Appendix A

HDR Site Assessment Report (October 24, 2019)

Memo

Date:	Thursday, October 24, 2019
Project:	Climate Adaptive Design (CAD) Studio – Piermont Living Shoreline Project
Prepared By:	HDR Engineering
Subject:	Site Assessment Report
Site Visit Participants:	HDR: David S. Davis, Dave Yozzo, Steve Seymour, Kevin Verweire, Casey Stokes, James Eberhardt, Zak Lehmann with Daniel Miller (NYSDEC-HRNERR) and Nathan Mitchell (Piermont Waterfront Resiliency Commission)

PURPOSE AND INTENT

HDR conducted a site investigation of the proposed Piermont living shoreline project ("Project") area on September 23, 2019 and on October 4, 2019 [unmanned aerial system (drone) survey only]. Prior to the site assessment a qualitative review of each of the five original Climate Adaptive Design (CAD) Studio concepts and input from the stakeholder engagement process were used to identify the potential project area located in the northwest corner of the existing Piermont Pier adjacent to and centered on the water-ward side of Flywheel Park and Parelli Park in the Village of Piermont, New York (**Figure 1**). The site assessment was intended to gather aerial drone, topographic, and ecological data to be used for the development of the preliminary design of a living shoreline feature that will meet the goals and objectives of the Project.

An ecological functional assessment was conducted to document the level to which the proposed Project area was performing NYSDEC-cited (Part 661.2; Tidal Wetlands – Land Use Regulations) functions and values for tidal wetlands and adjacent areas. By assessing the current ability of the Project area to perform these functions and values, goals may be set to improve or enhance functions through the living shoreline project design.

In addition, a reference shoreline was surveyed at the southeast end of Piermont Pier (reference site) on September 23, 2019. The objective of the reference site survey was to record the elevation of substrate and shoreline vegetation communities along transects perpendicular to the shore. The data collected from the reference site will be used during the development of the

preliminary design to design target plant communities and aid in the understanding of local tidal datums.

Site Assessment Activities

The following activities were conducted during the site assessment in accordance with the approved Quality Assurance Project Plan (QAPP), Version 1 dated August 13, 2019:

1: General assessment of existing shoreline features and condition.

2: Ecological assessment of existing ecological communities and functions at the site, with emphasis on dominant plant species; invasive species present; rare plants or animals; wildlife species observed; dominant substrate types, bank and shoreline stability, and observed site constraints/opportunities.

3: Topographic mapping - measure and record three-dimensional locations of both natural and man-made elements within the Project area and reference shoreline, and graphically represent the site's existing conditions in a plan-view map.

4: Collection of aerial imagery, videography, and photogrammetry using a DJI Phantom 4 RTK unmanned aerial system (UAS) platform.

General Site Description

Under NYSDEC Article 25, the regulated tidal wetlands adjacent area can extend up to 300 feet landward of the wetland edge. Bulkheads, riprap, and roadways running parallel to the wetland edge (and lawfully existing prior to 1977) can limit the extent of NYSDEC's tidal wetlands jurisdiction. Virtually the entire upland in the Project area has been developed; consisting of condominiums, single-family residences, parkland, paved parking areas, walking paths, lawns, and gardens. This developed area is located upgradient of a bulkhead that runs west to east along the north shore of Piermont Pier. Vegetation in the upland is dominated by invasive species such as common reed, mugwort, Japanese knotweed, Asian bittersweet, porcelain berry, black locust, and tree-of-heaven.

The intertidal area is unvegetated; near the overlook area the substrate consists of sand, fine gravel, cobbles, cinders, and glass. Sand is predominant at the upper tidal limits and finer grained material increased from east to west along the shoreline. The intertidal community area near the overlook area is best described by the "Marine Intertidal Gravel/Sand Beach" in Edinger (2014). HDR crews found several inches of very soft organic material over the gravel and cobbles in the subtidal shallows. A concrete bulkhead ranging from 7.3 to 8 ft. in height runs along the entire east-west shore of the Project area; there is one 30" diameter metal pipe embedded in and flush with the concrete wall. The pipe is fully exposed at low water; a metal grating over the pipe is partially dislodged. The foot of the concrete wall is exposed at low tide; the intertidal area

consists of cobbles with some larger boulders along the bulkhead face. There are large, discontinuous pieces of concrete, rock, and asphalt rubble in the "elbow" of the project area; some tidally stranded logs and woody debris are also present. A photographic log of key features observed during the site assessment is included as Attachment A of this report. The intertidal area at the foot of the bulkhead is best described by Edinger as the "Estuarine Riprap/Artificial Shore".

A Village of Piermont representative (Nathan Mitchell) indicated that an existing low area immediately north of the radio/siren tower serves as a conduit for storm surge into the adjacent paved parking area. He also said there is a check valve on the stormwater drain which closes at high tide to prevent surcharging via the drain. There are nearby street signs in Piermont citing the location as a "flood prone area."

In preparation for the site survey, estimates of the tidal datums were retrieved for the Project area using the NOAA Vdatum online tool on August 14, 2019. The values are shown in Table 1 below.

Table 1. Estimated Tidal Datum Elevations computed using NOAA Vdatum Online Tool. Retrieved 8/14/19.

Location	
Lat	41.042833
Lon	-73.913702

Tidal Datum	Elevation (NAVD88, US-feet)
MLLW	-1.894
MLW	-1.73
LMSL	0.113
MTL	0.008
MHW	1.841
MHHW	2.125

Based on NOAA topobathymetry data available from 2018, intertidal areas (MHHW to MLLW) down to an elevation of -2 feet (NAVD88) generally extend from approximately 25 to 75 feet riverward along the shoreline with the greatest extents occurring adjacent to Parelli Park and near the public kayak launch (**Figure 1**). Beyond the Mean Lower Low Water (MLLW) mark, project area bathymetry generally ranged from -4 to -6 feet within the Project area. Elevations recorded along shoreline transects and in upland areas during the field survey will be used during the development of the preliminary design to confirm the general bathymetric and topographic conditions.

Ecological Assessment

HDR ecologists walked the perimeter of the proposed Project area, documenting existing habitats and general site conditions, along with surrounding land use. HDR staff were accompanied by Dan Miller (NYSDEC-HRNERR) and Nathan Mitchell (Piermont Waterfront Resiliency Commission) for a portion of the site assessment. A variety of native and non-native plant species were documented in the supra-tidal and terrestrial environments above and adjacent to the site; however aquatic/intertidal vegetation was noticeably absent in the vicinity of the project area, possibly due to hydrodynamic (wind/wave) conditions and substrate type. Non-native species present above the shore zone included Japanese knotweed, mugwort, and tree-of-heaven. The dominant substrate type in the study area was cobble/gravel, with a gradation to coarse sand/gravel to the northwest, approaching the nearby marina. Estuarine organisms noted in the tidal shallows and intertidal zone included schools of juvenile Atlantic menhaden (a.k.a. "peanut bunker"), and blue crabs (both live animals, carcasses, and carapace sheds present). Atlantic rangia clam shells were abundant along the shore and in shallow water areas. A few small ribbed mussel shells were observed, but no live mussels were present in the intertidal zone. A single American eel was observed in a tide pool under a rock in the intertidal zone. Both aquatic and terrestrial/arboreal bird species were present; consisting of great blue heron, American crow, mallard, Canada goose, double-crested cormorant, rough-winged swallow, house sparrow, goldfinch, blue jay, mourning dove, Carolina wren, European starling, and ring-billed gull. No state or federally-listed rare plant or animal species were observed during the site assessment.

HDR also examined the reference shoreline on the south side of Piermont Pier. The upper intertidal area was predominantly sand, the lower intertidal area was soft peat. There was a distinct break along the shoreline where sand deposition was occurring to the east, and erosion of the peat mat was occurring to the west. Vegetation in the peat mat area was a common reed monoculture; there were several small patches of saltmarsh cordgrass associated with coarse rip rap to the east.

Functional Assessment

A summary of the NYSDEC-cited tidal wetland functions and values and observations with regard to the Project Area's current value for each function is presented below:

Wildlife Habitat – Bird use of the intertidal area and upland were noted; 13 bird species were observed during the walk-over. Blue heron, mallard, Canada geese, and gulls were observed in the intertidal area or nearby offshore waters. Schools of small menhaden and blue crabs were observed in the nearshore shallows, shells of rangia clams, ribbed mussel, and American oyster (few) were also observed.

Recreation – numerous walkers, joggers, dog walkers, and people pushing strollers were observed on the walkways and paths in the upland areas. There is an existing launch ramp for the Piermont Rowing Club for kayak and canoe launching. The nearshore waters are too shallow

for any motorized craft. No evidence of fishing was observed in the Project Area. Fishing is focused in the deeper waters to the east toward the end of Piermont Pier.

Flood, Storm and Hurricane Control – the vertical concrete bulkhead deflects waves but does not absorb wave energy. The east-west shoreline does attenuate and absorb some wave energy; but sufficient energy is apparently present to preclude intertidal plant growth.

Marine Food Production – is limited by the lack of intertidal vegetation. Use of the shallows by forage fish does contribute to the food base for larger fish and fish-eating birds.

Education and Research – Knowledge gained during the current project will contribute to restoration efforts elsewhere along the tidal Hudson River. Site is in close proximity to the Piermont Marsh component of the Hudson River National Estuarine Research Reserve (HRNERR), The Beacon Institute maintains a River and Estuary Observatory Network monitoring station at the east end of the Piermont pier and the Lamont Doherty Earth Observatory (LDEO) recently established a Hudson River Field Station on the pier.

Open Space – Parelli Park and walkways provide access to the Hudson River waterfront. Benches in the park were being used during the site visit.

Aesthetic Appreciation – The Project area provides views of the Hudson River and the Governor Mario Cuomo Bridge. A community garden is present to the west, as well as wildflower plantings.

Ecosystem Cleansing – is limited due to the lack of intertidal or subtidal vegetation. There is also no functional transition area between the upland and the intertidal area, much of the tidal range is on vertical or near-vertical surfaces in the Project Area, such as the concrete bulkhead, rip-rap, and timber cribbing backfilled with coarse rock.

Sediment/Toxicant Retention – retention of organic material is limited due to tidal flushing, lack of intertidal and subtidal vegetation, and predominantly coarse sediments.

Topographic Survey

A topographic survey was completed for the area including the existing seawall along the northern shore of the pier/condominium development, Flywheel Park, the parking area to the west of the Project area, and the overlook area near the River. The study team also visited the reference shoreline site along the southern shoreline of the pier to assess intertidal vegetation communities (both invasive common reed as well as small patches of native saltmarsh cordgrass), and substrate conditions at a small cove which may provide essential bio-“benchmarking” or reference data for the design of the living shoreline habitat mosaic. Elevation data was collected using an EOS Arrow Gold high accuracy real-time kinematic (RTK) Global Navigation Satellite System (GNSS). Points were recorded across pre-selected transects spanning the topographic profile from the pier into the Hudson River. Ground surface shots (latitude, longitude, and

elevation) were collected along transects run approximately every 50 feet perpendicular to the shoreline, and transects extended to the maximum safe wading depth out into the River. In addition, opportunistic spot elevations were recorded at various natural and man-made points of interest within the park, the adjacent community garden, and the parking lot. Finally, elevations corresponding to specific vegetation communities and shoreline features (e.g., eroding peat reefs, sand deposits, wrack line, MLW, etc.) were also recorded along two survey transects at the reference shoreline located on the southern shore of the Pier (**Figure 2**). See also Attachment B for a complete listing of all of the points that were collected.

Following the site visit, estimates of the tidal datums were retrieved for the reference site using the NOAA Vdatum online tool on October 1, 2019. The values are shown in Table 2 below.

Table 2. Estimated Tidal Datum Elevations computed using NOAA Vdatum Online Tool. Retrieved 10/1/19.

Location	
Lat	41.042097
Lon	-73.90446

Tidal Datum	Elevation (NAVD88, US-feet)
MLLW	-1.92
MLW	-1.753
LMSL	0.111
MTL	0.008
MHW	1.848
MHHW	2.13

The estimated tidal datum elevations were plotted along with elevation, substrate, and vegetation data collected at two transects (PLS-REF-T1 and PLS-REF-T2) at the reference site (**Figure 3** and **Figure 4**). These figures show *Spartina alterniflora* occurring between estimated MTL and MHW elevations, with *Phragmites australis* occurring above estimated MHW elevation, as expected for these species.

Aerial Imagery (Drone) Survey

The proposed drone flights could not be completed on September 23, 2019 because of airspace restrictions in effect related to activities at the United Nations. However, all ground control points were established and surveyed during the site visit. A second site visit including the drone survey was completed on October 4, 2019. Aerial still imagery, videos, and a photogrammetry survey were completed for the Project and adjacent areas during multiple drone flights. Following the drone survey, a 2D orthometric aerial photo was created and is shown in **Figure 2**. A preliminary digital surface model and point cloud were created for the Project site, and these models will be

reviewed further along with the on-the-ground topographic survey data during development of the preliminary design.

Engineering Summary

During the site visit, a number of subtidal and intertidal shoreline features and potential engineered solutions for the existing bulkhead were discussed with the Project partners. These features will be evaluated during the development of the preliminary design and the site-specific information collected during the site assessment will be used to inform the design. The following are some preliminary notes of those discussions and are not intended to be all inclusive of the potential features that will be considered for the design.

Subtidal Areas

Given the existing shallow water bathymetry, current recreational uses of the Project area and potential visual concerns from nearby property owners and park users, a variety of submerged aquatic habitat enhancement features were discussed including the use of concrete "reef balls" and "oyster castles." The idea of using a variety of features installed in an aggregated, nature-like non-linear manner were discussed. Given the uncertainty of biological success and potential permitting challenges, live oysters would likely not be transplanted but habitat for recruitment by native, local oysters (via natural reefs present in the vicinity of the GMC Bridge) could be created. Habitat enhancement for other, native suspension-feeding invertebrates such as ribbed mussels should be considered, and the design of the habitat structures should be optimized for use by a variety of resident, as well as transient/migratory species. Recreational access through the project area for kayaks and similar non-motorized recreational vessels should be maintained in the placement of habitat enhancement structures. The concept of using subtidal structures for the creation of aquatic habitat and enhancing recreational opportunities was considered in several of the original CAD concepts including Piermont Nexus and Piermont: The New Beginning.

Intertidal Shoreline

Opportunities for vegetated marsh plantings would likely focus on existing sandy substrate areas along the existing viewing area adjacent to Parelli Park and potentially into an area of privately owned shoreline to the north of the site. Plant species selection, substrate type and planting elevation ranges may be optimized based on bio-benchmarking data gathered from the reference shoreline site to the south of the pier and east of the Piermont Marsh reserve. The concept of using intertidal shoreline plantings to promote resiliency and habitat enhancement was considered in all of the original CAD concepts including most prominently in Re-Appearing Piermont and Piermont: The New Beginning.

Bulkheaded and Upland Areas

Educational signage describing the purpose and benefit of living shorelines could be placed along the existing viewing area in Parelli Park and potentially in Flywheel Park. Opportunities for

restoring, moving or incorporating the existing fire whistle/cell tower should be considered (note that a separate Piermont Lighthouse project is also considering this). Upland (coastal meadow) plantings and opportunities for increased water retention in Parelli Park could be considered. The existing kayak launch is being replaced within its existing same footprint and should be incorporated into the preliminary design. The concept of restoring the existing concrete and boulder bulkhead along Flywheel Park was also discussed by creating a more sloping revetment that could be planted with vegetation and by acquiring the existing paved pathway, and potentially moving the existing gazebo to the south. The concept of improving bulkheaded and upland areas to promote resiliency as well as promoting educational components was included in all of the original CAD concepts including most prominently in Evolve/Connect/Redefine, Cultural-Led Adaptation and Piermont: The New Beginning.

Restoration Constraints

Several potential design constraints were identified in the Project area. The elevation difference between the existing intertidal area and crest of the concrete bulkhead will require any change in the shoreline repose (revetment) to extend into the tidal Hudson or further to the south with a lowering of the current upland area. The current use of the adjacent upland as either a park, active roadway, or walking path may preclude any re-contouring to increase the width of the tidally affected area while maintaining the existing walkway elevation. However, the design could consider either an elevated walkway or a lower elevation walkway through the shoreline stabilization area. Preservation of the existing canoe/kayak launch in its current location may also limit the extent of plantings and shoreline stabilization measures. The potential effects of storm-driven tides on living shoreline features will need to be considered; storm tides at high water can cause flooding; storm tides at low water can erode or displace features in the tidal shallows.

Based on the results of this site assessment and ongoing stakeholder engagement, specific project features that consider these restoration constraints will be developed as part of the preliminary conceptual design for the living shoreline project. The overarching project goals for the project remain:

1. Protect and stabilize the existing shoreline north of the Piermont Pier and East of Parelli Park;

2. Develop intertidal and subtidal habitat features to benefit fish, shellfish and other wildlife within the project area;

3. Maintain and enhance recreational access to the river and its shoreline habitats while including educational and interpretive elements that effectively engage the public.

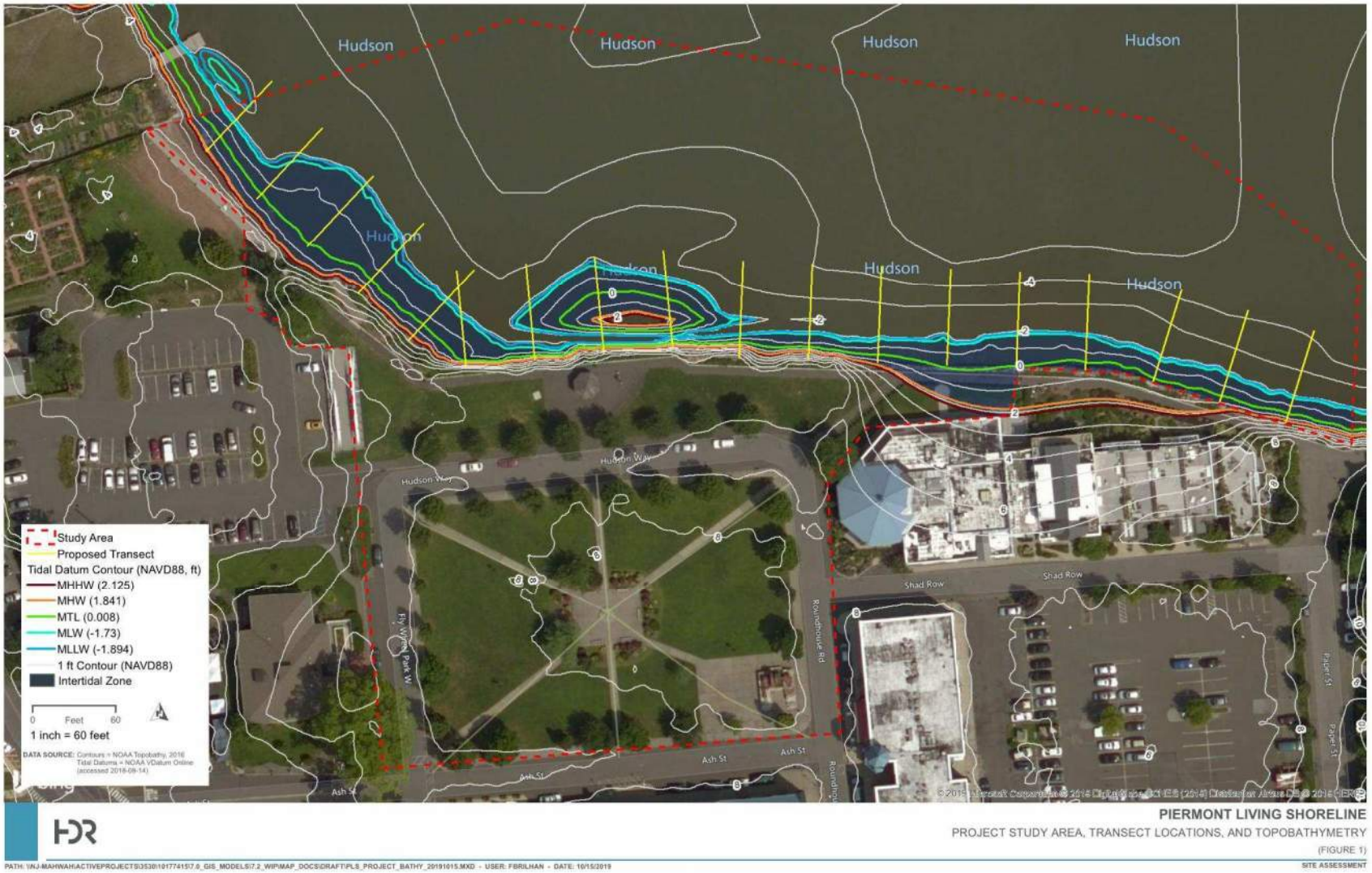


Figure 1. Project Study Area, Transect Locations, and Topobathymetry.

Figure 2. 2D Orthophoto and Topographic Elevation Mapping.

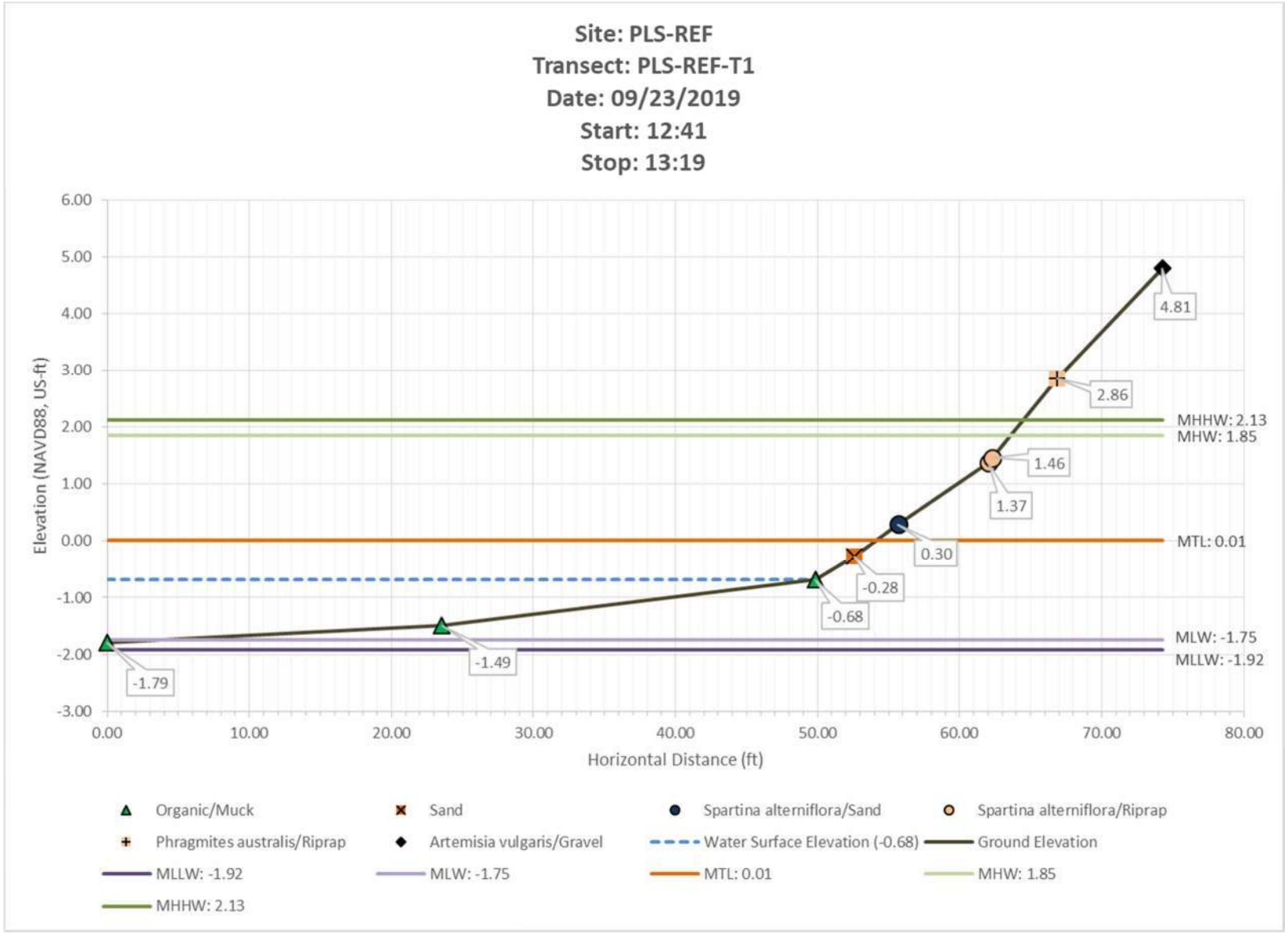


Figure 3. Survey Transect PLS-REF-T1

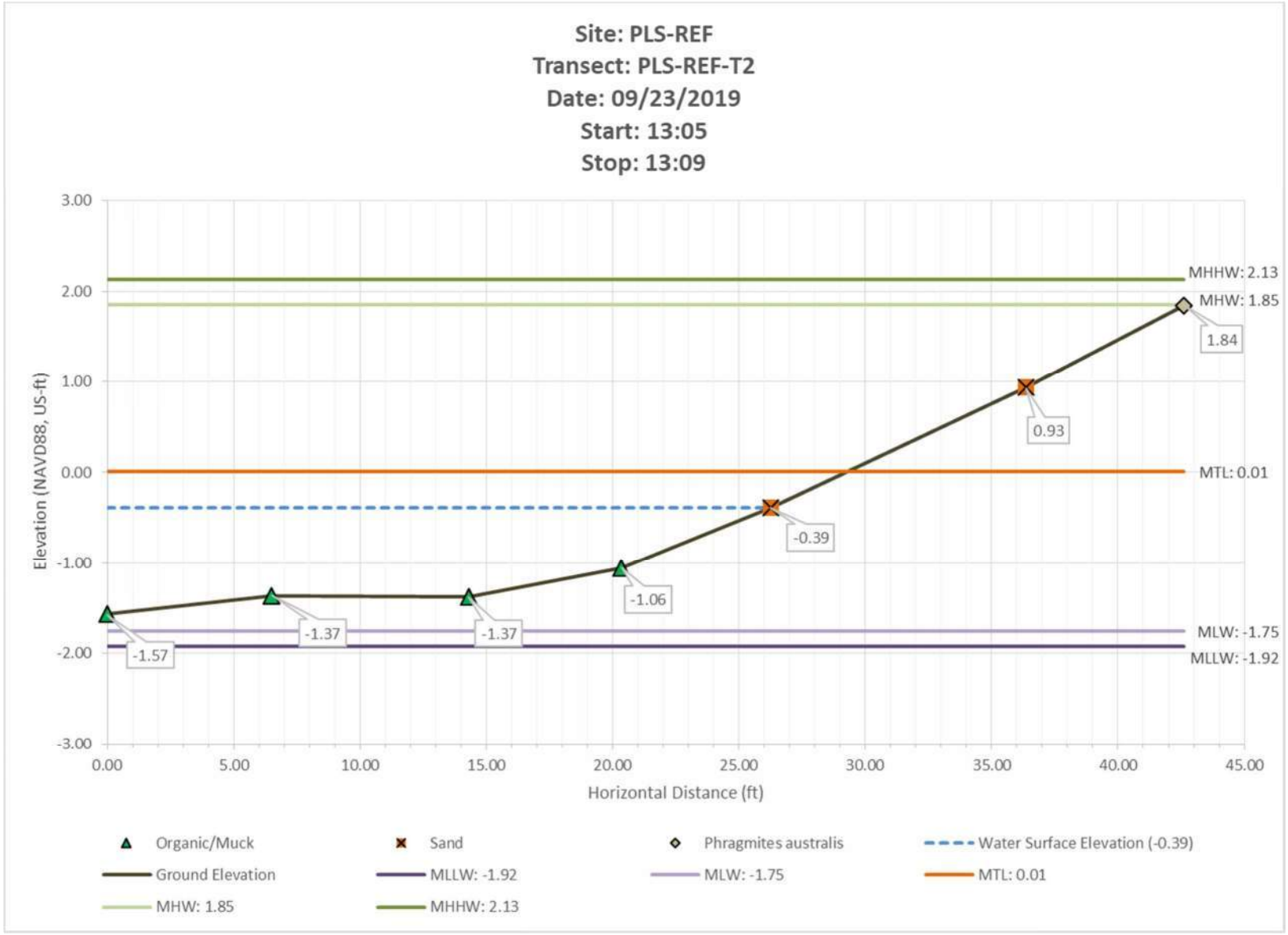


Figure 4. Survey Transect PLS-REF-T2

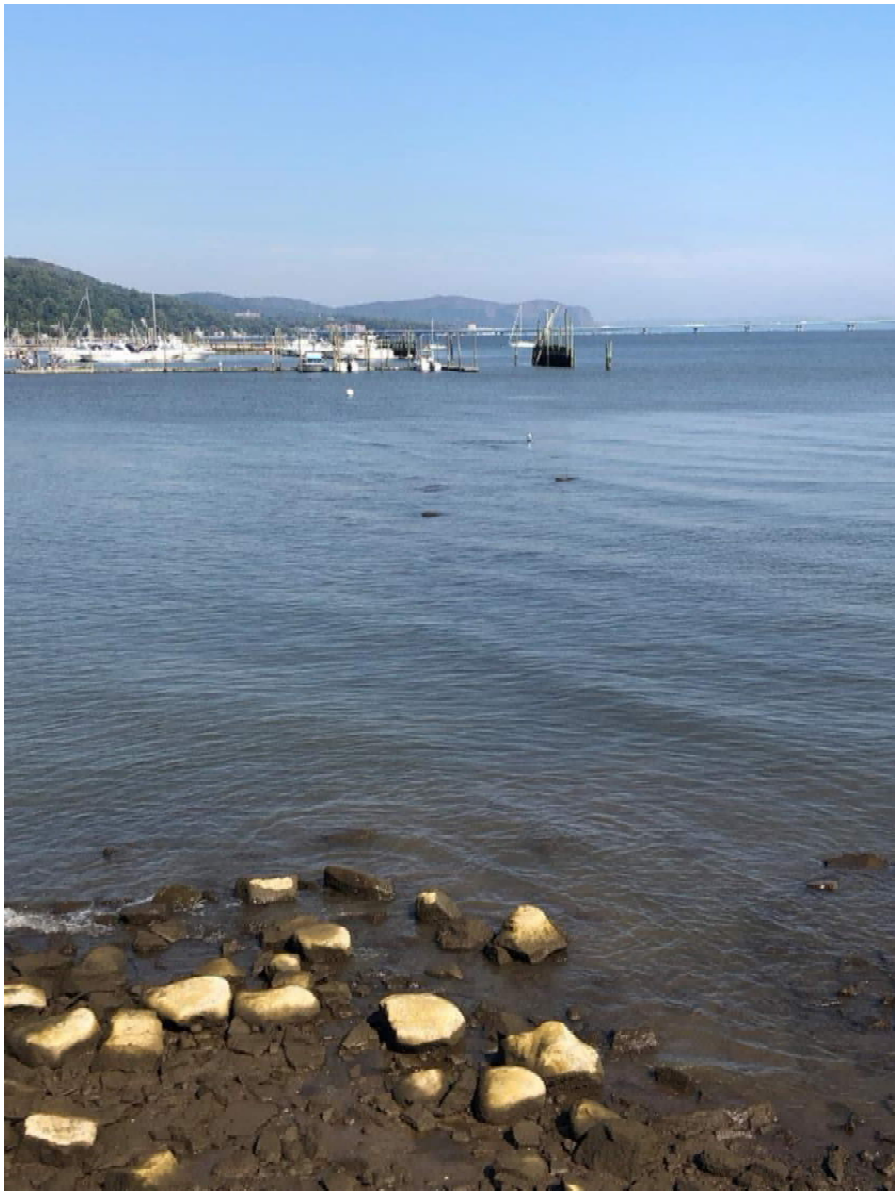
Attachment A

Site Assessment Photo Log

PIERMONT LIVING SHORELINE PROJECT

SITE ASSESSMENT 9-23-19

GENERAL SITE AND SHORELINE FEATURES




Parelli Park
Village of Piermont
No Dogs or Bicycles
Please keep gate closed
Play at your own risk
Park Closes at 9 p.m.


Village of Piermont
COMMUNITY
GARDEN
"To Nourish the Spirit"

SITE ASSESSMENT ACTIVITY

REPRESENTATIVE BIOTA

REFERENCE SITE – SOUTH SHORE OF PIER

UAS (Drone) Survey – 10-4-2019

Attachment B

Survey Datasheet

SURVEY DATASHEET

Location:	Piermont, New York			**Project Name:**	Piermont CAD-Living Shoreline
Date:	9/23/2019	**Observers:**	Verweire, Stokes, Lehmann, Eberhardt	**Project Number:**	N/A
Weather:	Partly cloudy, no rainfall in the past 3 days, high temp in the mid 80s°F, predicted low water at 11:37 a.m.			**Notes:**	See comments field
Start Time:	9:00	**Stop Time:**	15:00		

TransectID	Name	PointType	DomSubstrate	WaterDepth	Comments	POINT_X	POINT_Y	ElevNAVD88, ft	GNSS Fix DateTime (GMT)
PLS-T1	PLS-T1-1	General Ground	Sand - Medium			-73.9161514	41.0427562	1.43	2019-09-23 15:01
PLS-T1	PLS-T1-2	General Ground			transition	-73.9161343	41.0427636	0.68	2019-09-23 15:02
PLS-T1	PLS-T1-3	General Ground			transition substrate	-73.9161398	41.0427693	0.76	2019-09-23 15:02
PLS-T1	PLS-T1-4	General Ground	Gravel - Medium			-73.9161236	41.0427786	0.00	2019-09-23 15:02
PLS-T1	PLS-T1-5	General Ground	Gravel - Medium		wsel	-73.9161006	41.0427917	-1.25	2019-09-23 15:03
PLS-T1	PLS-T1-6	General Ground			transition of substrate	-73.9160947	41.0428052	-1.61	2019-09-23 15:04
PLS-T1	PLS-T1-7	General Ground	Silt/Clay			-73.9160377	41.0428494	-2.24	2019-09-23 15:05
PLS-T1	PLS-T1-8	General Ground	Silt/Clay			-73.9159990	41.0428793	-2.32	2019-09-23 15:05
PLS-T2	PLS-T2-1	General Ground			transition	-73.9160970	41.0426782	1.87	2019-09-23 15:07
PLS-T2	PLS-T2-2	General Ground			transition	-73.9160950	41.0426747	1.85	2019-09-23 15:08
PLS-T2	PLS-T2-3	General Ground	Gravel - Fine			-73.9160891	41.0426782	1.59	2019-09-23 15:08
PLS-T2	PLS-T2-4	General Ground			transition	-73.9160840	41.0426812	1.38	2019-09-23 15:09
PLS-T2	PLS-T2-5	General Ground	Gravel - Coarse			-73.9160721	41.0426910	0.83	2019-09-23 15:09
PLS-T2	PLS-T2-6	General Ground			transition	-73.9160599	41.0426995	0.22	2019-09-23 15:10
PLS-T2	PLS-T2-7	General Ground	Gravel - Fine			-73.9160527	41.0427040	-0.13	2019-09-23 15:10
PLS-T2	PLS-T2-8	General Ground			transition	-73.9160454	41.0427075	-0.45	2019-09-23 15:10
PLS-T2	PLS-T2-9	General Ground	Gravel - Coarse		wsel	-73.9160317	41.0427156	-1.26	2019-09-23 15:10
PLS-T2	PLS-T2-10	General Ground			transition	-73.9160171	41.0427334	-1.85	2019-09-23 15:11
PLS-T2	PLS-T2-11	General Ground	Silt/Clay			-73.9159608	41.0427795	-2.52	2019-09-23 15:11
PLS-T2	PLS-T2-12	General Ground	Silt/Clay			-73.9159076	41.0428242	-2.52	2019-09-23 15:12
PLS-T3	PLS-T3-1	General Ground	Sand - Medium			-73.9160083	41.0425512	3.29	2019-09-23 15:13
PLS-T3	PLS-T3-2	General Ground			transition	-73.9159842	41.0425682	1.85	2019-09-23 15:14
PLS-T3	PLS-T3-3	General Ground	Gravel - Fine			-73.9159817	41.0425693	1.73	2019-09-23 15:14
PLS-T3	PLS-T3-4	General Ground			transition	-73.9159781	41.0425726	1.56	2019-09-23 15:14
PLS-T3	PLS-T3-5	General Ground	Gravel - Coarse			-73.9159581	41.0425865	0.70	2019-09-23 15:14
PLS-T3	PLS-T3-6	General Ground			transition	-73.9159315	41.0426048	-0.84	2019-09-23 15:15
PLS-T3	PLS-T3-7	General Ground	Cobble - Small		wsel	-73.9159121	41.0426267	-1.32	2019-09-23 15:15
PLS-T3	PLS-T3-8	General Ground	Cobble - Small			-73.9158450	41.0426847	-1.85	2019-09-23 15:16
PLS-T3	PLS-T3-9	General Ground	Cobble - Small			-73.9157768	41.0427259	-2.33	2019-09-23 15:16
PLS-T4	PLS-T4-1	General Ground	Gravel - Coarse			-73.9158669	41.0424482	2.49	2019-09-23 15:18
PLS-T4	PLS-T4-2	General Ground			transition	-73.9158359	41.0424787	0.56	2019-09-23 15:18
PLS-T4	PLS-T4-3	General Ground	Cobble - Small			-73.9157808	41.0425325	-0.64	2019-09-23 15:19
PLS-T4	PLS-T4-4	General Ground	Cobble - Small		wsel	-73.9157077	41.0425815	-1.34	2019-09-23 15:20
PLS-T4	PLS-T4-5	General Ground	Cobble - Small			-73.9156487	41.0426350	-2.20	2019-09-23 15:20
PLS-T5	PLS-T5-1	General Ground	Boulder - Large/Vry Large			-73.9156982	41.0423922	3.57	2019-09-23 15:21
PLS-T5	PLS-T5-2	General Ground			transition	-73.9156793	41.0424096	0.25	2019-09-23 15:22
PLS-T5	PLS-T5-3	General Ground	Cobble - Small			-73.9156431	41.0424440	-1.03	2019-09-23 15:23
PLS-T5	PLS-T5-4	General Ground	Cobble - Small		wsel	-73.9156170	41.0424654	-1.37	2019-09-23 15:23

TransectID	Name	PointType	DomSubstrate	WaterDepth	Comments	POINT_X	POINT_Y	ElevNAVD88, ft	GNSS Fix DateTime (GMT)
PLS-T5	PLS-T5-5	General Ground			transition	-73.9155491	41.0425150	-2.19	2019-09-23 15:24
PLS-T5	PLS-T5-6	General Ground	Silt/Clay			-73.9155237	41.0425335	-2.17	2019-09-23 15:24
PLS-T6	PLS-T6-1	General Ground	Boulder - Medium			-73.9155700	41.0422862	2.46	2019-09-23 15:25
PLS-T6	PLS-T6-2	General Ground			transition	-73.9155312	41.0423267	-0.25	2019-09-23 15:26
PLS-T6	PLS-T6-3	General Ground	Cobble - Large			-73.9155137	41.0423444	-0.90	2019-09-23 15:26
PLS-T6	PLS-T6-4	General Ground	Cobble - Large		wsel	-73.9155036	41.0423605	-1.37	2019-09-23 15:26
PLS-T6	PLS-T6-5	General Ground			transition	-73.9154381	41.0424049		
PLS-T6	PLS-T6-6	General Ground			transition	-73.9154442	41.0424035	-2.21	2019-09-23 15:32
PLS-T6	PLS-T6-7	General Ground	Silt/Clay			-73.9153908	41.0424443	-2.39	2019-09-23 15:33
PLS-T7	PLS-T7-1	General Ground	Cobble - Large			-73.9154134	41.0422523	-0.19	2019-09-23 15:34
PLS-T7	PLS-T7-2	General Ground	Boulder - Small			-73.9154131	41.0422832	-0.91	2019-09-23 15:35
PLS-T7	PLS-T7-3	General Ground	Boulder - Small			-73.9154105	41.0423106	-1.56	2019-09-23 15:35
PLS-T7	PLS-T7-4	General Ground			transition	-73.9154241	41.0423894	-2.27	2019-09-23 15:36
PLS-T7	PLS-T7-5	General Ground	Silt/Clay			-73.9154397	41.0424345	-2.48	2019-09-23 15:37
PLS-T7	PLS-T7-6	General Ground	Silt/Clay			-73.9154460	41.0424510	-2.32	2019-09-23 15:37
PLS-T8	PLS-T8-1	General Ground	Silt/Clay			-73.9152321	41.0422567	-1.89	2019-09-23 15:38
PLS-T8	PLS-T8-2	General Ground			transition	-73.9152332	41.0422732	-1.66	2019-09-23 15:39
PLS-T8	PLS-T8-3	General Ground	Gravel - Coarse			-73.9152329	41.0422834	-1.47	2019-09-23 15:39
PLS-T8	PLS-T8-4	General Ground	Sand - Coarse			-73.9152422	41.0423579	-2.20	2019-09-23 15:40
PLS-T8	PLS-T8-5	General Ground			transition	-73.9152471	41.0423817	-2.62	2019-09-23 15:40
PLS-T8	PLS-T8-6	General Ground	Silt/Clay			-73.9152638	41.0424369	-2.76	2019-09-23 15:44
PLS-T8	PLS-T8-7	General Ground	Silt/Clay			-73.9152639	41.0424555	-2.68	2019-09-23 15:45
PLS-T8	PLS-T8-8	Other			storm water pipe	-73.9152287	41.0422540	-1.61	2019-09-23 15:46
PLS-T9	PLS-T9-1	General Ground	Gravel - Coarse			-73.9150596	41.0422630	-1.15	2019-09-23 17:27
PLS-T9	PLS-T9-2	General Ground	Gravel - Coarse			-73.9150630	41.0423147	-2.39	2019-09-23 17:27
PLS-T9	PLS-T9-3	General Ground			transition	-73.9150621	41.0423256	-2.78	2019-09-23 17:27
PLS-T9	PLS-T9-4	General Ground	Silt/Clay			-73.9150606	41.0423901	-2.90	2019-09-23 17:28
PLS-T9	PLS-T9-5	General Ground	Silt/Clay			-73.9150753	41.0424409	-3.06	2019-09-23 17:28
PLS-T9	PLS-T9-6	General Ground	Silt/Clay			-73.9150826	41.0424748	-2.96	2019-09-23 17:28
PLS-T10	PLS-T10-1	General Ground	Silt/Clay			-73.9148944	41.0424769	-2.82	2019-09-23 17:24
PLS-T10	PLS-T10-2	General Ground	Silt/Clay			-73.9148914	41.0423972	-2.85	2019-09-23 17:24
PLS-T10	PLS-T10-3	General Ground			transition	-73.9148930	41.0423315	-2.49	2019-09-23 17:25
PLS-T10	PLS-T10-4	General Ground	Gravel - Coarse			-73.9148751	41.0423009	-1.76	2019-09-23 17:26
PLS-T10	PLS-T10-5	General Ground	Gravel - Coarse			-73.9148747	41.0422744	-0.34	2019-09-23 17:26
PLS-T11	PLS-T11-1	General Ground	Gravel - Coarse			-73.9147117	41.0422651	0.09	2019-09-23 17:20
PLS-T11	PLS-T11-2	General Ground	Gravel - Coarse		wsel	-73.9147131	41.0422779	-0.46	2019-09-23 17:20
PLS-T11	PLS-T11-3	General Ground			transition	-73.9147132	41.0422838	-0.80	2019-09-23 17:20
PLS-T11	PLS-T11-4	General Ground	Boulder - Medium			-73.9147133	41.0423019	-1.41	2019-09-23 17:21
PLS-T11	PLS-T11-5	General Ground			transition	-73.9147073	41.0423234	-2.20	2019-09-23 17:21
PLS-T11	PLS-T11-6	General Ground	Silt/Clay			-73.9147109	41.0423717	-2.64	2019-09-23 17:22
PLS-T11	PLS-T11-7	General Ground	Silt/Clay			-73.9147048	41.0424261	-2.91	2019-09-23 17:22
PLS-T11	PLS-T11-8	General Ground	Silt/Clay			-73.9147004	41.0424607	-2.91	2019-09-23 17:23
PLS-T12	PLS-T12-1	General Ground	Silt/Clay			-73.9145083	41.0424562	-3.12	2019-09-23 16:40
PLS-T12	PLS-T12-2	General Ground	Silt/Clay			-73.9145202	41.0423923	-2.90	2019-09-23 16:40
PLS-T12	PLS-T12-3	General Ground			transition	-73.9145170	41.0423802	-2.74	2019-09-23 16:41
PLS-T12	PLS-T12-4	General Ground	Gravel - Coarse			-73.9145194	41.0423224	-1.87	2019-09-23 16:42
PLS-T12	PLS-T12-5	General Ground	Gravel - Coarse			-73.9145286	41.0422918	-1.10	2019-09-23 16:42
PLS-T12	PLS-T12-6	General Ground	Gravel - Coarse			-73.9145208	41.0422621	-0.56	2019-09-23 16:43

TransectID	Name	PointType	DomSubstrate	WaterDepth	Comments	POINT_X	POINT_Y	ElevNAVD88, ft	GNSS Fix DateTime (GMT)
PLS-T13	PLS-T13-1	General Ground	Gravel - Coarse			-73.9143375	41.0422448	-0.33	2019-09-23 16:36
PLS-T13	PLS-T13-2	General Ground	Gravel - Coarse		wsel	-73.9143396	41.0422609	-0.87	2019-09-23 16:37
PLS-T13	PLS-T13-3	General Ground			transition	-73.9143417	41.0423115	-2.50	2019-09-23 16:37
PLS-T13	PLS-T13-4	General Ground	Silt/Clay			-73.9143445	41.0423644	-2.81	2019-09-23 16:38
PLS-T13	PLS-T13-5	General Ground	Silt/Clay			-73.9143364	41.0424234	-3.09	2019-09-23 16:38
PLS-T13	PLS-T13-6	General Ground	Silt/Clay			-73.9143315	41.0424542	-3.20	2019-09-23 16:39
PLS-T14	PLS-T14-1	General Ground	Sand - Fine			-73.9141465	41.0424387	-3.31	2019-09-23 16:31
PLS-T14	PLS-T14-2	General Ground	Sand - Fine			-73.9141587	41.0423607	-2.89	2019-09-23 16:32
PLS-T14	PLS-T14-3	General Ground			transition	-73.9141643	41.0423073	-2.19	2019-09-23 16:33
PLS-T14	PLS-T14-4	General Ground	Cobble - Small		wsel	-73.9141498	41.0422587	-0.98	2019-09-23 16:34
PLS-T14	PLS-T14-5	General Ground	Cobble - Small			-73.9141509	41.0422460	-0.53	2019-09-23 16:34
PLS-T14	PLS-T14-6	General Ground	Cobble - Small			-73.9141537	41.0422374	-0.31	2019-09-23 16:35
PLS-T15	PLS-T15-1	General Ground	Boulder - Small			-73.9137962	41.0422322	0.18	2019-09-23 16:26
PLS-T15	PLS-T15-2	General Ground			transition	-73.9137932	41.0422607	-0.96	2019-09-23 16:26
PLS-T15	PLS-T15-3	General Ground	Cobble - Large			-73.9137892	41.0423198	-2.17	2019-09-23 16:27
PLS-T15	PLS-T15-4	General Ground	Cobble - Large			-73.9137787	41.0424013	-2.67	2019-09-23 16:29
PLS-T15	PLS-T15-5	General Ground	Cobble - Large			-73.9137949	41.0424344	-2.56	2019-09-23 16:29
PLS-T16	PLS-T16-1	General Ground	Sand - Fine			-73.9133645	41.0423573	-3.34	2019-09-23 16:21
PLS-T16	PLS-T16-2	General Ground	Sand - Fine			-73.9133922	41.0422735	-2.99	2019-09-23 16:22
PLS-T16	PLS-T16-3	General Ground			transition	-73.9134122	41.0422362	-2.71	2019-09-23 16:23
PLS-T16	PLS-T16-4	General Ground	Cobble - Large		wsel	-73.9134328	41.0421959	-1.04	2019-09-23 16:23
PLS-T16	PLS-T16-5	General Ground	Cobble - Large			-73.9134484	41.0421664	0.05	2019-09-23 16:24
PLS-T17	PLS-T17-1	General Ground	Silt/Clay			-73.9130075	41.0422773	-3.27	2019-09-23 14:34
PLS-T17	PLS-T17-2	General Ground	Gravel - Coarse			-73.9131099	41.0420872	0.60	2019-09-23 16:17
PLS-T17	PLS-T17-3	General Ground	Gravel - Coarse			-73.9131011	41.0420977	0.15	2019-09-23 16:17
PLS-T17	PLS-T17-4	General Ground			transition	-73.9130954	41.0421067	-0.37	2019-09-23 16:18
PLS-T17	PLS-T17-5	General Ground	Cobble - Small		wsel	-73.9130885	41.0421190	-0.89	2019-09-23 16:18
PLS-T17	PLS-T17-6	General Ground			transition	-73.9130744	41.0421583	-2.60	2019-09-23 16:19
PLS-T17	PLS-T17-7	General Ground	Silt/Clay			-73.9130416	41.0422008	-3.03	2019-09-23 16:19
PLS-T17	PLS-T17-8	General Ground	Silt/Clay			-73.9130237	41.0422716	-3.13	2019-09-23 16:20
	GCP-1	Other			GCP-1	-73.9154096	41.0415186	7.74	2019-09-23 13:23
	GCP-2	Other			GCP-2	-73.9145427	41.0415413	8.41	2019-09-23 13:25
	GCP-3	Other			GCP-3	-73.9145439	41.0421844	7.84	2019-09-23 13:29
	GCP-4	Other			GCP-4	-73.9160255	41.0425887	2.90	2019-09-23 13:32
	PLS-GS-1	General Ground			parking lot curb	-73.9166031	41.0419033	5.23	2019-09-23 13:54
	PLS-GS-2	General Ground			parking lot curb	-73.9166186	41.0421664	5.16	2019-09-23 13:55
	PLS-GS-3	General Ground			catch basin	-73.9164266	41.0421870	3.78	2019-09-23 13:56
	PLS-GS-4	General Ground			catch basin	-73.9164147	41.0423015	3.84	2019-09-23 13:57
	PLS-GS-5	General Ground			catch basin	-73.9164106	41.0423810	3.00	2019-09-23 13:57
	PLS-GS-6	General Ground			gate to community garden	-73.9164318	41.0425435	3.60	2019-09-23 13:59
	PLS-GS-7	General Ground			center of community garden	-73.9165363	41.0425173	3.85	2019-09-23 14:01
	PLS-GS-8	General Ground	Vegetation - Herbaceous			-73.9163005	41.0425973	3.73	2019-09-23 14:05
	PLS-GS-9	General Ground	Vegetation - Herbaceous		overlook decking	-73.9162421	41.0427130	5.37	2019-09-23 14:06
	PLS-GS-10	General Ground	Vegetation - Herbaceous		overlook decking	-73.9161459	41.0426389	5.31	2019-09-23 14:06
	PLS-GS-11	General Ground	Vegetation - Herbaceous			-73.9161428	41.0425183	3.83	2019-09-23 14:07
	PLS-GS-12	Other			ground at tree, ornamental beech	-73.9160712	41.0424705	4.38	2019-09-23 14:11
	PLS-GS-13	Other			ground at tree, red maple, 16"	-73.9162691	41.0424532	3.23	2019-09-23 14:13
	PLS-GS-14	Other			ground at tree, crab apple	-73.9163707	41.0424721	3.50	2019-09-23 14:13

TransectID	Name	PointType	DomSubstrate	WaterDepth	Comments	POINT_X	POINT_Y	ElevNAVD88, ft	GNSS Fix DateTime (GMT)
	PLS-GS-15	Other			ground at tree, crab apple	-73.9164119	41.0425756	3.98	2019-09-23 14:14
	PLS-GS-16	General Ground			curb	-73.9161771	41.0423578	3.39	2019-09-23 14:16
	PLS-GS-17	General Ground			catch basin	-73.9160936	41.0422423	1.98	2019-09-23 14:16
	PLS-GS-18	General Ground			catch basin	-73.9160740	41.0420654	2.18	2019-09-23 14:17
	PLS-GS-19	General Ground			curb	-73.9160349	41.0418918	3.39	2019-09-23 14:17
	PLS-GS-20	General Ground			catch basin	-73.9158857	41.0419223	3.09	2019-09-23 14:19
	PLS-GS-21	General Ground			lot corner curb	-73.9157576	41.0419098	4.87	2019-09-23 14:19
	PLS-GS-22	General Ground			curb	-73.9157918	41.0420285	4.56	2019-09-23 14:20
	PLS-GS-23	General Ground	Gravel - Medium			-73.9158134	41.0421604	3.73	2019-09-23 14:20
	PLS-GS-24	General Ground			top wall	-73.9157777	41.0421654	6.89	2019-09-23 14:21
	PLS-GS-25	General Ground			top wall	-73.9157656	41.0420636	6.76	2019-09-23 14:21
	PLS-GS-26	General Ground			top end wall	-73.9158627	41.0422820	6.94	2019-09-23 14:22
	PLS-GS-27	General Ground			top corner wall	-73.9157919	41.0422861	6.98	2019-09-23 14:22
	PLS-GS-28	General Ground			top end wall	-73.9157662	41.0420638	6.79	2019-09-23 14:24
	PLS-GS-29	Other			tree, mulberry	-73.9158476	41.0423384	8.71	2019-09-23 14:25
	PLS-GS-30	General Ground			paved walkway	-73.9158261	41.0423951	6.66	2019-09-23 14:27
	PLS-GS-31	General Ground			top wall	-73.9158257	41.0423979	8.17	2019-09-23 14:27
	PLS-GS-32	General Ground	Boulder - Medium	0		-73.9138034	41.0427628	-1.14	2019-09-23 14:28
	PLS-GS-33	General Ground			top wall at gate	-73.9157112	41.0423291	8.41	2019-09-23 14:28
	PLS-GS-34	General Ground				-73.9156203	41.0421539	6.35	2019-09-23 14:29
	PLS-GS-35	General Ground			catch basin	-73.9155797	41.0420862	6.73	2019-09-23 14:30
	PLS-GS-36	General Ground	Boulder - Medium	0		-73.9137915	41.0426118	-1.10	2019-09-23 14:30
	PLS-GS-37	General Ground			catch basin	-73.9156368	41.0420366	6.35	2019-09-23 14:30
	PLS-GS-38	General Ground			top curb	-73.9156285	41.0420402	6.84	2019-09-23 14:31
	PLS-GS-39	General Ground			corner curb	-73.9155772	41.0419555	6.98	2019-09-23 14:31
	PLS-GS-40	General Ground			catch basin	-73.9155868	41.0419222	6.87	2019-09-23 14:31
	PLS-GS-41	General Ground			catch basin	-73.9156660	41.0419164	6.41	2019-09-23 14:32
	PLS-GS-42	General Ground			top curb	-73.9155599	41.0417262	7.48	2019-09-23 14:32
	PLS-GS-43	General Ground	Vegetation - Herbaceous			-73.9153618	41.0417327	7.98	2019-09-23 14:33
	PLS-GS-44	General Ground	Vegetation - Herbaceous			-73.9151800	41.0415637	8.00	2019-09-23 14:33
	PLS-GS-45	General Ground			top curb	-73.9152161	41.0414648	7.63	2019-09-23 14:34
	PLS-GS-46	General Ground			flag pole	-73.9150502	41.0417432	9.77	2019-09-23 14:35
	PLS-GS-47	General Ground			top curb	-73.9150821	41.0420084	8.45	2019-09-23 14:35
	PLS-GS-48	General Ground			top curb	-73.9150920	41.0420745	8.09	2019-09-23 14:36
	PLS-GS-49	General Ground	Silt/Clay			-73.9130328	41.0425773	-3.91	2019-09-23 14:36
	PLS-GS-50	General Ground			south center of gazebo	-73.9151004	41.0421755	7.87	2019-09-23 14:36
	PLS-GS-51	General Ground			north center of gazebo	-73.9151053	41.0422289	7.63	2019-09-23 14:37
	PLS-GS-52	General Ground			top wall	-73.9151084	41.0422424	8.52	2019-09-23 14:37
	PLS-GS-53	General Ground	Sand - Very Fine			-73.9134676	41.0429866	-4.21	2019-09-23 14:37
	PLS-GS-54	General Ground			top outer wall	-73.9151139	41.0422539	7.02	2019-09-23 14:38
	PLS-GS-55	General Ground			ground wall	-73.9151118	41.0422452	6.98	2019-09-23 14:38
	PLS-GS-56	General Ground			paved ground wall	-73.9151102	41.0422422	7.44	2019-09-23 14:38
	PLS-GS-57	General Ground	Sand - Very Fine			-73.9141927	41.0432655	-4.29	2019-09-23 14:39
	PLS-GS-58	General Ground			maintenance point access to storm drain	-73.9152323	41.0421822	7.62	2019-09-23 14:39
	PLS-GS-59	General Ground	Silt/Clay			-73.9150350	41.0432844	-3.31	2019-09-23 14:41
	PLS-GS-60	General Ground			top outer wall	-73.9154363	41.0422325	7.15	2019-09-23 14:41
	PLS-GS-61	General Ground			ground at wall	-73.9154337	41.0422243	6.62	2019-09-23 14:42
	PLS-GS-62	General Ground			top wall	-73.9154339	41.0422228	8.41	2019-09-23 14:42

TransectID	Name	PointType	DomSubstrate	WaterDepth	Comments	POINT_X	POINT_Y	ElevNAVD88, ft	GNSS Fix DateTime (GMT)
	PLS-GS-63	General Ground			pavement at wall	-73.9154340	41.0422207	7.29	2019-09-23 14:42
	PLS-GS-64	General Ground			top wall	-73.9155242	41.0422150	8.56	2019-09-23 14:43
	PLS-GS-65	General Ground			pavement at wall	-73.9155238	41.0422142	7.35	2019-09-23 14:43
	PLS-GS-66	General Ground			top wall	-73.9148666	41.0422578	8.47	2019-09-23 14:44
	PLS-GS-67	General Ground			ground at wall	-73.9148675	41.0422609	6.62	2019-09-23 14:44
	PLS-GS-68	General Ground			top outer wall	-73.9148662	41.0422680	7.23	2019-09-23 14:44
	PLS-GS-69	General Ground			pavement at wall	-73.9148684	41.0422569	7.33	2019-09-23 14:45
	PLS-GS-70	General Ground			pavement at wall	-73.9148356	41.0422401	7.48	2019-09-23 14:46
	PLS-GS-71	General Ground			top wall	-73.9148360	41.0422406	8.56	2019-09-23 14:46
	PLS-GS-72	General Ground			top curb	-73.9148422	41.0420909	7.55	2019-09-23 14:48
	PLS-GS-73	General Ground			top curb	-73.9148321	41.0420238	7.41	2019-09-23 14:48
	PLS-GS-74	General Ground			center walkway	-73.9148247	41.0418824	8.32	2019-09-23 14:48
	PLS-GS-75	General Ground	Vegetation - Herbaceous			-73.9147499	41.0417858	8.57	2019-09-23 14:49
	PLS-GS-76	General Ground			sidewalk	-73.9147352	41.0416024	8.59	2019-09-23 14:49
	PLS-GS-77	General Ground			top curb	-73.9146918	41.0414988	8.33	2019-09-23 14:50
	PLS-GS-78	General Ground			corner of flywheel monument	-73.9146624	41.0415430	8.47	2019-09-23 14:50
	PLS-GS-79	General Ground			corner of flywheel monument	-73.9145479	41.0415527	8.45	2019-09-23 14:51
	PLS-GS-80	General Ground			corner of flywheel monument	-73.9145576	41.0416502	8.28	2019-09-23 14:51
	PLS-GS-81	General Ground			corner of flywheel monument	-73.9146737	41.0416419	8.72	2019-09-23 14:51
	PLS-GS-82	General Ground			top curb	-73.9145457	41.0417599	8.01	2019-09-23 14:53
	PLS-GS-83	General Ground			catch basin	-73.9146604	41.0420376	6.50	2019-09-23 14:54
	PLS-GS-84	General Ground			top curb	-73.9146155	41.0420359	7.47	2019-09-23 14:54
	PLS-GS-85	General Ground			catch basin	-73.9146653	41.0420997	6.32	2019-09-23 14:54
	PLS-GS-86	General Ground			top curb	-73.9145709	41.0420959	7.30	2019-09-23 14:54
	PLS-GS-87	General Ground			sewer manhole cover	-73.9145109	41.0421119	7.68	2019-09-23 14:55
	PLS-GS-88	General Ground	Vegetation - Herbaceous			-73.9145801	41.0421767	7.57	2019-09-23 14:56
	PLS-GS-89	General Ground			manhole cover	-73.9145301	41.0422192	7.71	2019-09-23 14:56
	PLS-GS-90	General Ground			hydrant	-73.9144625	41.0420905	7.89	2019-09-23 14:57
	PLS-GS-91	General Ground			sidewalk	-73.9143932	41.0421487	7.35	2019-09-23 14:58
	PLS-GS-92	General Ground			sidewalk in front of gate to the View	-73.9141735	41.0422124	7.61	2019-09-23 14:58
	PLS-GS-93	General Ground	Boulder - Small		top outer wall, transition point to boulder wall	-73.9148322	41.0422523	6.92	2019-09-23 15:01
	PLS-GS-94	General Ground			top wall	-73.9137406	41.0422072	8.68	2019-09-23 15:04
	PLS-GS-95	General Ground			ground at wall	-73.9137410	41.0422057	7.64	2019-09-23 15:04
	PLS-GS-96	General Ground			ground at wall	-73.9137388	41.0422093	7.84	2019-09-23 15:04
	PLS-GS-97	General Ground			top outer wall, concrete on top of small boulders	-73.9137361	41.0422184	7.93	2019-09-23 15:05
	PLS-GS-98	General Ground	Sand - Medium			-73.9161475	41.0426590	3.76	2019-09-23 15:06
	PLS-GS-99	General Ground			pavement at wall	-73.9131210	41.0420611	7.95	2019-09-23 15:06
	PLS-GS-100	General Ground			top wall	-73.9131214	41.0420639	8.74	2019-09-23 15:07
	PLS-GS-101	General Ground			ground at wall	-73.9131223	41.0420645	8.20	2019-09-23 15:09
	PLS-GS-102	General Ground	Boulder - Small		top outer wall, rip rap	-73.9131208	41.0420741	7.68	2019-09-23 15:09
	PLS-GS-103	General Ground			catch basin	-73.9131347	41.0419974	7.56	2019-09-23 15:11
	PLS-GS-104	General Ground			hydrant	-73.9131247	41.0419820	8.19	2019-09-23 15:11
	PLS-GS-105	General Ground			top curb	-73.9130674	41.0420182	8.74	2019-09-23 15:12
	PLS-GS-106	General Ground			water main access, V91 marker	-73.9131024	41.0420368	7.96	2019-09-23 15:12
	PLS-GS-107	General Ground			water main access, V92 marker	-73.9131432	41.0420304	7.60	2019-09-23 15:13
	PLS-GS-108	General Ground			water main access	-73.9131507	41.0419869	7.65	2019-09-23 15:13
	PLS-GS-109	General Ground			top curb	-73.9132400	41.0420677	8.24	2019-09-23 15:14
	PLS-GS-110	General Ground			catch basin	-73.9132440	41.0420529	7.69	2019-09-23 15:14

TransectID	Name	PointType	DomSubstrate	WaterDepth	Comments	POINT_X	POINT_Y	ElevNAVD88, ft	GNSS Fix DateTime (GMT)
	PLS-GS-111	Photo				-73.9132031	41.0420522	9.29	2019-09-23 15:16
	PLS-GS-112	Photo				-73.9138596	41.0422088	7.51	2019-09-23 15:17
	PLS-GS-113	Photo				-73.9142740	41.0422127	8.88	2019-09-23 15:18
	PLS-GS-114	Photo				-73.9146827	41.0419954	9.16	2019-09-23 15:19
	PLS-GS-115	Photo				-73.9153466	41.0422148	7.62	2019-09-23 15:21
	PLS-GS-116	Photo				-73.9156899	41.0419422	8.39	2019-09-23 15:23
	PLS-GS-117	General Ground			east corner of overlook decking	-73.9158960	41.0424633	5.59	2019-09-23 15:34
	PLS-GS-118	General Ground			southeast corner of overlook decking	-73.9159129	41.0424507	5.51	2019-09-23 15:34
	PLS-GS-119	General Ground			edge of overlook decking at stairs	-73.9160715	41.0425963	5.60	2019-09-23 15:35
	PLS-GS-120	General Ground			south edge of overlook decking at stairs	-73.9160868	41.0425827	5.54	2019-09-23 15:36
	PLS-GS-121	General Ground			northwest corner of overlook decking	-73.9162319	41.0427161	5.43	2019-09-23 15:37
	PLS-GS-122	General Ground			west corner of overlook decking	-73.9162524	41.0427071	5.38	2019-09-23 15:37
	PLS-GS-123	General Ground			wooden ramp northeast corner	-73.9157594	41.0424274	2.23	2019-09-23 15:42
	PLS-GS-124	General Ground			wooden ramp northwest corner	-73.9157803	41.0424169	2.34	2019-09-23 15:43
	PLS-GS-125	General Ground			wooden ramp southwest corner at gate	-73.9156958	41.0423235	7.81	2019-09-23 15:43
	PLS-GS-126	General Ground			wooden ramp northeast corner at gate	-73.9156762	41.0423425	7.89	2019-09-23 15:44
	PLS-GS-127	General Ground			wooden ramp corner at gate	-73.9156982	41.0423547	7.75	2019-09-23 15:44
	PLS-GS-128	General Ground			wooden ramp corner at gate	-73.9157149	41.0423375	7.75	2019-09-23 15:44
	PLS-GS-129	General Ground			top end wall	-73.9158681	41.0424237	7.86	2019-09-23 15:45
	PLS-GS-130	General Ground			ground end wall	-73.9158677	41.0424226	5.99	2019-09-23 15:46
	PLS-GS-131	General Ground	Sand - Medium		ground at edge stairs	-73.9160558	41.0425985	2.96	2019-09-23 15:48
	PLS-GS-132	General Ground	Sand - Medium		ground at edge stairs	-73.9160701	41.0426092	3.09	2019-09-23 15:48
	PLS-GS-133	General Ground			top bulkhead	-73.9163088	41.0429645	4.13	2019-09-23 15:50
	PLS-GS-134	General Ground	Cobble - Small		ground at bulkhead	-73.9163056	41.0429668	0.47	2019-09-23 15:51
	PLS-GS-135	General Ground	Gravel - Medium			-73.9162662	41.0429793	-1.26	2019-09-23 15:52
	PLS-GS-136	General Ground			top cribbing	-73.9162099	41.0428208	4.38	2019-09-23 15:54
	PLS-GS-137	General Ground	Sand - Fine		ground at cribbing wall	-73.9162083	41.0428214	1.48	2019-09-23 15:55
	PLS-GS-138	General Ground	Gravel - Medium			-73.9161719	41.0428327	-0.03	2019-09-23 15:56
	PLS-GS-139	Water Surface	Gravel - Medium			-73.9161468	41.0428470	-1.21	2019-09-23 15:59
	PLS-GS-140	General Ground	Sand - Medium		corner if crib wall	-73.9161412	41.0427421	1.46	2019-09-23 15:59
	PLS-GS-141	General Ground	Sand - Medium		top corner if crib wall	-73.9161430	41.0427409	4.78	2019-09-23 16:00
	PLS-GS-142	Other			base of cell tower	-73.9158779	41.0424406	3.41	2019-09-23 16:02
	PLS-GS-143	Benchmark				-73.9160259	41.0425886	2.91	2019-09-23 16:10
	PLS-GS-144	Photo				-73.9158956	41.0424792	2.31	2019-09-23 16:18
	PLS-GS-145	Other	(blank)	(blank)	pipe	-73.9151400	41.0422570	-1.00	2019-09-23 16:12
	PLS-GS-146	Other	(blank)	(blank)	(blank)	-73.9145300	41.0422600	-0.60	2019-09-23 16:14
	PLS-GS-147	Other	(blank)	(blank)	pipe	-73.9137610	41.0422360	-0.22	2019-09-23 16:25
	PLS-REF-P1	General Ground	Gravel - Very Fine			-73.9048137	41.0419057	0.38	2019-09-23 17:10
	PLS-REF-P2	General Ground	Other		organic mat	-73.9048175	41.0419031	0.94	2019-09-23 17:11
	PLS-REF-P3	Wrack			wrack line	-73.9048181	41.0419797	2.87	2019-09-23 17:13
	PLS-REF-SA-1	General Ground			s. alt low elev, muck on rip rap	-73.9042939	41.0421400	-0.13	2019-09-23 16:57
	PLS-REF-SA-2	General Ground	Other		s. alterniflora low end, muck on rip rap	-73.9042413	41.0421371	-0.66	2019-09-23 16:59
	PLS-REF-SA-3	General Ground	Other		s. alterniflora high, muck on rip rap	-73.9042524	41.0421453	0.09	2019-09-23 17:00
PLS-REF-T1	PLS-REF-T1-1	General Ground	Other	1.1	organics/muck	-73.9042789	41.0419923	-1.79	2019-09-23 16:40
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PLS-REF-T1	PLS-REF-T1-3	General Ground	Other	edge water	organics/muck	-73.9043563	41.0421159	-0.68	2019-09-23 16:42
PLS-REF-T1	PLS-REF-T1-4	General Ground	Sand - Coarse		some riprap, gravel	-73.9043658	41.0421208	-0.28	2019-09-23 16:45
PLS-REF-T1	PLS-REF-T1-5	General Ground	Sand - Coarse		s. alterniflora start	-73.9043635	41.0421311	0.30	2019-09-23 16:46

TransectID	Name	PointType	DomSubstrate	WaterDepth	Comments	POINT_X	POINT_Y	ElevNAVD88, ft	GNSS Fix DateTime (GMT)
PLS-REF-T1	PLS-REF-T1-6	General Ground	Other		s. alterniflora upper, muck on rip rap	-73.9043780	41.0421451	1.37	2019-09-23 16:47
PLS-REF-T1	PLS-REF-T1-7	General Ground	Other		s. alt end, start rip rap, muck on riprap	-73.9043803	41.0421452	1.46	2019-09-23 16:50
PLS-REF-T1	PLS-REF-T1-8	General Ground	Cobble - Large		stop rip rap, start phrag.	-73.9043796	41.0421593	2.86	2019-09-23 16:51
PLS-REF-T1	PLS-REF-T1-9	General Ground	Gravel - Medium		mug wort, road edge	-73.9043943	41.0421765	4.81	2019-09-23 17:18
PLS-REF-T2	PLS-REF-T2-1	General Ground	Other	1.0	muck	-73.9045807	41.0419343	-1.57	2019-09-23 17:09
PLS-REF-T2	PLS-REF-T2-2	General Ground	Other	1.0	muck	-73.9045932	41.0419494	-1.37	2019-09-23 17:08
PLS-REF-T2	PLS-REF-T2-3	General Ground	Other	0.90	muck	-73.9046091	41.0419671	-1.37	2019-09-23 17:08
PLS-REF-T2	PLS-REF-T2-4	General Ground	Other	0.65	muck	-73.9046220	41.0419805	-1.06	2019-09-23 17:07
PLS-REF-T2	PLS-REF-T2-5	General Ground	Sand - Medium	edge water	muck	-73.9046385	41.0419915	-0.39	2019-09-23 17:06
PLS-REF-T2	PLS-REF-T2-6	General Ground	Sand - Medium		start organic deposit	-73.9046589	41.0420146	0.93	2019-09-23 17:05
PLS-REF-T2	PLS-REF-T2-7	General Ground	Sand - Fine		edge phrag	-73.9046729	41.0420281	1.84	2019-09-23 17:05

Appendix B

Stakeholder Kickoff Meeting (August 22, 2019)

Climate Adaptive Design (CAD) Studio

Piermont Living Shoreline Project

Kickoff Meeting
Piermont Village Hall
August 22, 2019

NEIWPCC
New England Interstate Water Pollution Control Commission

NEW YORK STATE OF OPPORTUNITY | Hudson River Estuary Program
A Program of the New York State Department of Environmental Conservation

VILLAGE OF PIERMONT, NY

HDR

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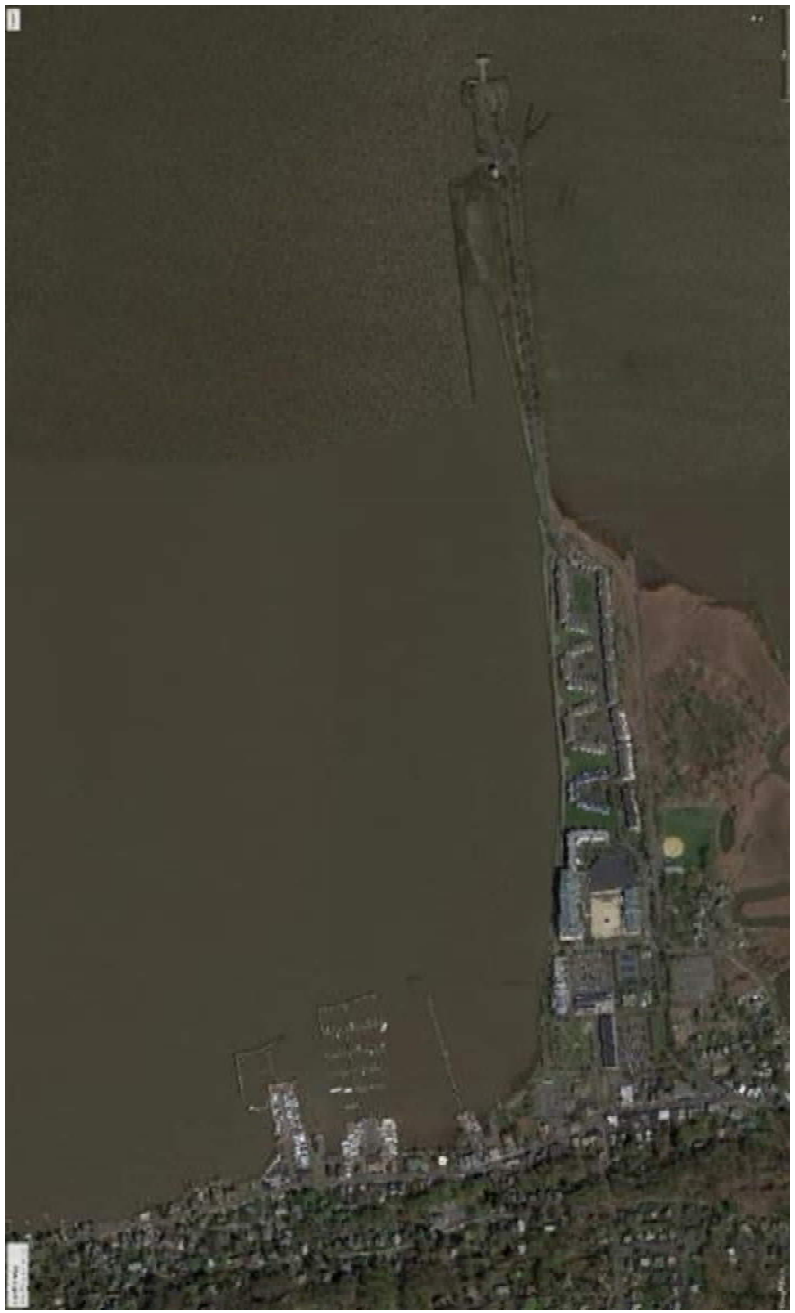
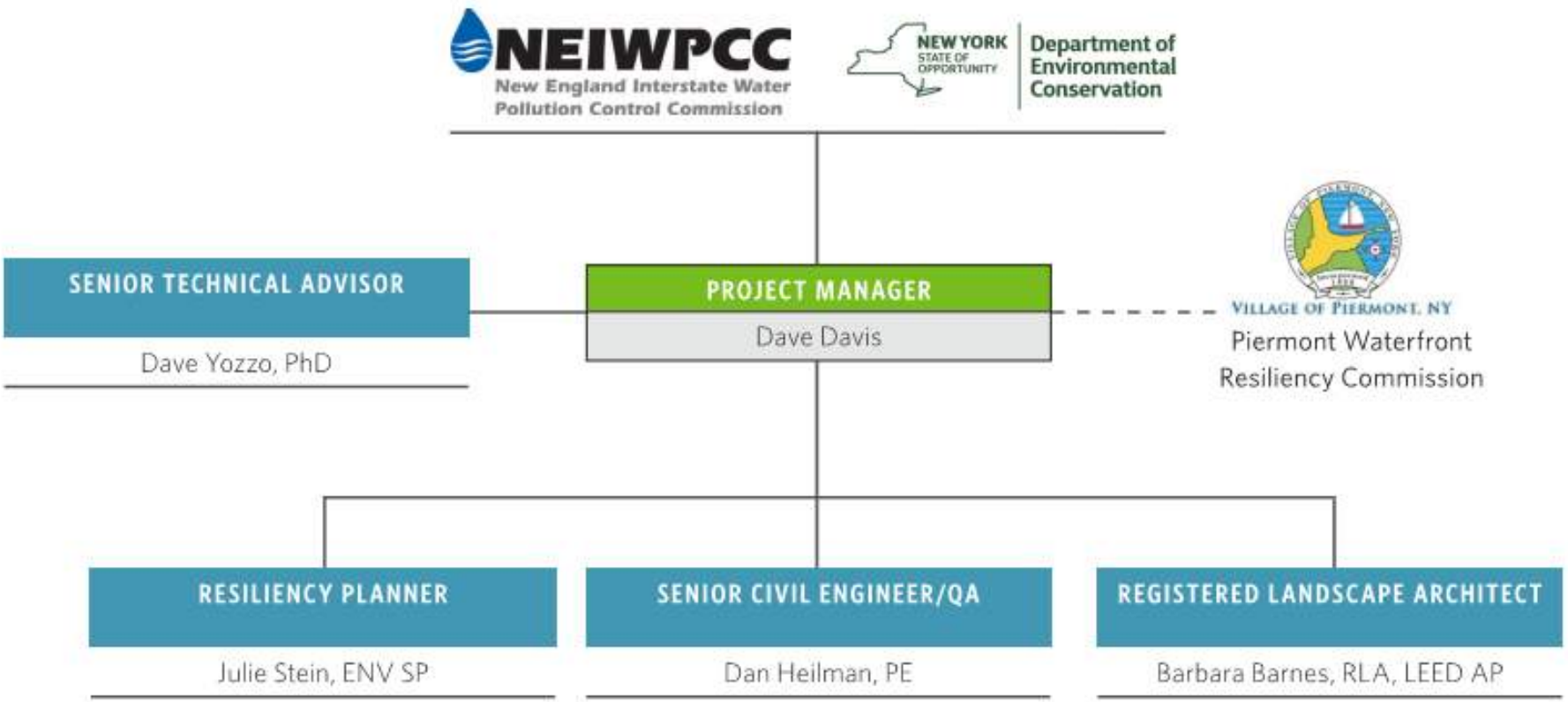
Agenda

- Introduce HDR team & Project Partners (Roles & Responsibilities)
- Project Background & Shared Vision
- CAD Concepts & Overall Design Objectives (Expected Outputs & Outcomes)
- QAPP & Site Investigation
- Stakeholder Engagement & Coordination
- Overall Permitting Strategy
- Project Schedule
- Site Visit





ADDITIONAL RESOURCES

SITE ASSESSMENT LEAD
Kevin Verweire

ENVIRONMENTAL SCIENTISTS
David Brizzolara
Jaclyn Chapman
Darren Sinnott

WATER RESOURCE ENGINEER
Kim Lukas, PE

WETLAND SCIENTIST
Steve Seymour, PWS

FIELD/LAB COORDINATOR
Ehren Deppert

DATA AQUISITION MANAGER/QC
Jaak Van den Sype

DRONE PILOT-IN-COMMAND
Casey Stokes

GIS ANALYST
Marc Korpus

Roles & Responsibilities

Organization	Name	Role	Responsibility
HDR	Julie Stein	HDR Principle in Charge (PiC)	• Overall contract management for HDR
HDR	David S. Davis	Project Manager	• Establish and maintain project schedule and budget • Stakeholder strategy and engagement • Oversight and final review of all project deliverables • QAPP implementation
HDR	David J. Yozzo	Senior Technical Advisor/QA	• Technical oversight of data collections and review of deliverables • QAPP implementation
HDR	Barbara Barnes	Registered Landscape Architect/QC	• QC Review and oversight of landscape design and deliverables
HDR	Kim Lukas	Water Resource Engineer	• Review CAD concepts • Prepare engineering design report
HDR	Kevin VerWeire	Site Assessment Lead	• Site assessment lead and living shoreline design
NYSDEC	Daniel Miller	NEIWPCC Project Manager	• Review and oversight of technical work progress and deliverables • Coordinate NYSDEC and HREP stakeholder engagement
NEIWPCC	Peter Zaykoski	Quality Assurance Program Manager	• Contract management • Review QAPP and subsequent revisions for conformance to NEIWPCC guidelines
NYSDEC/ Cornell Cooperative Extension	Libby Zemaitis	HREP Climate Outreach Specialist	• Project implementation and reviews
Village of Piermont	Nathan Mitchell	Piermont Waterfront Resiliency Commission Chair	• Project implementation and oversight • Local stakeholder engagement

Project Background

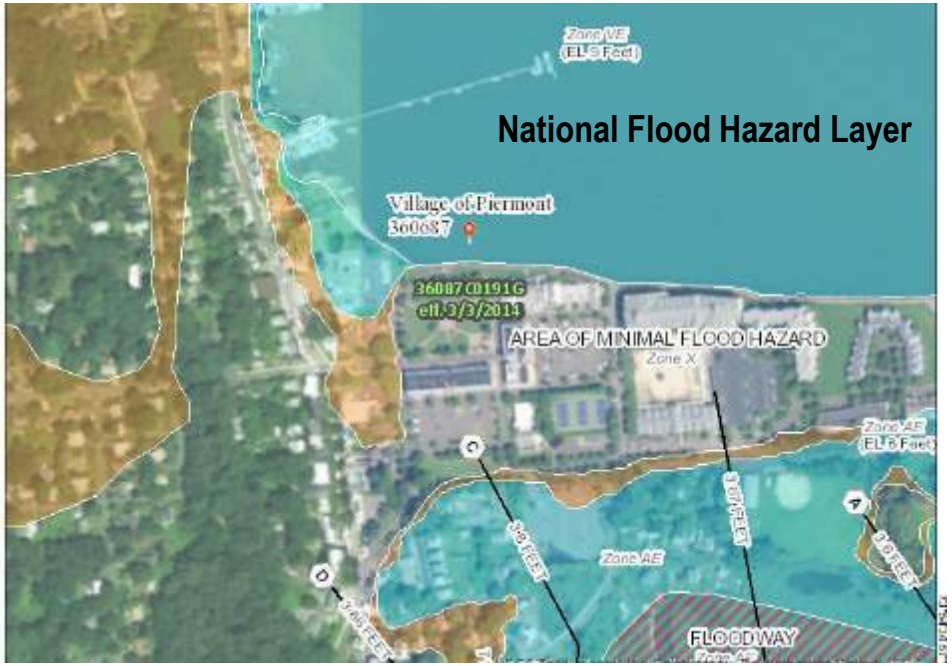
- Piermont's location is a great asset and offers a unique opportunity for coastal resiliency planning.
- The challenges of climate change and sea level rise will be significant:
  - ✓ 0.75 to 2.5 feet rise by 2050 and 1.25 to 9.5 feet by 2100 in lower HR estuary (NYSDEC)
  - ✓ 52.5% of Piermont at risk from 1% flood event (Rockland County Hazard Mitigation Plan)
- Through collective planning, engaged citizens and a shared stakeholder vision, Piermont is uniquely positioned to face the challenge.

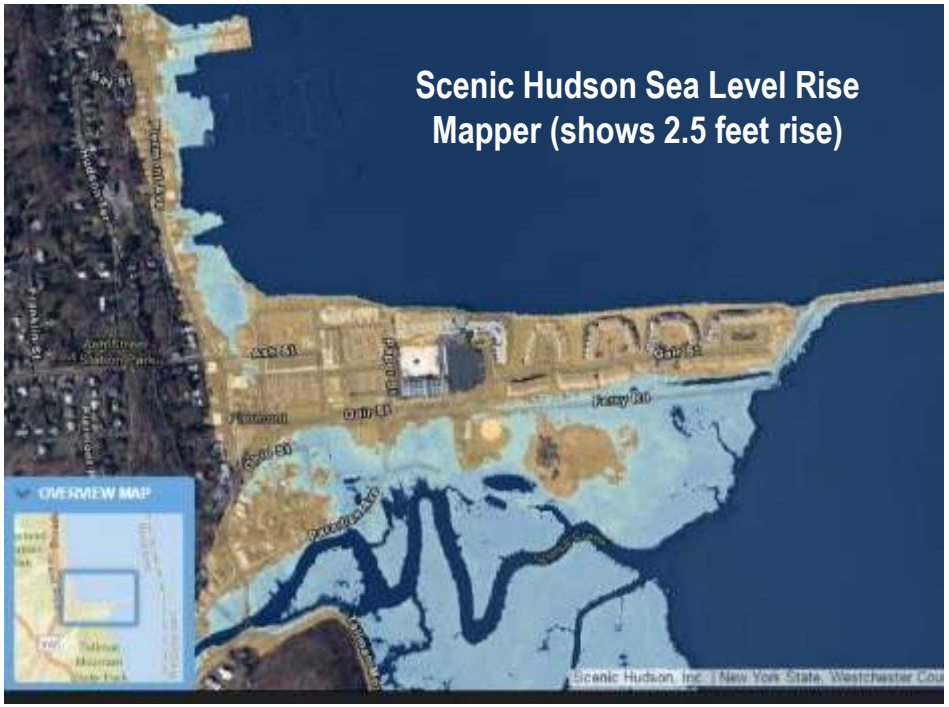
From Piermont Waterfront Resiliency Commission 2018

From Piermont Marsh Reserve Management Plan 2017 (NYSDEC)

Shared Vision for a Resilient Piermont

- Report of the Piermont Waterfront Resilience Task Force (2014)
- Desired outcomes from the community, a resilient Piermont will…
  - ✓ adapt gradually to avoid and minimize risks
  - ✓ be a model for others
  - ✓ help its residents and businesses to recover quickly from floods and storms
  - ✓ maintain the Village's relationship with the Hudson River
  - ✓ maintain a vibrant business district and local economy
  - ✓ foster and build community
  - ✓ be environmentally responsible





Climate Adaptive Design (CAD) Studio

- Cornell University's CAD Studio began design process in Fall 2017.
- Students developed 5 independent designs that envisioned future waterfront reinforcement, adaptation and relocation in Piermont.
- Each of the CAD Studio designs offers well thought out, innovative ideas for improving Piermont's coastal resiliency.

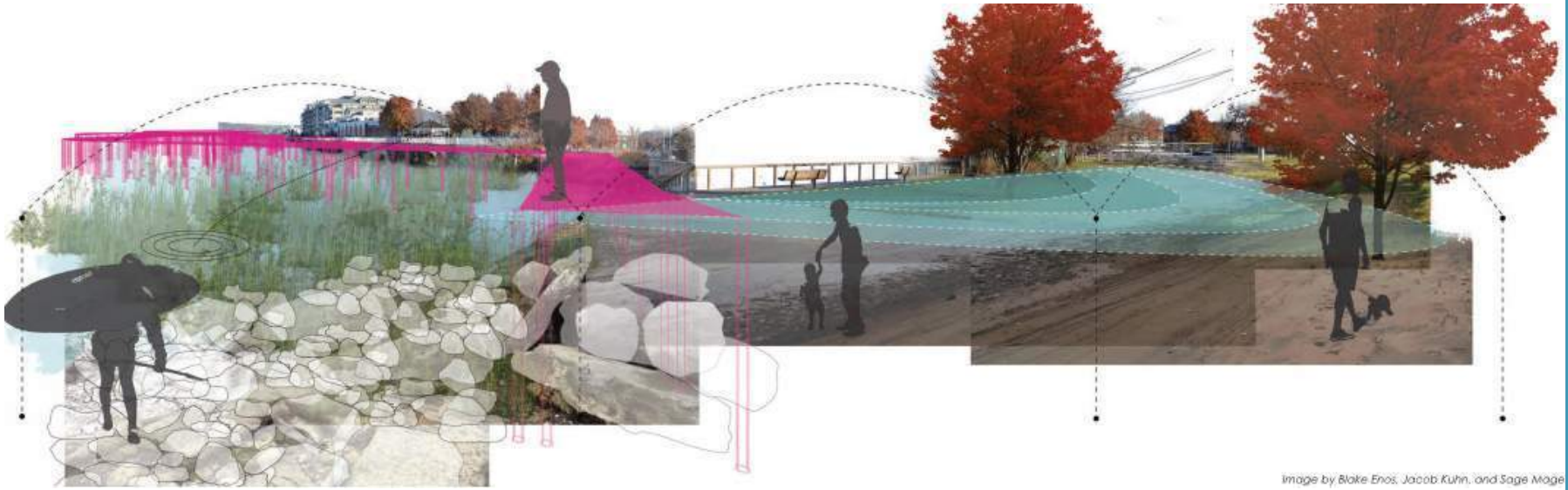
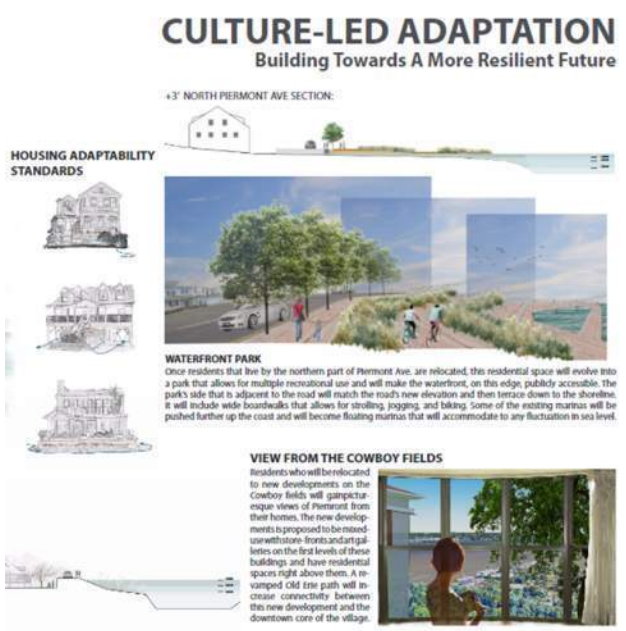
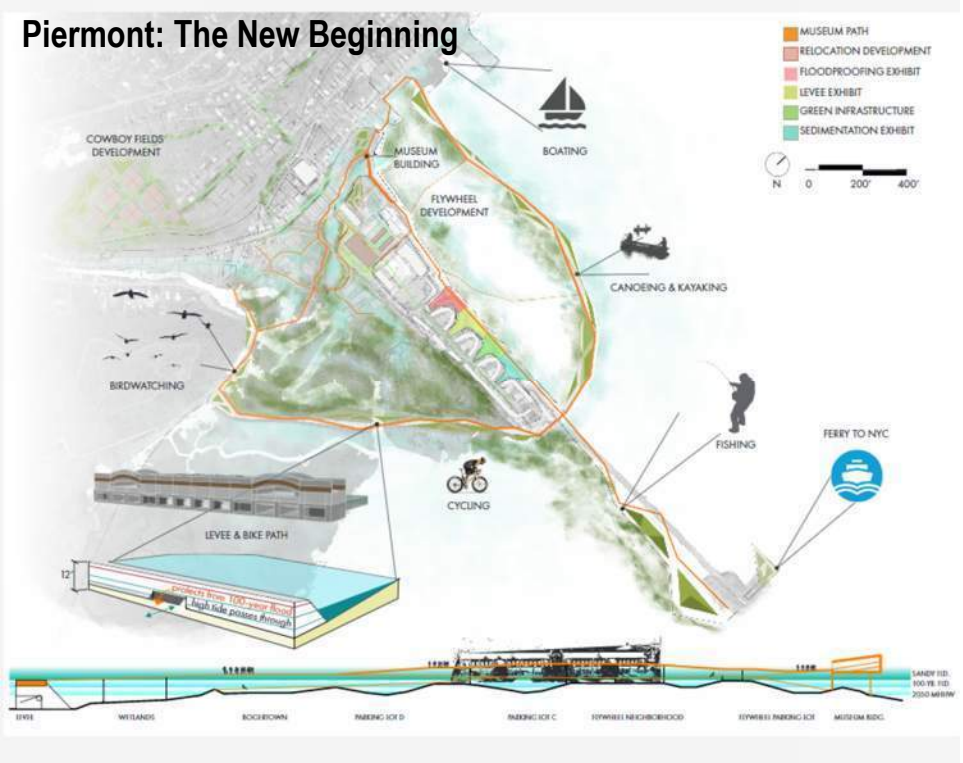


Image by Blake Enos, Jacob Kuhn, and Sage Mage

Design Objective

- Review CAD Studio concepts and use common elements to develop a cohesive and implementable design for a coastal resiliency project.
- Must achieve five overarching criteria:
  - ✓ Be cost-effective and able to attain state and local agency support and permits
  - ✓ Align with Piermont's existing Waterfront Resiliency Program and Local Waterfront Revitalization Plan (LWRP)
  - ✓ Align with the goals of the Hudson River Estuary Program and nearby Piermont Marsh reserve.
  - ✓ Be in keeping with the village's scenic and waterfront character
  - ✓ Include educational or interpretive elements





Site Identification

- During the RFP stage, HDR met with the Village and identified a potential project area north of the existing pier.
- Public open space area that could offer an opportunity to restore ecological diversity and protect a mix of land uses and infrastructure offset from the waterfront.
- An ecological and general site condition assessment will be conducted during a one-day site investigation planned for mid to late September.

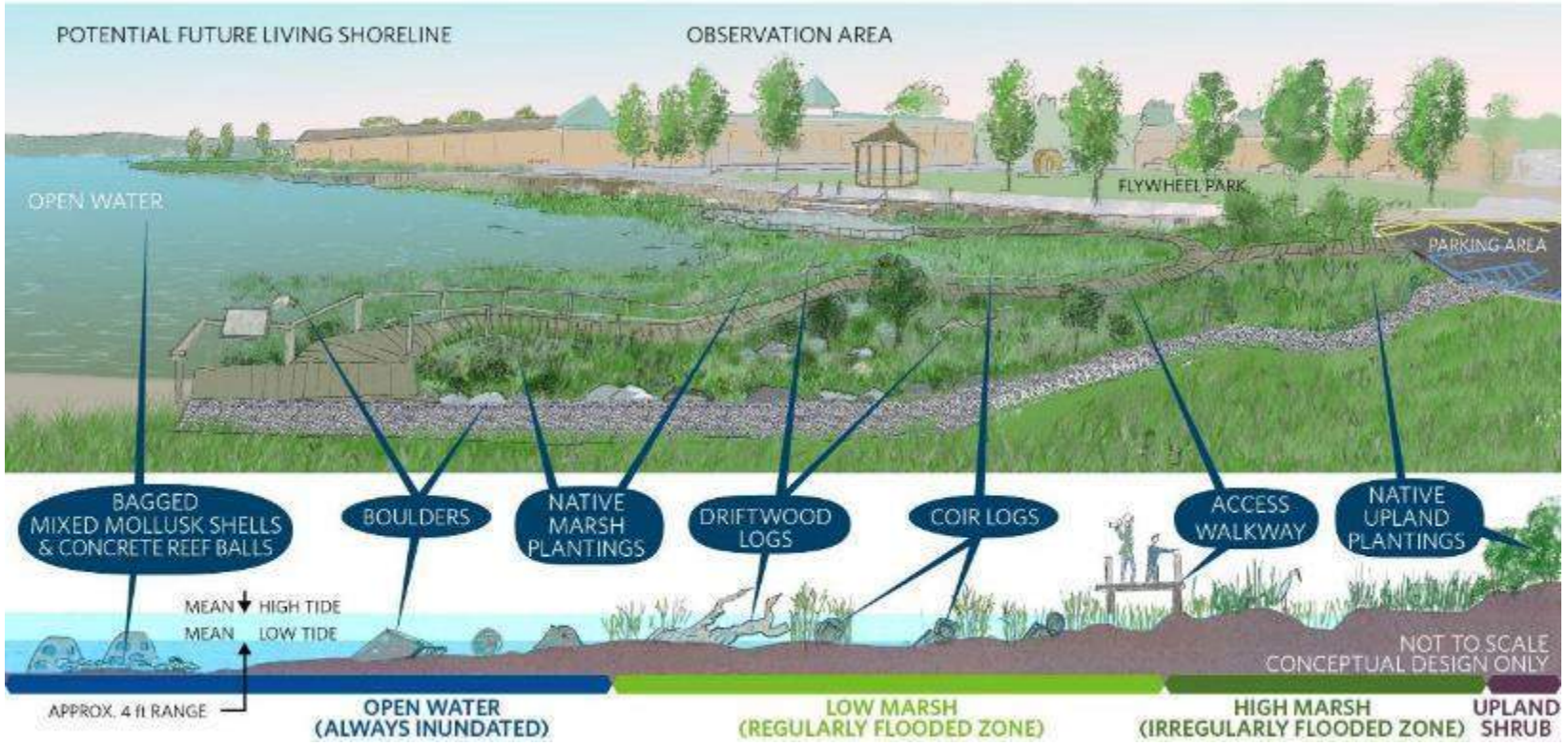
Design Methodology

- Preliminary design will follow the guidance outlined by NYSDEC for Marine and Coastal District Waters including the Hudson River south of the Tappan Zee Bridge.
- Living shorelines use vegetation and other natural elements, such as oysters or mussel beds, often in combination with harder shoreline structures to stabilize and protect coastlines in an estuarine system.
- Added benefits:
  - ✓ Improving water quality by filtering nutrients and pollutants,
  - ✓ Creating habitat for fish, birds and other living resources,
  - ✓ Promoting recreation and adaptive uses.

Preliminary Design (to be investigated)

- Incorporate additional structured protection as appropriate to stabilize the slope and protect against erosive forces such as boat wakes, ice scour and storm surge.

- Low profile sills made of broken rock, bagged mixed mollusk shells, modular oyster “castles”, or concrete reef balls to protect marsh plantings and provide additional habitat for aquatic organisms.



First Steps

- ✓ Finalize Quality Assurance Project Plan (QAPP)
- ✓ Project Kickoff Meeting (August 22, 2019)
- Review CAD Concepts and Develop Checklist of Key Elements
- Conduct Site Assessment (September 2019)

Northern pier ecological buffer and pedestrian walkway to protect Piermont against wave action and reduce sediment deposition

Site Assessment (Topo)

- Review existing data (see NOAA Digital Coast Topobathymetry Base Map with elevation contours).
- Aerial drone survey will collect aerial imagery, videography, and photogrammetry as well as high-accuracy topography.
- Water elevations collected at low tide every 50 feet along the shoreline as well as locations of both natural and man-made features to a wadeable depth using RTK GPS.

Site Assessment (Ecological and General Site Condition)

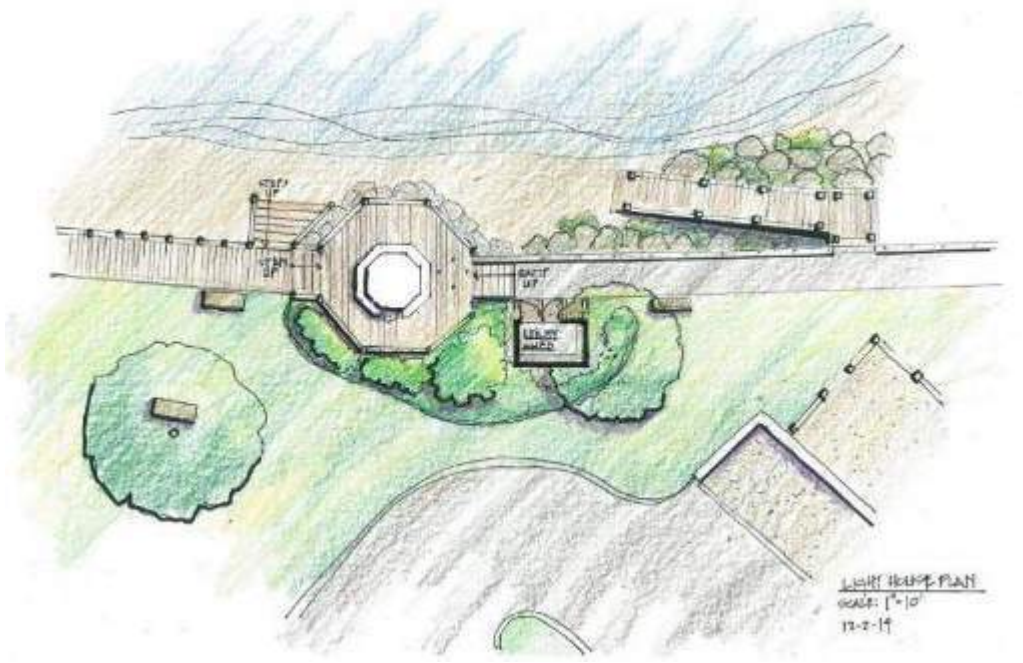
- Describe existing ecological communities based on Edinger *et al.* 2014
- Record:
  - ✓ Dominant plant species
  - ✓ Invasive species present
  - ✓ Rare plants or animals observed
  - ✓ Dominant substrate types
  - ✓ Visual assessment of bank and shoreline stability
  - ✓ Observed site constraints and ecological opportunities

Stakeholder Engagement

- Stakeholder engagement will guide the selection of design features and refine preliminary concept design.
- Key stakeholders include:
  - ✓ NYSDEC Hudson River Estuary Program (HREP)
  - ✓ NYSDEC Division of Fish & Wildlife (Regulatory)
  - ✓ Hudson River National Estuarine Research Reserve (HRNERR)
  - ✓ Hudson River Sustainable Shorelines Project
  - ✓ New England Interstate Water Pollution Control Commission (NEIWPCC)
  - ✓ U.S. Army Corps of Engineers – New York District
  - ✓ NOAA National Marine Fisheries Service (NMFS)
  - ✓ Village of Piermont
  - ✓ Piermont Waterfront Resiliency Commission
  - ✓ Cornell University
  - ✓ Scenic Hudson

Local Stakeholders

- Village staff will assist planning and stakeholder engagement including coordination with property/landowners at the community level.
- Concurrent Projects Near Parelli Park:
  - ✓ Rebuild of Public Boat Ramp Damaged during Superstorm Sandy
  - ✓ Memorial Lighthouse Project



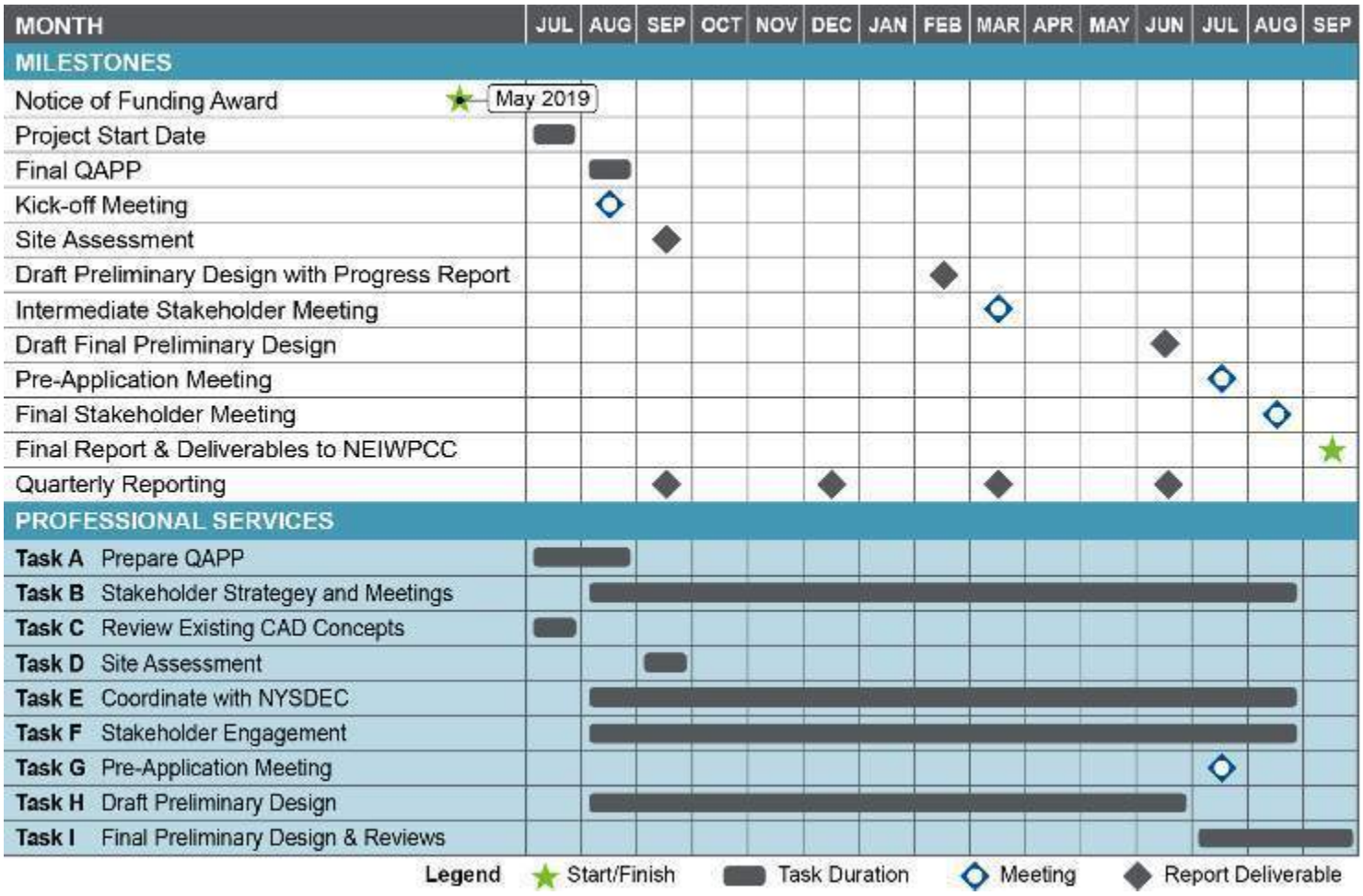
Permitting Strategy

- As part of the Preliminary Design Report, HDR will outline an overall permitting strategy for the proposed project.
- HDR will prepare materials and attend a pre-application meeting with relevant state and federal regulatory staff to review the draft preliminary design.
- No permit applications will be filed under this contract.

Preliminary Concept Design Deliverables

- Engineering Report and Drawings (Draft & Final)
- Summary of CAD Studio Design Review and Project Justification
- Stakeholder Engagement Summary
- Site Assessment Summary
- Permitting Strategy and Compiled Application Materials
- Implementation Strategy that estimates:
  - ✓ Future construction and maintenance costs
  - ✓ Permitting and construction timelines
  - ✓ Recommended project specifications with construction, maintenance and monitoring considerations
  - ✓ Potential funding source(s)
  - ✓ General implementation recommendations

Project Schedule with Key Milestones & Deliverables



Discussion

- Questions for the project team?
- Action Items
- HDR will prepare a meeting summary for review and inclusion in the Preliminary Design Report
- Site Visit

Appendix C

NYSDEC Pre-application Meeting (June 26, 2020)

Climate Adaptive Design (CAD) Studio

Piermont (Hudson River) Living Shoreline Preliminary Design Project

NYSDEC Pre-Application Meeting
June 26, 2020

NEIWPCC
New England Interstate Water Pollution Control Commission

NEW YORK STATE OF OPPORTUNITY | Hudson River Estuary Program
A Program of the New York State Department of Environmental Conservation

VILLAGE OF PIERMONT, NY

HDR

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Meeting Agenda

- Introductions
- Overview of the Cornell Climate Adaptive Design (CAD) Studio program
- Design goals for the Piermont Living Shoreline
- Review the project's preliminary/30% design plans
- Permitting discussion
- Next steps/Action Items

Project Background

- Piermont's location is a great asset and offers a unique opportunity for coastal resiliency planning.
- The challenges of climate change and sea level rise will be significant:
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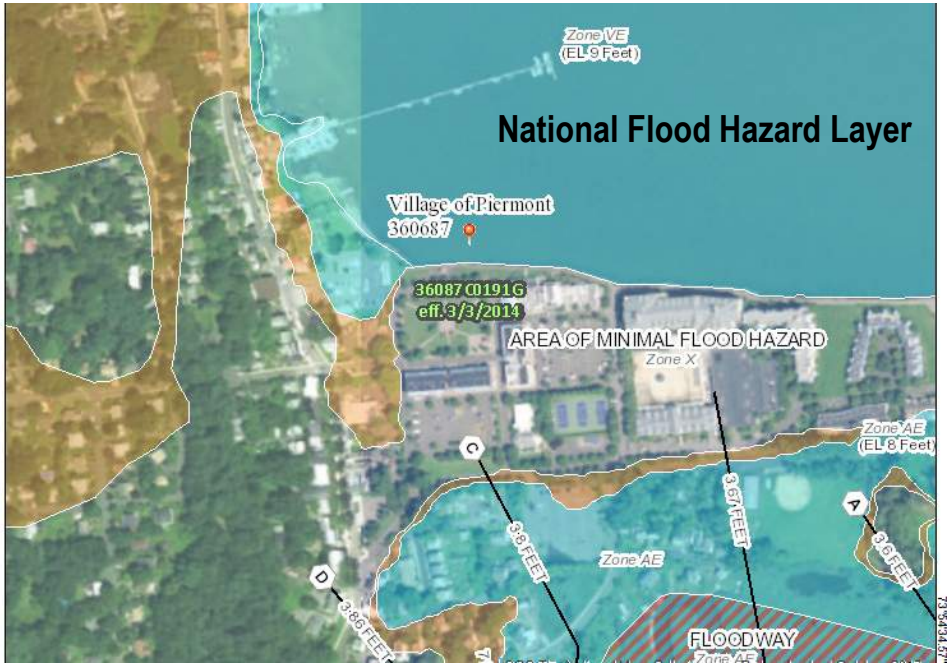

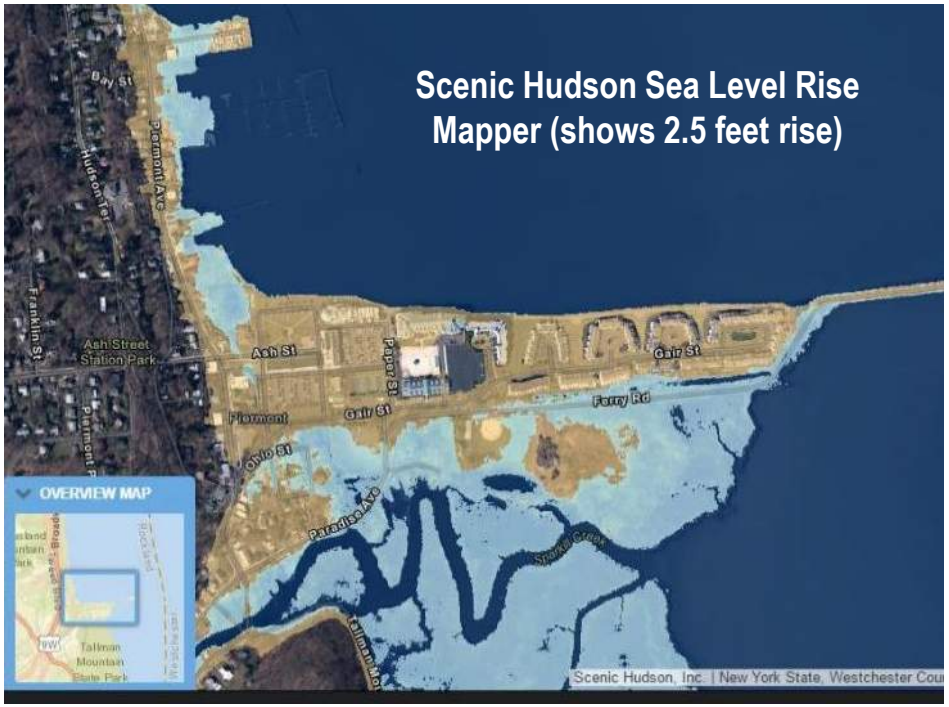

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- Students developed 5 independent designs that envisioned future waterfront reinforcement, adaptation and relocation in Piermont.
- Each of the CAD Studio designs offers well thought out, innovative ideas for improving Piermont's coastal resiliency.

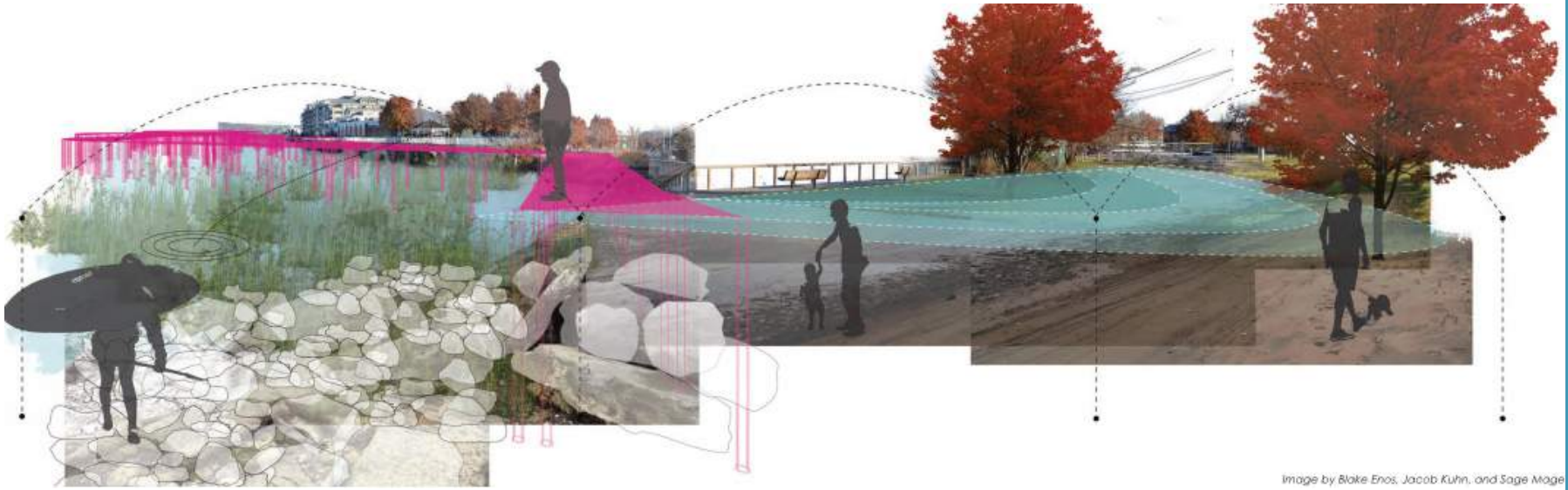
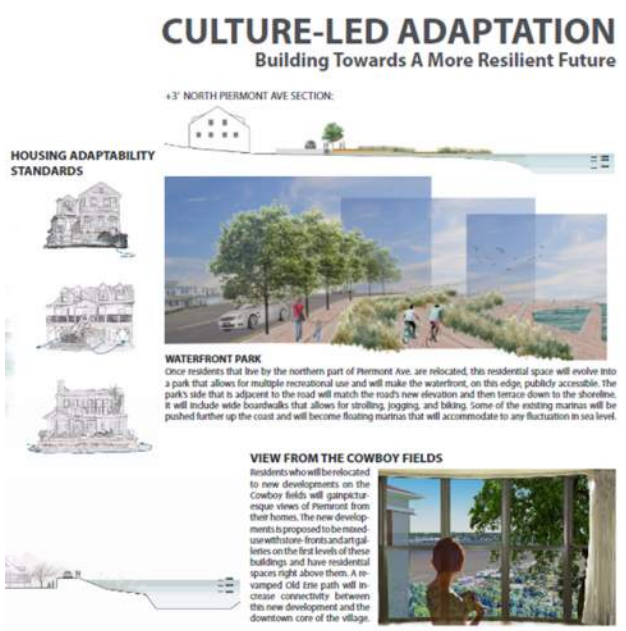
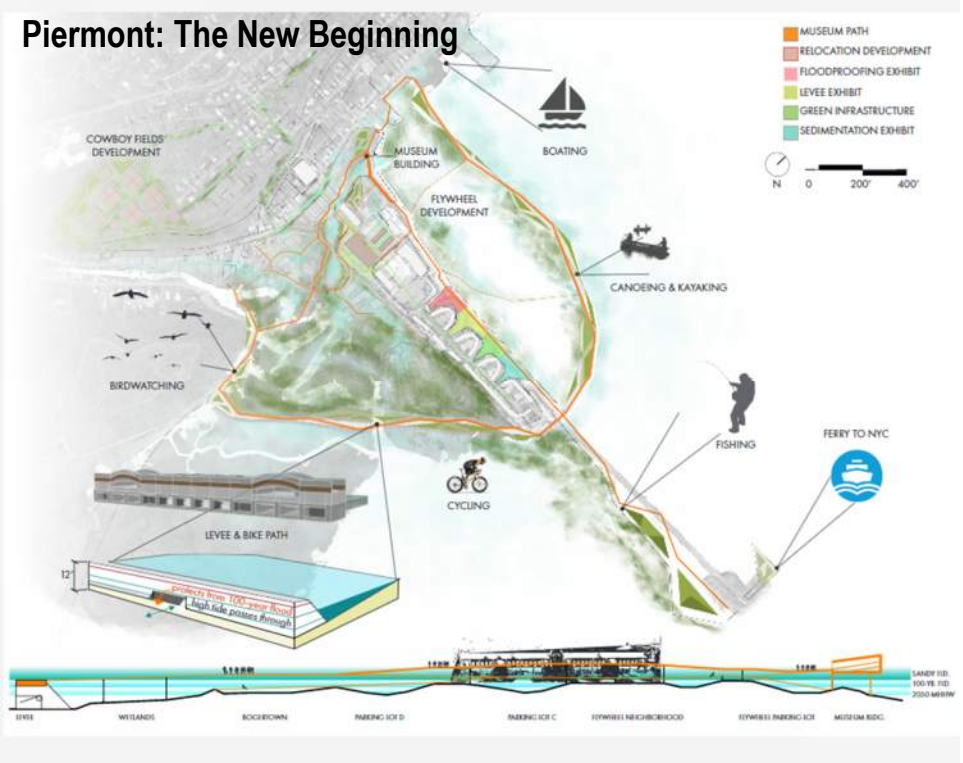


Image by Blake Enos, Jacob Kuhn, and Sage Mage

Design Objective

- Review CAD Studio concepts and use common elements to develop a cohesive and implementable design for a coastal resiliency project.
- Must achieve five overarching criteria:
  - ✓ Be cost-effective and able to attain state and local agency support and permits
  - ✓ Align with Piermont's existing Waterfront Resiliency Program and Local Waterfront Revitalization Plan (LWRP)
  - ✓ Align with the goals of the Hudson River Estuary Program and nearby Piermont Marsh reserve.
  - ✓ Be in keeping with the village's scenic and waterfront character
  - ✓ Include educational or interpretive elements





Site Identification

- During the RFP stage, HDR met with the Village and identified a potential project area north of the existing pier.
- Public open space area that could offer an opportunity to restore ecological diversity and protect a mix of land uses and infrastructure offset from the waterfront.
- An ecological and general site condition assessment was conducted in September 2019.

Site Assessment (Topo)

- Review existing data (see NOAA Digital Coast Topobathymetry Base Map with elevation contours).
- Aerial drone survey will collect aerial imagery, videography, and photogrammetry as well as high-accuracy topography.
- Water elevations collected at low tide every 50 feet along the shoreline as well as locations of both natural and man-made features to a wadeable depth using RTK GPS.

Site Assessment (Ecological and General Site Condition)

- Describe existing ecological communities based on Edinger *et al.* 2014
- Record:
  - ✓ Dominant plant species
  - ✓ Invasive species present
  - ✓ Rare plants or animals observed
  - ✓ Dominant substrate types
  - ✓ Visual assessment of bank and shoreline stability
  - ✓ Observed site constraints and ecological opportunities

Design Methodology

- Preliminary design follows the guidance outlined by NYSDEC for Marine and Coastal District Waters including the Hudson River south of the Tappan Zee Bridge.
- Improve coastal resiliency by protecting and stabilizing the existing shoreline through the development of both intertidal and subtidal habitat features to attenuate wave energy.
- Added benefits:
  - ✓ Improving water quality by filtering nutrients and pollutants,
  - ✓ Creating habitat for fish, birds and other living resources,
  - ✓ Promoting recreation and adaptive uses.

Preliminary Design - Proposed Site Plan

HDR

ISSUE	DATE	DESCRIPTION
1	05-15-20	DRAFT FINAL FOR PERMITTING REVIEW
0	02-14-20	PRELIMINARY DRAFT FOR CLIENT REVIEW

PROJECT MANAGER	D. DAVIS
DESIGNER	K. VERWEIRE
DRAFTER	J. WYNOHRADNYK
REVIEWER	D. HEILMAN
PROJECT NUMBER	10000001017415

CLIMATE ADAPTIVE DESIGN (CAD) STUDIO
PIERMONT LIVING SHORELINE PROJECT
PIERMONT, NEW YORK

PROPOSED SITE PLAN

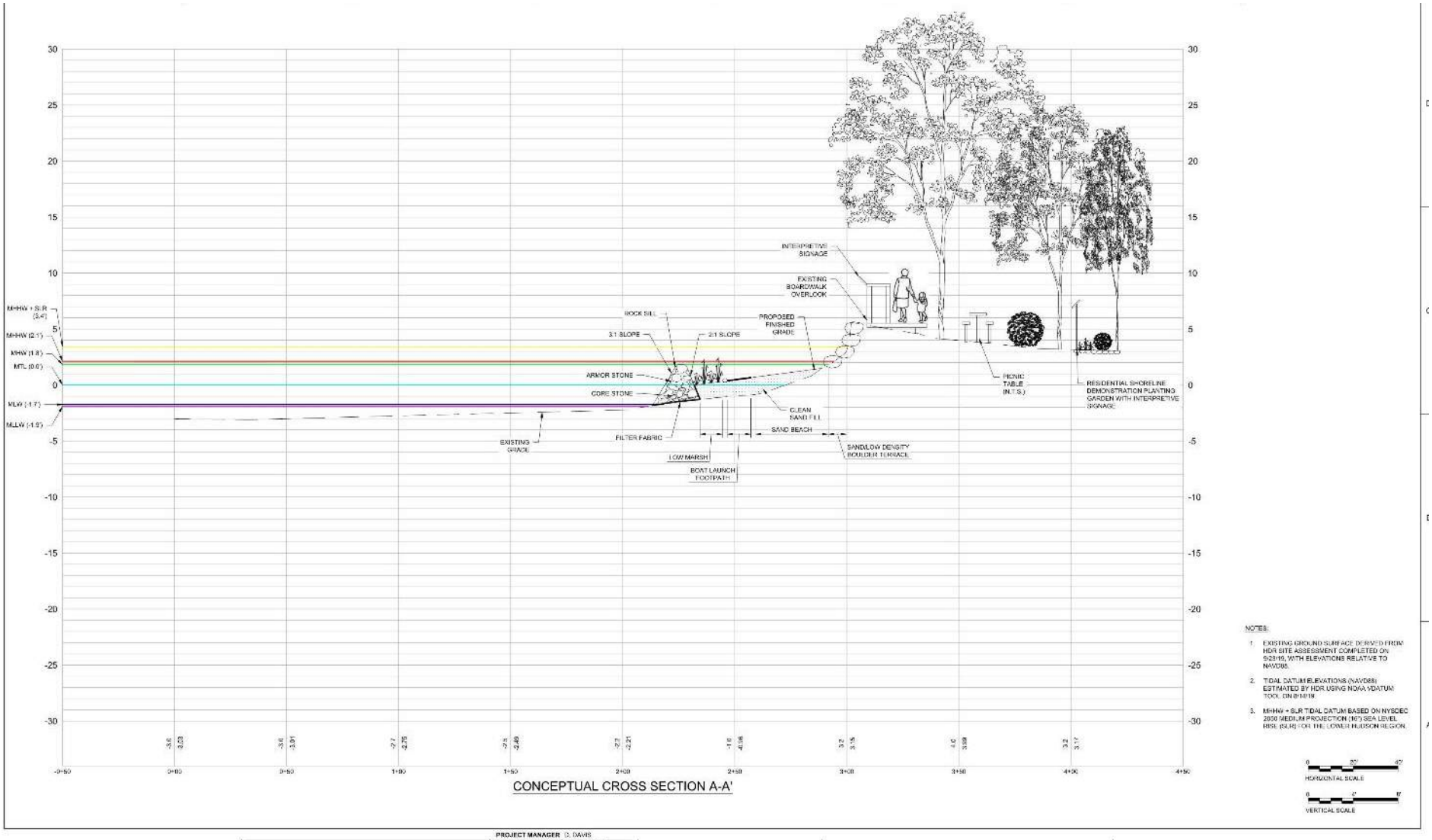
0 30' 60'

FILENAME

SCALE 1" = 30'

SHEET
C-101

Preliminary Design – Cross Section



CONCEPTUAL CROSS SECTION A-A'

ISSUE	DATE	DESCRIPTION
1	05-15-20	DRAFT FINAL FOR PERMITTING REVIEW
0	02-14-20	PRELIMINARY DRAFT FOR CLIENT REVIEW

PROJECT MANAGER	D. DAVIS
DESIGNER	K. VERWEIRE
DRAFTER	J. WYNOHRADNYK
REVIEWER	D. HELLMAN
PROJECT NUMBER	00303010177415

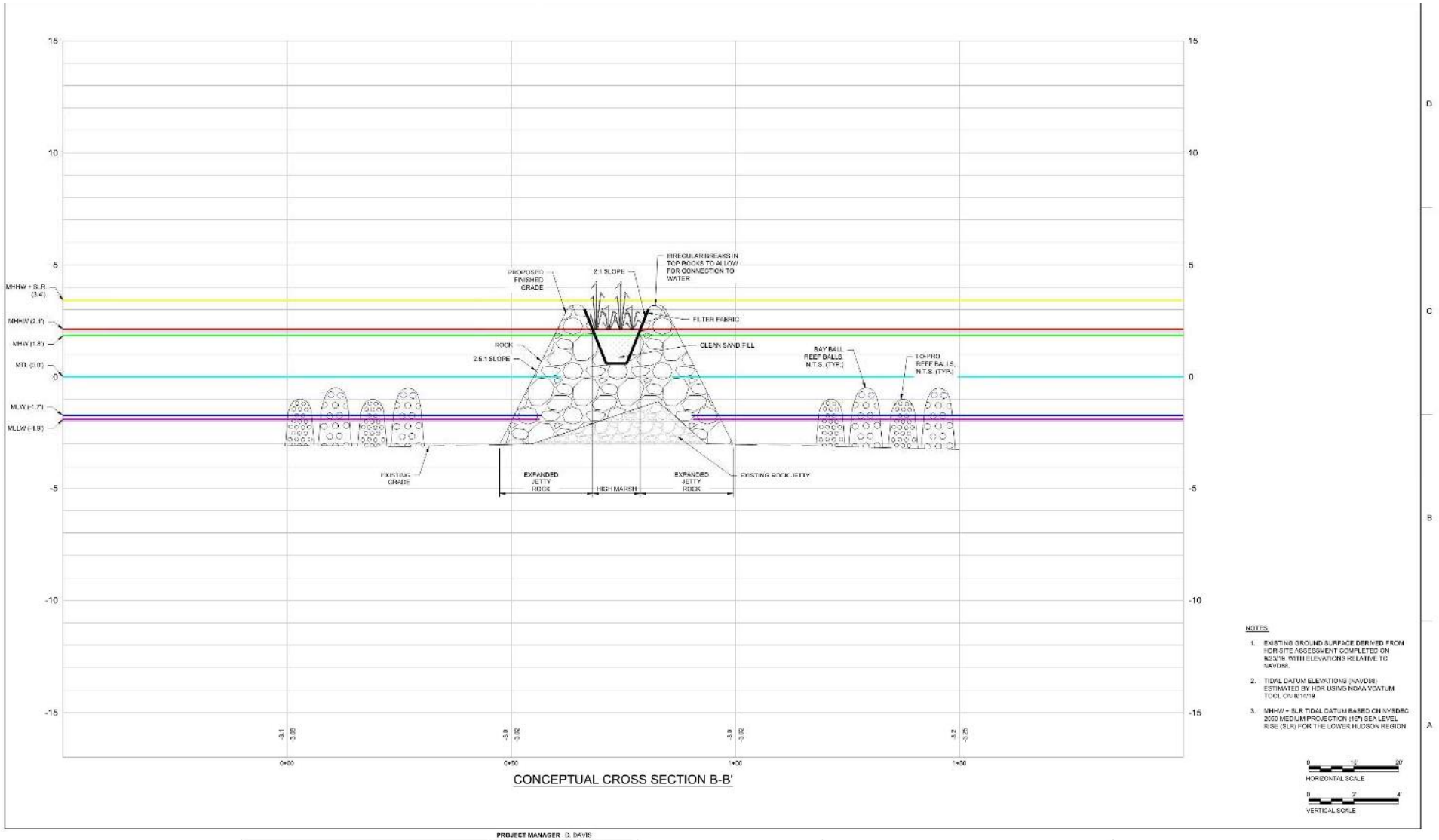
CLIMATE ADAPTIVE DESIGN (CAD) STUDIO
PIERMONT LIVING SHORELINE PROJECT
PIERMONT, NEW YORK

SECTIONS

FILENAME -
SCALE 1" = 20'

SHEET C-301

Preliminary Design – Rock Jetty Cross Section



CONCEPTUAL CROSS SECTION B-B'

NOTES:

1. EXISTING GROUND SURFACE DERIVED FROM HDR SITE ASSESSMENT COMPLETED ON 8/23/19, WITH ELEVATIONS RELATIVE TO NAVD88.
2. TIDAL DATUM ELEVATIONS (NAVD88) ESTIMATED BY HDR USING NOAA VDATUM TOOL ON 8/16/19.
3. MHHW + SLR TIDAL DATUM BASED ON NYSDEC 2050 MEDIUM PROJECTION (16") SEA LEVEL RISE (SLR) FOR THE LOWER HUDSON REGION.

HORIZONTAL SCALE 0 10' 20'

VERTICAL SCALE 0 2' 4'

ISSUE	DATE	DESCRIPTION
1	05-15-20	DRAFT FINAL FOR PERMITTING REVIEW
0	02-14-20	PRELIMINARY DRAFT FOR CLIENT REVIEW

PROJECT MANAGER	D. DAVIS
DESIGNER	K. VERWEIRE
DRAFTER	J. WYNOHRADNYK
REVIEWER	D. HEILMAN
PROJECT NUMBER	10090010177415

CLIMATE ADAPTIVE DESIGN (CAD) STUDIO
PIERMONT LIVING SHORELINE PROJECT
PIERMONT, NEW YORK

SECTIONS

FILENAME

SCALE 1" = 10'

SHEET C-302

Permitting Discussion

- Early engagement of regulatory staff.
- Document the type of project information required by regulatory staff for future permit approvals.
- Opportunity to provide initial feedback and perspective to be used in future design development.
- Actual permit applications will be submitted during the next phase of the project.

Habitat Zone	Habitat Area (Acre)	Habitat Area (ft^^{2})	Estimated Fill Depth (ft)	Estimated Fill Volume (CY)
Rock Jetty	0.20	8,787	5	1,925
Rock Low Sill	0.19	8,145	4	1,207
Low Marsh	0.19	8,264	4	1,224
High Marsh	0.23	10,054	5	1,862
Pocket Sand Beach (microhabitat areas)	0.01	605	1	11
Sand/Low Density Boulder Terrace	0.26	11,329	4	1,678
Sand/Gravel/Boat Launch Path	0.02	934	1	35
Sand Beach	0.10	4,285	1	159
Pathway Rock	0.00	154	1	6
Reef Balls	0.03	1,225	1	45
Totals	**1.23**	**53,782**		**8,151**

Project would result in the creation and enhancement of 1.23 acres of intertidal and subtidal habitat.

Next Steps/Action Items

Appendix D

Reasonable Order of Magnitude - Opinion of Probable Final Design and Construction Costs

Piermont Climate Adaptive Design

Class V Reasonable Order of Magnitude - Opinion of Probable Construction Costs - May 2020

Category	Item No.	Task	Quantity	UOM	Unit Cost (2020$s)	Total Cost (2020$s)	Assumptions & Notes
Soft Costs							
Site Assessment / Investigation	**1**	Delineation of Wetlands and Waters/Functional Assessment	1	EA	$ 10,000	$ 10,000	Delineation for approx. 1 acre acre site
	2	Section 106	1	EA	$ 10,000	$ 10,000	Includes Phase 1A/B archeological survey and coordination with SHPO.
	3	Threatened and Endangered Species Consultation	1	EA	$ 5,000	$ 5,000	Basic habitat assessment, coordination with USFWS and NY
	4	Phase 1 Environmental Site Assessment	1	EA	$ 10,000	$ 10,000	
	5	Sediment / Geotechnical Sampling	1	EA	$ 40,000	$ 40,000	Sediment sampling to confirm material classification and required management during construction and geotech samples for evaluating stability of existing jetty
	6	Site survey (property lines, utilities, topography)	1	EA	$ 15,000	$ 15,000	For approx. 1 acre site
		Subtotal				$ 90,000	
Permitting & Engineering Design Development	**7**	65% Design Plans	6	EA	$ 15,000	$ 90,000	65% Design
	8	95% Design Plans	6	EA	$ 10,000	$ 60,000	95% Design
	9	Final Contract Drawings - 100% Design	6	EA	$ 7,500	$ 45,000	Construction bid documents
	10	Response to contractor RFIs during bidding		POC	$ 0	$ 10,375	Assume 5% of overall design cost
	11	Estimate Quantities/Engineer's Cost Estimate	1	EA	$ 5,000	$ 5,000	
	12	Specifications	1	EA	$ 7,500	$ 7,500	
	13	U.S. Army Corps of Engineers Permitting	1	EA	$ 50,000	$ 50,000	Includes a joint permit with USACE and NYSDEC to address: • Article 25- Tidal Wetlands Permit • Article 15 – Excavation & Fill in Navigable Waters with Water Quality Certification • Coastal Zone Consistency – 15 CFR Part 930 and 19 NYCRR Part 600 • NYS Office of General Services (NYSOGS) – Public Land Law, Article 6 • Essential Fish Habitat (EFH) consultation with National Marine Fisheries Service
	14	NYSDEC Stormwater Permit preparation	1	EA	$ 25,000	$ 25,000	Preparation of SWPPP, NOI, MS4 Acceptance Form, and NOT for SPDES General Permit for Construction
	15	Local Permits and/or Site Plan Review	1	EA	$ 20,000	$ 20,000	
	16	Stakeholder Engagement During Design	1	EA	$ 40,000	$ 40,000	
		Subtotal				$ 352,875	
Construction Costs							
Construction Materials	**17**	Rock Jetty Improvements	1039.5	TON	$ 743	$ 771,964	Tonnage of boulders installed
	18	Rock Low Sill	1207	CYD	$ 39	$ 47,379	
	19	Low and High Marsh Construction	3086	CYD	$ 48	$ 147,327	Comprised of Clean Sand Fill
	20	Pocket Sand & Sand Beach	170	CYD	$ 48	$ 8,116	
	21	Geotextile Filter Fabric	905	SYD	$ 11	$ 10,186	Beneath Rock Sill areas
	22	Sand / Low Density Boulder Terrace	1678	CYD	$ 39	$ 65,867	
	23	Sand / Gravel Boat Launch Path	35	SYD	$ 68	$ 2,376	
	24	Educational Signage	2	EA	$ 15,000	$ 30,000	
	25	Reef Balls - Low Pro	120	EA	$ 96	$ 11,480	
	26	Reef Balls - Bay Ball	120	EA	$ 163	$ 19,584	
	27	Permanent Vegetation - Spartina	2035	SYD	$ 3	$ 6,046	Plantings for low and high marsh areas
	28	Sediment Excavation & Relocation on Site	6079.5	CYD	$ 13	$ 78,274	Assume 75% of excavated sediment volume can be reused on site
	29	Removal & Disposal of Unusable Sediment / Materials	2229	TON	$ 113	$ 250,893	Assume 25% of excavated sediment volume will be disposed of offsite
	30	Existing Stormwater Outfall Modification	1	EA	$ 3,000	$ 3,000	
	31	Tree Plantings - Shade / Ornamental	6	EA	$ 1,600	$ 9,600	
	32	Picnic table	3	EA	$ 6,600	$ 19,800	
	33	File Notice to Mariners During Construction and for Proposed Conditions	1	EA	$ 1,000	$ 1,000	
	34	Metes and Bounds Description for Easements and As-Built Conditions	1	EA	$ 10,000	$ 10,000	To be prepared by a licensed surveyor
		Subtotal				$ 1,492,891	
General Reqts & Contractor Costs	**35**	Contractor Management		POC	6%	$ 116,146	Assumed percentage of overall construction cost
	36	Mobilization & Demobilization		POC	5%	$ 96,788	Assumed percentage of overall construction cost
	37	Soil Erosion and Sediment Control During Construction		POC	0.5%	$ 9,679	Assumed percentage of overall construction cost
	38	Contractor Bonds & Insurance		POC	2.0%	$ 38,715	Assumed percentage of overall construction cost
	39	Contractor Profit		POC	8.0%	$ 154,861	Assumed percentage of overall construction cost
	40	Contractor Direct Expense		POC	20%	$ 387,153	Assumed percentage of overall construction cost
		Subtotal				$ 803,343	
		Total Estimated 2020 Project Cost (without Contingency)				**$ 2,739,109**	