Saltmarsh	S-ES032-18FSP4-10-20	ES032	1.0	2.0	3/15/2018	Total 209 PCB cong (excl non-detects)	170	
25-34A	Saltmarsh	S-ES032-18FSP4-20-30	ES032	2.0	3.0	3/15/2018	Total 209 PCB cong (excl non-detects)	19.5	
25-34A	Mudflat	S-ES033-18FSP4-20-30	ES033	2.0	3.0	3/22/2018	Total 209 PCB cong (excl non-detects)	0.289	
25-34A	Mudflat	S-ES033-18FSP4-10-20	ES033	1.0	2.0	3/22/2018	Total 209 PCB cong (excl non-detects)	0.047	
25-34A	Mudflat	S-ES033-18FSP4-30-32	ES033	3.0	3.2	3/22/2018	Total 209 PCB cong (excl non-detects)	0.0427	
25-34A	Saltmarsh	S-ES035-18FSP4-00-10	ES035	0.0	1.0	3/19/2018	Total 209 PCB cong (excl non-detects)	2.97	
25-34A	Saltmarsh	S-ES066-18FSP4-00-10	ES066	0.0	1.0	3/9/2018	Total 209 PCB cong (excl non-detects)	0.964	
25-34A	Saltmarsh	S-ES086-18FSP4-10-20	ES086	1.0	2.0	7/12/2018	Total 209 PCB cong (excl non-detects)	1.01	
25-34A	Saltmarsh	S-ES087-18FSP4-10-20	ES087	1.0	2.0	7/12/2018	Total 209 PCB cong (excl non-detects)	0.204	
25-34A	Saltmarsh	S-15A-INT28-00-10	INT28	0.0	1.0	4/21/2015	Aroclor 1254 - Immunoassay	5654	D
25-34A	Saltmarsh	S-15A-INT28-10-20	INT28	1.0	2.0	4/21/2015	Aroclor 1254 - Immunoassay	1.30	
25-34A	Saltmarsh	S-15A-INT29-00-10	INT29	0.0	1.0	4/17/2015	Aroclor 1254 - Immunoassay	369	D
25-34A	Saltmarsh	S-15A-INT29-10-20	INT29	1.0	2.0	4/17/2015	Aroclor 1254 - Immunoassay	3.90	
25-34A	Saltmarsh	S-15A-INT30-00-10	INT30	0.0	1.0	4/21/2015	Aroclor 1254 - Immunoassay	464	D
25-34A	Saltmarsh	S-15A-INT30-10-20	INT30	1.0	2.0	4/21/2015	Aroclor 1254 - Immunoassay	3.50	
25-34A	Saltmarsh	S-15A-INT31-00-10	INT31	0.0	1.0	4/21/2015	Aroclor 1254 - Immunoassay	128	D
25-34A	Saltmarsh	S-15A-INT31-10-20	INT31	1.0	2.0	4/21/2015	Aroclor 1254 - Immunoassay	0.50	U
25-34A	Mudflat	S-15A-INT42-00-10	INT42	0.0	1.0	4/21/2015	Aroclor 1254 - Immunoassay	1287	D
25-34A	Mudflat	S-15A-INT42-10-20	INT42	1.0	2.0	4/21/2015	Aroclor 1254 - Immunoassay	5.20	
25-34A	Saltmarsh	S-17Y-INT424-00-10	INT424	0.0	1.0	5/24/2017	Aroclor 1254 - Immunoassay	10.4	D
25-34A	Saltmarsh	S-17Y-INT424-10-19	INT424	1.0	1.9	5/24/2017	Aroclor 1254 - Immunoassay	1.2	
25-34A	Saltmarsh	S-17Y-INT425-00-10	INT425	0.0	1.0	5/24/2017	Aroclor 1254 - Immunoassay	2.2	
25-34A	Saltmarsh	S-17Y-INT425-10-20	INT425	1.0	2.0	5/24/2017	Aroclor 1254 - Immunoassay	0.5	U
25-34A	Saltmarsh	S-17Y-INT426-00-10	INT426	0.0	1.0	5/25/2017	Total 139 PCB cong (excl non-detects)	44	
25-34A	Saltmarsh	S-17Y-INT426-10-20	INT426	1.0	2.0	5/25/2017	Aroclor 1254 - Immunoassay	2.1	
25-34A	Saltmarsh	S-17Y-INT426-20-23	INT426	2.0	2.3	5/25/2017	Aroclor 1254 - Immunoassay	0.5	U
25-34A	Mudflat	S-15A-INT43-00-10	INT43	0.0	1.0	4/21/2015	Aroclor 1254 - Immunoassay	990	D
25-34A	Mudflat	S-15A-INT43-10-20	INT43	1.0	2.0	4/21/2015	Aroclor 1254 - Immunoassay	2.00	
25-34A	Saltmarsh	S-15A-INT44-00-10	INT44	0.0	1.0	4/21/2015	Aroclor 1254 - Immunoassay	1766	D
25-34A	Saltmarsh	S-15A-INT44-10-20	INT44	1.0	2.0	4/21/2015	Aroclor 1254 - Immunoassay	0.90	
25-34A	Saltmarsh	S-15A-INT45-00-10	INT45	0.0	1.0	4/23/2015	Aroclor 1254 - Immunoassay	1192	D
25-34A	Saltmarsh	S-15A-INT45-10-20	INT45	1.0	2.0	4/23/2015	Aroclor 1254 - Immunoassay	0.80	
25-34A	Saltmarsh	S-15A-INT46-00-10	INT46	0.0	1.0	4/23/2015	Aroclor 1254 - Immunoassay	0.80	
25-34A	Saltmarsh	S-15A-INT46-10-20	INT46	1.0	2.0	4/23/2015	Aroclor 1254 - Immunoassay	0.50	U
25-34A	Saltmarsh	S-3251-0.0-1.0	S-3251	0.0	1.0	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	49.4	
25-34A	Saltmarsh	S-3251-1.0-1.5	S-3251	1.0	1.5	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	1.53	

Table 2-1
Parcel 25-34A Pre-Excavation PCB Characterization Sample Results

Parcel	Type	Sample ID	Station ID	Sample Depth Top (ft)	Sample Depth Bottom (ft)	Sample Date	Description	Total PCB (mg/kg)	Final Qualifier
25-34A	Saltmarsh	S-3251-1.5-1.7	S-3251	1.5	1.7	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	0.05	
25-34A	Saltmarsh	S-3259-0.0-1.0	S-3259	0.0	1.0	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	252	
25-34A	Saltmarsh	S-3259-1.0-2.0	S-3259	1.0	2.0	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	0.88	
25-34A	Saltmarsh	S-3259-2.0-3.0	S-3259	2.0	3.0	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	0.09	
25-34A	Mudflat	S-3265-0.0-1.0	S-3265	0.0	1.0	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	7020	
25-34A	Mudflat	S-3265-1.0-2.0	S-3265	1.0	2.0	10/23/2001	Total 18 NOAA PCB cong (excl non-detects)	10.9	
25-34A	Saltmarsh	S-3272-0.0-1.0	S-3272	0.0	1.0	10/9/2001	Total 18 NOAA PCB cong (excl non-detects)	130	
25-34A	Saltmarsh	S-3272-1.0-2.0REP	S-3272	1.0	2.0	10/9/2001	Total 18 NOAA PCB cong (excl non-detects)	49.4	
25-34A	Saltmarsh	S-3272-2.0-3.0	S-3272	2.0	3.0	10/9/2001	Total 18 NOAA PCB cong (excl non-detects)	25.7	
25-34A	Saltmarsh	S-3272-1.0-2.0	S-3272	1.0	2.0	10/9/2001	Total 18 NOAA PCB cong (excl non-detects)	16.9	
25-34A	Mudflat	S-0034-3	S-34	2.0	3.0	9/9/1999	Total PCB Congeners (sum CONG x factor)	230	
25-34A	Saltmarsh	S-0726-1	S-726	0.0	1.0	10/16/2000	Total 18 NOAA PCB cong (excl non-detects)	1924	
25-34A	Saltmarsh	S-0726-2	S-726	1.0	2.0	10/16/2000	Total 18 NOAA PCB cong (excl non-detects)	2.86	
25-34A	Saltmarsh	S-0738-1	S-738	0.0	1.0	10/16/2000	Total 18 NOAA PCB cong (excl non-detects)	52.0	
25-34A	Saltmarsh	S-0738-2	S-738	1.0	2.0	10/16/2000	Total 18 NOAA PCB cong (excl non-detects)	23.9	
25-34A	Saltmarsh	S-0738-2DUP	S-738	1.0	2.0	10/16/2000	Total 18 NOAA PCB cong (excl non-detects)	2.44	
25-34A	Saltmarsh	S-0739-1	S-739	0.0	1.0	10/16/2000	Total 18 NOAA PCB cong (excl non-detects)	8.06	
25-34A	Saltmarsh	S-0739-2	S-739	1.0	2.0	10/16/2000	Total 18 NOAA PCB cong (excl non-detects)	0.0	U
25-34A	Saltmarsh	S-ad594	S-ad594	0.0	1.0	1/1/2000	Total PCB Congeners (sum CONG x factor)[1]	6.00	

Notes:
Pre-excavation confirmatory congener samples are highlighted green.
D - reported value is from a dilution; U - not detected.
Total 18 NOAA PCB congeners multiplied by a factor of 2.6.
1. Pre-ROD sample result is most likely a total Aroclor value although it is reported in the project database as Sum 18 NOAA PCB congeners X factor.

Table 7-1
Proposed Restoration Acreages by Cover Type

Habitat Type	Existing Pre-Construction Area [acres]	Proposed Area of Restoration [acres]
Phragmites	0.57	0.00
High Marsh	0.22	0.51
Low Marsh	0.09	0.35
Scrub-Shrub Marsh	0.03	0.00
Mudflat[1]	0.15	0.15
Stream/Open Water	0.00	0.02
TOTAL	**1.06**	**1.03**

Notes:
1. Minimal backfill as needed for drainage or slope stability.

Table 7-2
Parcel 25-34A Shrub Restoration Summary

Scientific Name	Common Name	On-Center Spacing Requirements (inches)	Number of Proposed Plants	Shrub Restoration Area
Vaccinium corymbosum	highbush blueberry	60"	5	Area 1
Viburnum dentatum	southern arrowwood	48"	8	Area 1
Acer rubrum	red maple	120"	1	Area 1
Fraxinus pennsylvanica	green ash	120"	1	Area 1
Vaccinium corymbosum	highbush blueberry	60"	15	Area 2
Viburnum dentatum	southern arrowwood	48"	24	Area 2
Iva frutescens	high-tide bush	36"	13	Area 3
Vaccinium corymbosum	highbush blueberry	60"	5	Area 3
Viburnum dentatum	southern arrowwood	48"	7	Area 3
Amelanchier canadensis	Canadian serviceberry	48"	7	Area 3
Acer rubrum	red maple	120"	1	Area 3
Fraxinus pennsylvanica	green ash	120"	1	Area 3
Lindera benzoin	spicebush	36"	14	Area 4
Viburnum dentatum	southern arrowwood	48"	8	Area 4
Amelanchier canadensis	Canadian serviceberry	48"	8	Area 4
Quercus rubra	northern red oak	120"	1	Area 4
Iva frutescens	high-tide bush	36"	14	Area 4
Total Proposed Trees/Shrubs for Parcel 25-34A			**133**	

Appendix A

Parcel 25-34A Pre-Excavation Tree and Shrub Inventory

Memorandum

JACOBS

Subject	Parcel 25-34A Native Tree and Shrub Inventory	**Project Name**	New Bedford Harbor Superfund Site
Attention	Marie Esten USACE	**Project No.**	35BG2000
From	Jessica Rebholz/Kim Degutis	**Document Control No.**	ACE-J23-35BG2000-M1-0117
Date	17 January 2019		

Attachments: Figure 1 Existing Trees and Shrubs, Parcel 25-34A, Tables 3-1 through 3-5 (inventory results)

1.0 Background

Jacobs conducted an inventory of existing trees and shrubs on Parcel 25-34A in the intertidal remediation area (Figure 1) on 31 May 2018. The purpose of the inventory was to identify existing trees and shrubs that would be removed in association with site remediation activities, including construction of the gravel access road and areas of excavation associated with contaminated sediment and soil removal. The information collected from this inventory is intended to be used to inform selection of proposed native woody species for future restoration plantings.

2.0 Methods

For the purposes of the inventory, trees were defined as any nonclimbing, woody plant that had at least one erect perennial stem (trunk) with a diameter at breast height (DBH) of 3.0 inches or greater, regardless of height. Jacobs' wetland biologists walked the planned remediation portions of Parcel 25-34A and identified all trees within the proposed excavation area and proposed access road. Tree locations were recorded using a Trimble Geo 7X GPS, capable of sub-meter accuracy.

For the purposes of the inventory, shrubs were defined as any nonclimbing, woody plant with a DBH less than 3.0 inches. Shrubs were inventoried according to dominant shrub types that appeared to constitute similar species diversity and percent areal cover. For purposes of documentation and reference, the results of the tree and shrub inventories are recorded by sub-area in separate tables included in Section 3 below.

3.0 Results

Red maple (*Acer rubrum*) is the dominant tree type within Parcel 25-34A. All of the trees identified on-site are considered native and non-invasive. A list of the trees identified is provided in Table 3-1. For each species, the number of individual trees noted was calculated as an indication of the relative dominance of the species on-site.

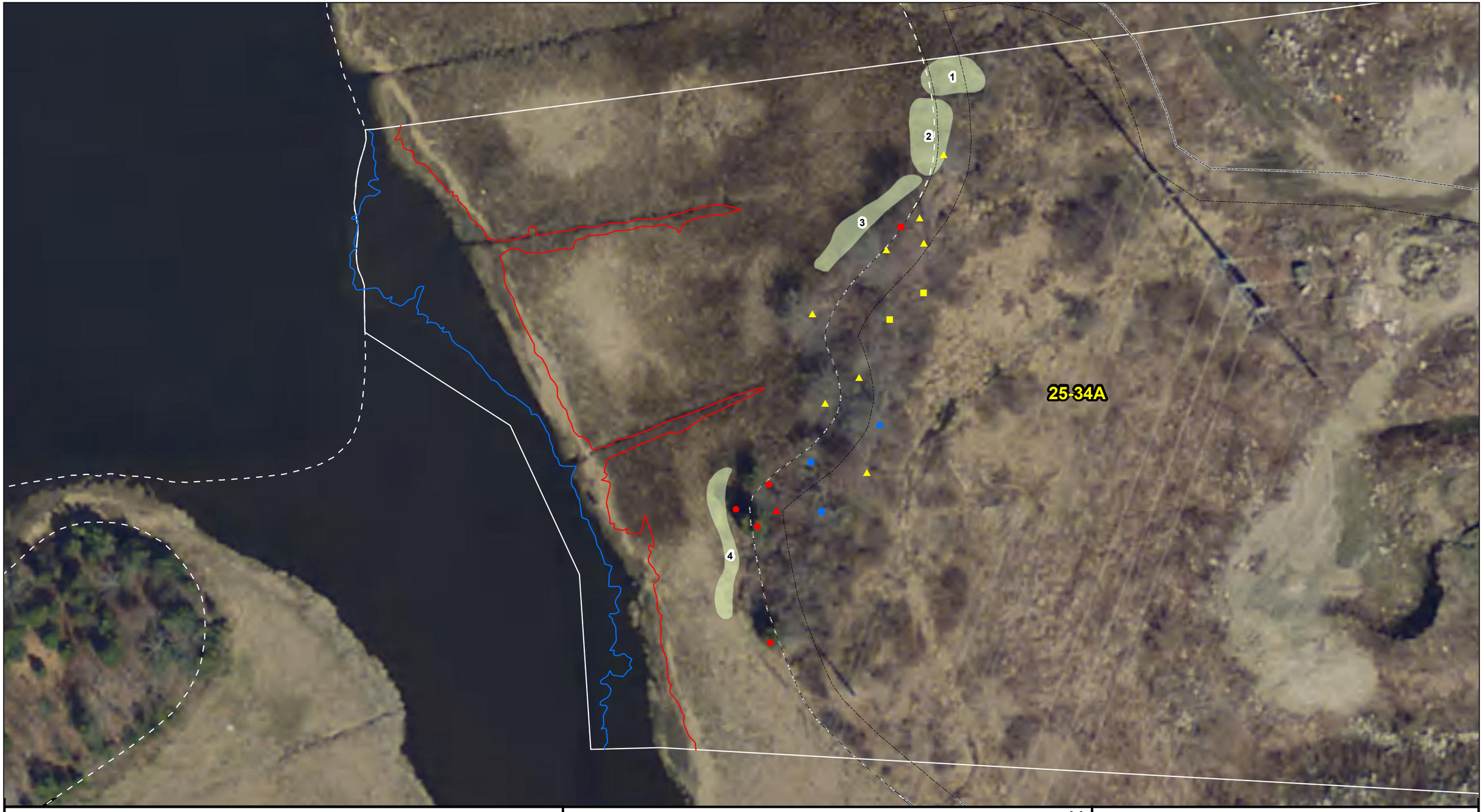
Southern arrowwood (*Viburnum dentatum*) is the dominant shrub type for Area 1 within Parcel 25-34A. Highbush blueberry (*Vaccinium corymbosum*) is the dominant shrub type for Areas 2 and 3 within Parcel 25-34A. High-tide bush (*Iva frutescens*) is the dominant shrub type for Area 4 within Parcel 25-34A. The majority of the shrubs identified are considered native and non-invasive (Tables 3-2, 3-3, 3-4 and 3-5).

Each area where shrubs were identified and inventoried is identified on Figure 1. Shrubs were classified by genus and species. Tables 3-2 through 3-5 also identify whether the shrub typically occurs in an upland area or within a wetland.

4.0 Conclusion

The species makeup of Parcel 25-34A is comprised of native, non-invasive trees and shrubs, with southern arrowwood (*Viburnum dentatum*), highbush blueberry (*Vaccinium corymbosum*), and high-tide bush (*Iva frutescens*) being the dominant shrub types and red maple (*Acer rubrum*) being the dominant tree type.

Of note, there is a large stand (~0.57 acres) of *Phragmites australis* within the planned excavation boundary of this parcel. Additionally, the boundary of *Phragmites australis* extends beyond the proposed excavation extent.



Legend

- MLLW
- MHHW
- 0-1' Excavation Depth
- Proposed Access Road
- Parcel Boundary
- Inventoried Shrub Areas
- Red cedar
- Highbush blueberry
- White oak
- Black cherry
- Red maple
- Bitternut hickory
- American linden

0 25 50 100 Feet

January 2019

N

Basemap Data Source:
MassGIS, ESRI

Parcel 25-34A
Existing Trees and Shrubs

New Bedford Harbor Superfund Site

JACOBS

Figure 1

Table 3-1
Existing Tree Inventory for Parcel 25-34A

Scientific Name	Common Name	Tree Count (≥3" DBH)	Invasive[1]	Native/Non-Native[2]
Acer rubrum	red maple	8	no	native, county documented
Quercus alba	white oak	1	no	native, county documented
Tilia americana	American linden	2	no	native, county documented
Vaccinium corymbosum	highbush blueberry	1	no	native, county documented
Prunus serotina	black cherry	2	no	native, county documented
Juniperus virginiana	eastern red cedar	4	no	native, county documented
Carya cordiformis	bitternut hickory	1	no	native, county documented
	Total	**19**		

[1]According to "The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts": https://www.mass.gov/files/documents/2016/08/tm/invasive-plantlist.pdf

[2]New England Wildflower Society. 2011. Go Botany, 12 April 2018 (https://gobotany.newenglandwild.org/). New England Wildflower Society, Framingham, MA

Table 3-2
Existing Shrub Cover for Parcel 25-34A, Area 1

Scientific Name	Common Name	Area 1 Percent Areal Cover	Invasive[1]	Native/Non-Native[2]	Upland/Wetland
Cornus florida	flowering dogwood	15%	no	native, county documented	upland
Viburnum dentatum	southern arrowwood	55%	no	native, county documented	wetland
Fraxinus americana	white ash	5%	no	native, county documented	upland
Vaccinium corymbosum	highbush blueberry	20%	no	native, county documented	wetland
Acer rubrum	red maple	15%	no	native, county documented	both

Table 3-3
Existing Shrub Cover for Parcel 25-34A, Area 2

Scientific Name	Common Name	Area 2 Percent Areal Cover	Invasive[1]	Native/Non-Native[2]	Upland/Wetland
Rosa virginiana	Virginia rose	5%	no	native, county documented	both
Vaccinium corymbosum	highbush blueberry	45%	no	native, county documented	wetland
Viburnum dentatum	southern arrowwood	5%	no	native, county documented	wetland

[1]According to "The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts": https://www.mass.gov/files/documents/2016/08/tm/invasive-plantlist.pdf

[2]New England Wildflower Society. 2011. Go Botany, 12 April 2018 (https://gobotany.newenglandwild.org/). New England Wildflower Society, Framingham, MA

Table 3-4
Existing Shrub Cover for Parcel 25-34A, Area 3

Scientific Name	Common Name	Area 3 Percent Areal Cover	Invasive[1]	Native/Non-Native[2]	Upland/Wetland
Rosa virginiana	Virginia rose	25%	no	native, county documented	both
Acer rubrum	red maple	10%	no	native, county documented	both
Lonicera morrowii	Morrow's honeysuckle	5%	yes	non-native, county documented	upland
Fraxinus americana	white ash	5%	no	native, county documented	upland
Vaccinium corymbosum	highbush blueberry	40%	no	native, county documented	wetland
Viburnum dentatum	southern arrowwood	15%	no	native, county documented	wetland
Amelanchier canadensis	Canadian serviceberry	2%	no	native, county documented	both
Hamamelis virginiana	American witch hazel	10%	no	native, county documented	upland
Ilex opaca	American holly	1%	no	native, county documented	upland
Juniperus virginiana	eastern red cedar	5 - 10%	no	native, county documented	upland

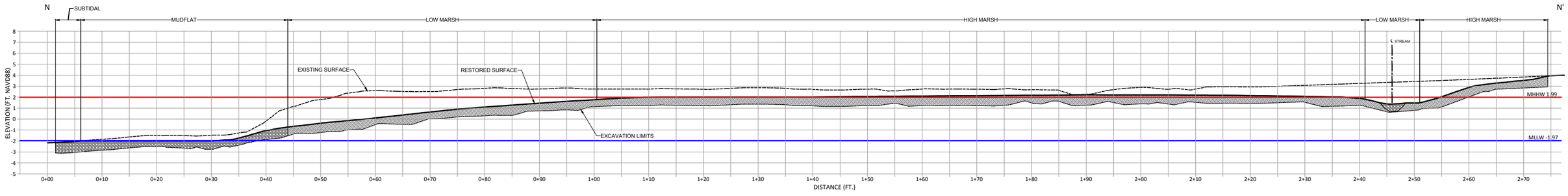
[1]According to “The Evaluation of Non-Native Plant Species for Invasiveness in Massachusetts”: https://www.mass.gov/files/documents/2016/08/tm/invasive-plantlist.pdf

[2]New England Wildflower Society. 2011. Go Botany, 12 April 2018 (https://gobotany.newenglandwild.org/). New England Wildflower Society, Framingham, MA

Table 3-5
Existing Shrub Cover for Parcel 25-34A, Area 4

Scientific Name	Common Name	Area 4 Percent Areal Cover	Invasive[1]	Native/Non-Native[2]	Upland/Wetland
Lindera benzoin	northern spicebush	25%	no	native, county documented	wetland
Juniperus virginiana	eastern red cedar	5%	no	native, county documented	upland
Quercus rubra	red oak	5%	no	native, county documented	upland

Appendix B
Cross Sections



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

0 3 6 9
1" = 9' VERTICAL

0 6 12 18
1" = 18' HORIZONTAL

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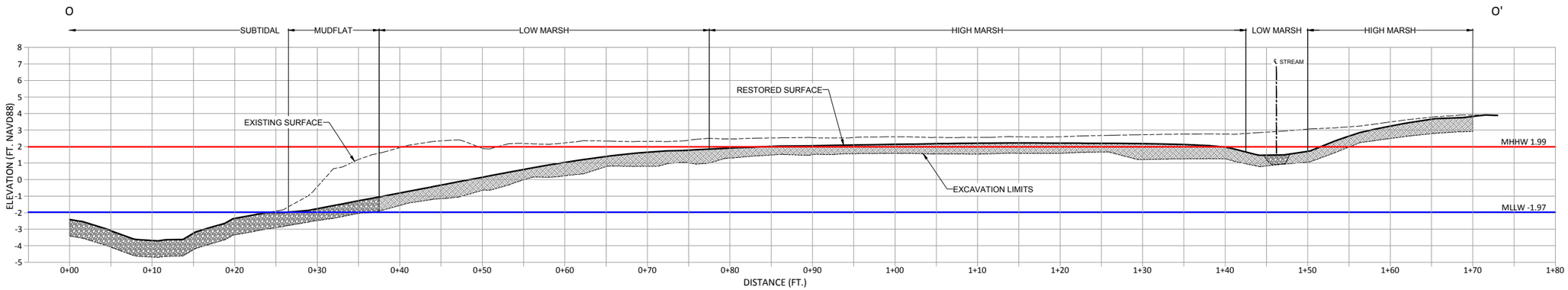
EAST ZONE 1
PARCEL 25-34A
SECTION N-N'
NEW BEDFORD HARBOR

FEBRUARY 2019 | FIGURE 1



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

0 2 4 6
1" = 7' VERTICAL

0 4 8 12
1" = 14' HORIZONTAL

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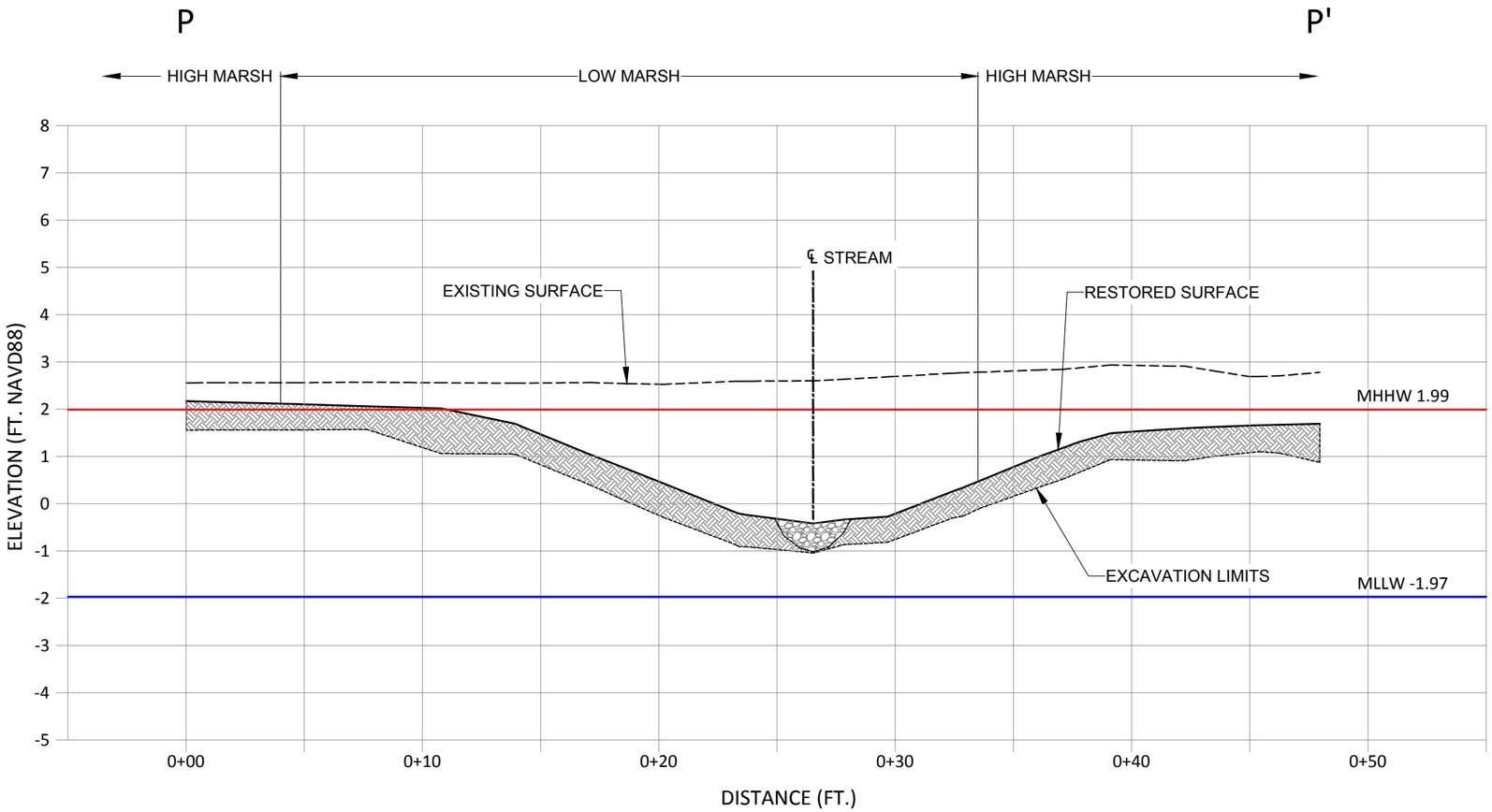
EAST ZONE 1
PARCEL 25-34A
SECTION O-O'
NEW BEDFORD HARBOR

FEBRUARY 2019 | FIGURE 2



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

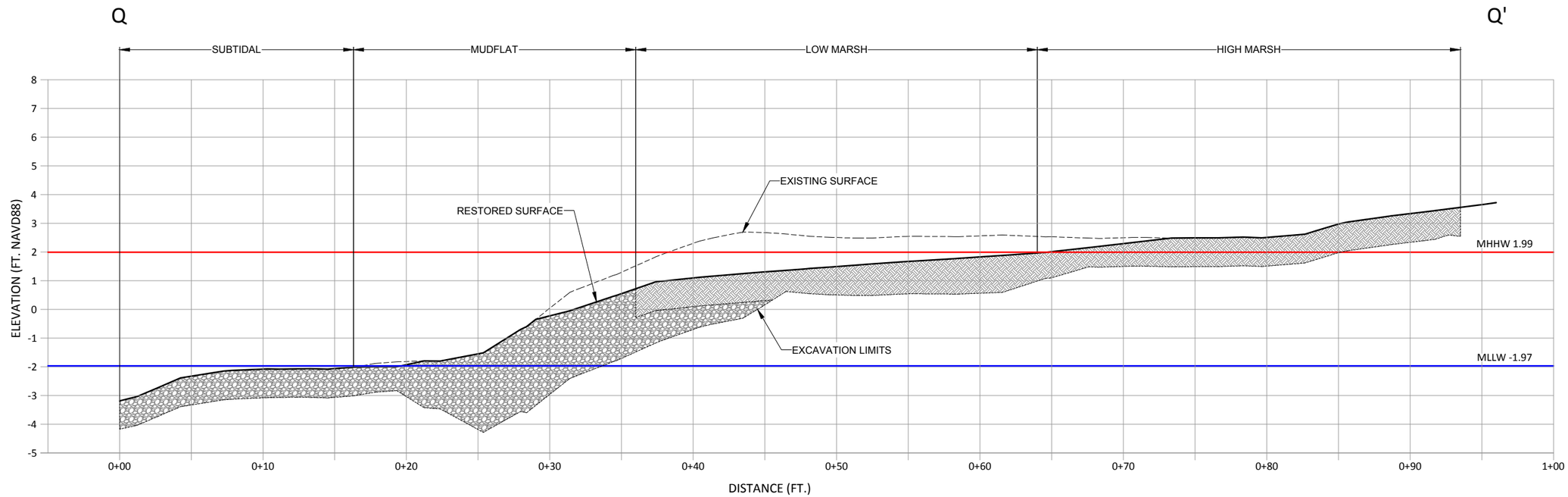
0 1 2 3
1" = 3' VERTICAL

0 2 4 6
1" = 6' HORIZONTAL

JACOBS™

EAST ZONE 1
PARCEL 25-34A
SECTION P-P'
NEW BEDFORD HARBOR

FEBRUARY 2019 | FIGURE 3



LEGEND:

- MHHW (1.99 FT)
- MLLW (-1.97 FT)
- TOPSOIL BACKFILL
- GRAVEL BACKFILL

NOTES:

1) The existing surface is shown where it is different from the restored surface.
2) Mudflats will be backfilled to pre-excavation elevations to approximately 10 feet seaward of the coir logs installed at the low marsh/mudflat boundary, then sloped downward to meet the existing harbor bottom.

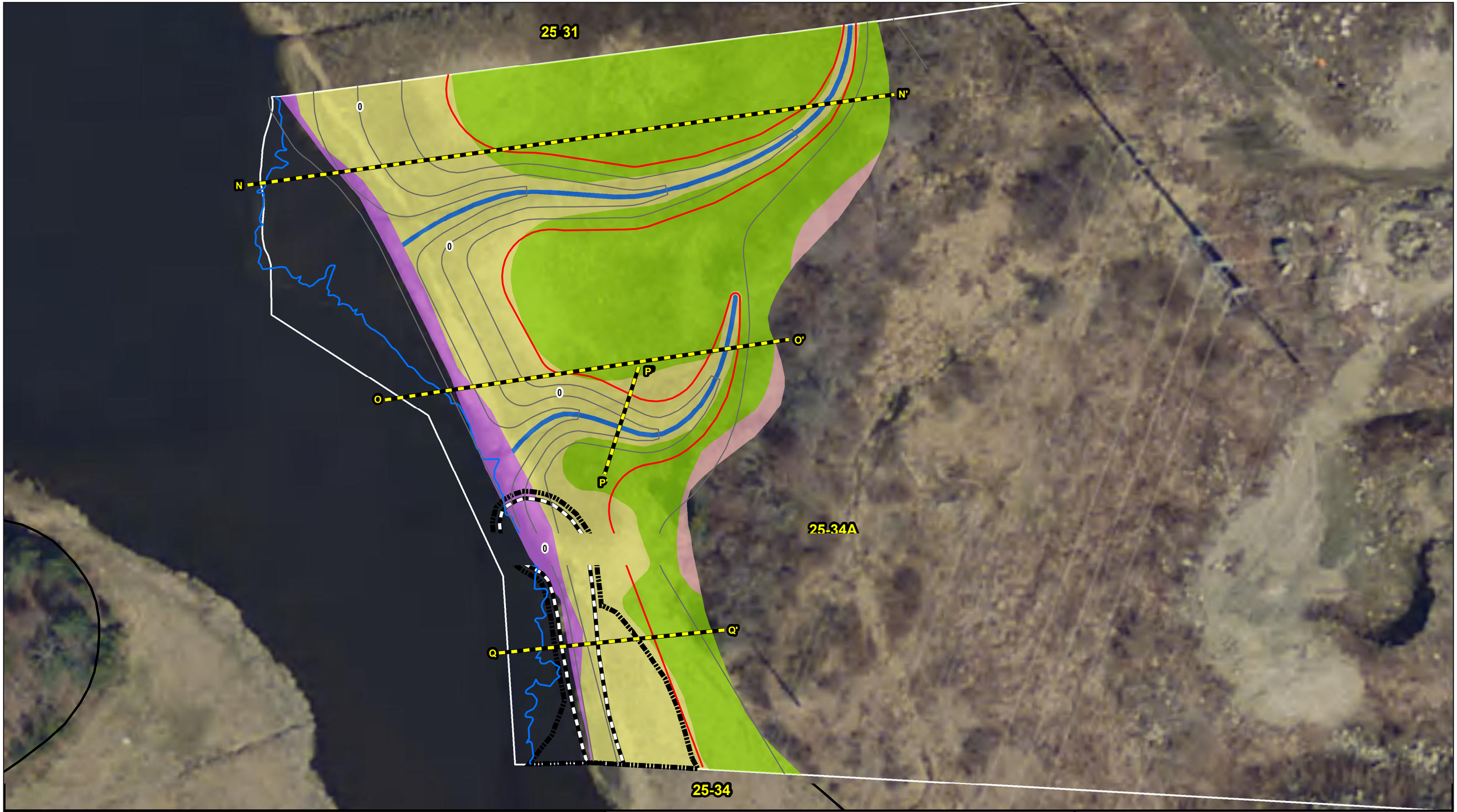
0 1 2 3 4
1" = 4' VERTICAL

0 2 4 6 8
1" = 8' HORIZONTAL

JACOBS™

EAST ZONE 1
PARCEL 25-34A
SECTION Q-Q'
NEW BEDFORD HARBOR

FEBRUARY 2019 | FIGURE 4



Legend

- Cross Section Locations
- Mean Higher High Water
- Mean Lower Low Water
- 1-foot Contour
- 0-1' Excavation Depth
- 1-2' Excavation Depth
- 2-3' Excavation Depth
- Parcel Boundary
- Proposed High Marsh
- Proposed Low Marsh
- Minimal Backfill as Needed for Drainage or Slope Stability
- Proposed Stream
- Proposed Upland

0 50 100 Feet

April 2019

Basemap Data Source: MassGIS

Vertical Datum: NAVD88

Upper Harbor East Zone 1 Parcel 25-34A
Cross Section Locations
New Bedford Harbor Superfund Site

JACOBS

Figure 5

Appendix C

Schedule

(to be added at a later date)