Southport Beach
Resilient Design & Recommended Maintenance Program

Town of Fairfield, CT

March 22, 2017

Prepared by:

RACE COASTAL ENGINEERING

Project No. 201644

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1. Introduction

RACE Coastal Engineering (RACE), at the request of the Town of Fairfield, CT, performed a coastal engineering study that included assessment of the existing site and characteristic environmental conditions at Southport Beach and development of an engineered beach design and maintenance plan. The purpose of this plan is to increase the stability of the existing beach and contribute to continued recreational opportunities for Town residents and guests. This report is intended to provide the Town with a tool for planning and implementing future beach and backshore nourishment programs, necessitated by storm related damage, that will be eligible for FEMA disaster assistance. Such eligibility is based upon the Stafford Act, 42 USC 5121-5206, as amended, Sections 403 and 406 and CFR §§206.225, Emergency Work and CFR §§ 205.226, Restoration of Damaged Facilities.

This document provides the Town of Fairfield with a baseline Beach Plan, including characterization of the existing beach sand materials, identification of the sand size and type that will be needed for future nourishment programs, quantification of environmental load conditions (i.e. waves and water surface conditions), that are representative of a coastal storm with a 5-yr and 10-yr recurrence interval, and a design for the backshore and beach fill that are intended to meet FEMA requirements for future disaster assistance.

1.1. Study Objective

The fundamental purpose of the study was to provide the Town of Fairfield with a planning document that will allow the shoreline to continually be managed and maintained for recreational, flood protection, and habitat enhancement purposes. In addition, this document describes an engineered beach and backshore design and maintenance plan that meets the minimum standards established by FEMA that are intended to allow the Town to seek FEMA assistance for future sand replacements necessitated by a beach avulsion event.

1.2. Project Site

The Southport Beach site is a 900± linear feet beach utilized by the public for recreational beach opportunities. The western end of the site is armored as it transitions into Sasco Creek which separates the Town of Fairfield from Westport. The site contains a large stone jetty at the western end which aids in keeping sediment out of Sasco Creek. East of the site is a groin which separates the site from a seawall to its east. Geomorphologically, the site can be described as a sand beach. It is a dynamic coastal landform whose shape and form will be most strongly influenced by wave action. It remains in a natural state in spite of relatively high utilization and modest anthropogenic impacts.

It was originally formed in the post-glacial period when sand that was moved along the shoreline under the influence of waves and to some extent tidal currents was deposited at the terminus of the glacier that covered the area. The general vicinity of the project is shown on the photograph included in the following section, Figure 1 – Aerial Photograph – Southport Beach. The beach system in this area is a result of the complex interaction of glacial melting and consequential sea level rise that occurred as recently as 5,000 years ago and the sculpting effects of waves and stream flow that have impacted the site since that time. The sand material and the underlying gravel deposits that characterize the beaches and the tidal ponds of Long Island Sound originated in the glacial deposits of that past glacial recession. The current sand beach formation is dynamic in nature, varying in size with the complexities of sand deposition and erosion, and in geometry and orientation when impacted by storm waves and severe winds or the semi-diurnal flooding and ebbing of the tide.

The Connecticut Department of Energy and Environmental Protection (DEEP) recognizes the site as including valuable and protected natural resources comprised of *beaches and dunes, tidal wetlands,* and *intertidal flats* (Ref 1). Areas adjacent to the site are more developed and include a parking lot and road way.

To the casual visitor, Southport Beach is a place for reflection, exercise, entertainment, sport, picnic gatherings, bird watching, fishing, and other such activities. It is a valuable asset to residents and guests and deserving of facilities that will maximize its use and serve to protect the infrastructure from storm damage, while protecting the neighboring resources.

The site is normally exposed to winds and waves originating from the southerly direction. The aerial photograph in Figure 1 is orientated with north to the top of the page. Additional photographs are provided in Appendix A. A site plan of the Southport Beach project area, including topography, is provided in the construction drawings included as part of Appendix B.

The site is exposed to Long Island Sound and is subject to coastal flooding associated with storm conditions. Such conditions yield extreme stillwater elevations and wave conditions. The shorefront is subject to semi-diurnal tidal fluctuation and is subject to storm events, most typically associated with hurricanes and nor'easters.

2. Existing Site Conditions

Site investigations were performed by **RACE** to document the existing site conditions. The site investigation and findings are documented in the following sections.

2.1. Site Investigation

A site field investigation was performed by **RACE** on May 25, 2016 during a period of low water to collect sediment samples and document the existing conditions. Base mapping was prepared, under subcontract to **RACE**, by Gesick & Associates P.C. from a series of field surveys that took place from May 31, 2016 to June 10, 2016. Beach and backshore grades were measured along transects that were spaced at approximately 50' intervals and subsequently mapped so as to develop the site topography for this study. In addition, offshore hydrographic survey data to the depth of closure was collected by **RACE** on June 16, 2016 to optimally locate and position the required beach fill. The hydrographic survey was prepared such that offshore information on depths could be incorporated into a Site Plan showing depths and any obstructions to navigation which may exist on the site. The data collected during the field visit, site survey, and hydrographic survey were compiled to determine the baseline condition of the site. These data are compiled in Appendices A-C of this report.

Source: Google Earth, 2016

Figure 1: Aerial Photograph – Southport Beach

2.2. Findings

The sandy foreshore slope of the beach was determined to vary from 1V:7H to 1V:11H. The beach is split into two sections by a jetty at Sta. 1+07. East of the jetty the foreshore of the beach extends landward to a relatively flat planar sandy backshore area for approximately 350 feet. The elevation of this planar backshore ranges in elevation from approximately El. +7' to El. +8' (NAVD 88) adjacent to the parking lot. The backshore transions at Sta.4+61 to a rock wall wave breaker structure. West of the jetty, there is a small sandy beach before the shoreline transitions into an armored revetment and intersects Sasco Creek. In addition, there are several areas of tidal wetlands west of the jetty. A Site Plan, which includes this and more detailed topographic information, is included in the construction drawing set in Appendix B.

2.3. Beach Sand Characterization

Three (3) sand samples were collected from the site to determine the gradation of the existing beach sand. Sand was collected from mean low water (MLW), mid beach (El. +6'), and high beach (El. +9'). The high and mid beach samples from the site were described as gray beach sand with the Unified Soil Classification System (USCS) classification of a poorly graded sand (SP). The MLW sample was described as a gray beach sand with USCS classification of well graded sand (SW). A sieve analysis was performed and the results from the sieve analysis are graphically displayed in Figure 2.

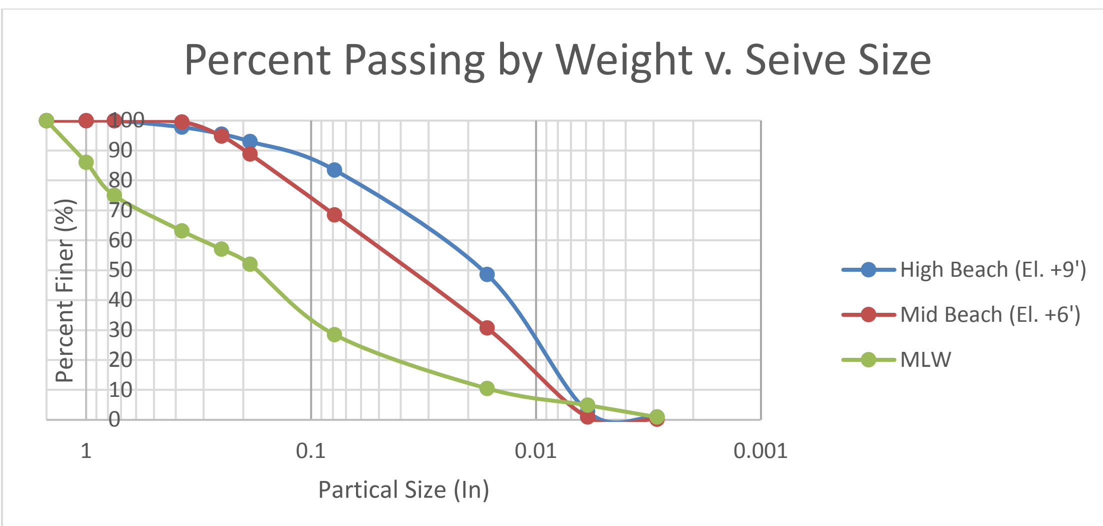


Figure 2: Percent Passing by Weight vs. Sieve Size

The average D_{50} of the samples was determined to be 0.079 inches (2.01 mm). The existing sediment information was used as input into **RACE's** coastal morphology model as well as to determine a specification for import material.

3. Environmental Settings

The Southport Beach site is exposed to the waters of Long Island Sound from the north, northeast, and easterly directions and is subject to coastal flooding associated with storm conditions. Such conditions can yield extreme stillwater elevations and wave conditions which can cause beach and dune erosion, nearshore shoaling, and damage to near shore structures (Ref 3). Wind generated waves are defined by their height, length, and period. These characteristics can be measured at a given location and are determined by the following factors:

- Water depth (determined from stillwater elevation)
- Wind speed and duration
- Distance over which wind blows (Fetch)

Water depth, wind speed, duration, and fetch lengths, discussed in the following section, were used as design conditions to determine wave height, length, and period. Water depths, published in the Federal Emergency Management Agency's (FEMA) Flood Insurance Study (FIS), and wind speeds from FEMA's Engineering Library (Ref 4) were used to generate offshore waves with 10-yr and 5-yr return periods. These waves were transformed as they approached shore. The transformed wave heights and periods were used as input into the coastal morphology model that **RACE** used to evaluate the existing conditions and guide the design of the beach fill and nourishment schemes.

3.1. Stillwater Elevation

Stillwater elevation is defined as the elevation of the water surface without the presence of wave action, but including storm surge as well as astronomical tides. The stillwater elevation reflects storm surge and tides typical of the Atlantic Ocean and, specifically, Long Island Sound. All elevations are referenced to the North American Vertical Datum of 1988 (NAVD 88) unless otherwise noted. The stillwater elevations, characteristic of the Southport Beach site and associated with a range of return periods, are summarized in Table 1.

Return Period	Stillwater Elevation (ft)
100-yr	10.2
50-yr	9.6
10-yr	8
5-yr	6.8

Table 1: Stillwater Elevations

The 100-yr, 50-yr, and 10-yr tidal flood frequency information is referenced to Transect 36 from the Federal Emergency Management Agency (FEMA), Flood Insurance Study (FIS) No. 09001CV001C and dated October 16, 2013 (Ref 3). The 5-yr SWL was determined by interpolation. These stillwater elevations were used to determine water depths for the modeling and design of the proposed beach fill at the Southport Beach site.

The modeling and design study was extended from the open water offshore of the site in a section of the reach where wave setup does not occur. Waves were transformed, utilizing the applicable Storm-Induced Beach Change model (SBEACH) described in subsequent sections, based on the fixed stillwater elevations described in Table 1 as they propagated landward.

3.2. Wind Climatology

The design wind condition for this site was based upon the recommended design wind speed from FEMA's Engineering Library (Ref 4). These wind speeds are based on a Peaks-Over-Threshold analysis of wind data collected from Sikorsky Airport in Stratford, CT. The published wind speed $U_{100,hr}$ = 85 mph is based upon winds with a 1 hour duration occurring at 30-ft above the water surface and a 100-yr recurrence interval (1% chance of occurring in any given year). This 100-yr wind speed was adjusted, based upon the guidelines of ASCE 7-05 (Ref 5), to generate wind speeds for both a 10-yr and a 5-yr event. These 1-hour duration wind speeds were then utilized as a basis for the determination of the design height, period, and length of the offshore wave(s) using the US Army Corps of Engineers *Wind Speed & Wave Growth* application of the *Automated Coastal Engineering System (ACES Version 4.03)* (Ref 6) as described in Section 3.3.

3.3. Site Wave Characteristics

The height and period of the offshore waves generated by the winds discussed in the previous section are dependent upon the length of the fetch over which the wind blows. Southport Beach is exposed from a bearing of 60° from North to 230° from North. The exposure of each fetch from different directions at Southport Beach is listed below in Table 2.

Bearing (deg)	Fetch (Miles)	Bearing (deg)	Fetch (Miles)
60	0.1	150	15.5
70	0.27	160	15.38
80	0.29	170	14.97
90	0.9	180	13.66
100	1.07	190	13.7
110	31.56	200	0.25
120	23.52	210	0.2
130	16.58	220	0.18
140	13.84	230	0.07

Table 2: Fetch Radials

The direction and length of each fetch radial was input into the *Wind Speed & Wave Growth* application of the *Automated Coastal Engineering System (ACES)* and used to determine the 10-yr and 5-yr design wave height and wave period based off of the windspeeds and water surface elevations described above in Sections 3.1 and 3.2. The incident design wave was assumed to originate over the longest exposure at a bearing of 110° with a distance of 31.56 miles across Long Island Sound. The model results are displayed in Figures 3 and 4**.**

Case: Southport

Windspeed Adjustment and Wave Growth

Breaking criteria 0.780

Item	Value	Units
El of Observed Wind (Zobs)	30.00	feet
Observed Wind Speed (Uobs)	71.40	mph
Air Sea Temp. Diff. (dT)	0.00	deg F
Dur of Observed Wind (DurO)	1.00	hours
Dur of Final Wind (DurF)	1.00	hours
Lat. of Observation (LAT)	41.20	deg
Results		
Wind Fetch Length (F)	26.81	MILES
Wind Direction (WDIR)	110.00	deg
Eq Neutral Wind Speed (Ue)	72.23	mph
Adjusted Wind Speed (Ua)	123.30	mph
Mean Wave Direction (THETA)	114.00	deg
Wave Height (Hmo)	9.02	feet
Wave Period (Tp)	5.72	sec

Wave Growth: Deep

Wind Obs Type	Wind Fetch Options
Shore (windward)	Deep restricted

Restricted Fetch Geometry

#	Fetch Angle (deg)	Fetch Length (miles)
1	60.00	0.10
2	70.00	0.27
3	80.00	0.29
4	90.00	0.90
5	100.00	1.07
6	110.00	31.56
7	120.00	23.52
8	130.00	16.58
9	140.00	13.84
10	150.00	15.50
11	160.00	15.38
12	170.00	14.97
13	180.00	13.66
14	190.00	13.70
18	230.00	0.07

Figure 3: ACES Model Results for Offshore Design Wave 10-yr

Case: Southport

Windspeed Adjustment and Wave Growth

Breaking criteria 0.780

Item	Value	Units
El of Observed Wind (Zobs)	30.00	feet
Observed Wind Speed (Uobs)	61.20	mph
Air Sea Temp. Diff. (dT)	0.00	deg F
Dur of Observed Wind (DurO)	1.00	hours
Dur of Final Wind (DurF)	1.00	hours
Lat. of Observation (LAT)	41.20	deg
Results		
Wind Fetch Length (F)	26.81	MILES
Wind Direction (WDIR)	110.00	deg
Eq Neutral Wind Speed (Ue)	61.86	mph
Adjusted Wind Speed (Ua)	99.80	mph
Mean Wave Direction (THETA)	114.00	deg
Wave Height (Hmo)	6.83	feet
Wave Period (Tp)	5.03	sec
Wave Growth:	Deep	

Wind Obs Type	Wind Fetch Options
Shore (windward)	Deep restricted

Restricted Fetch Geometry

#	Fetch Angle (deg)	Fetch Length (miles)
1	60.00	0.10
2	70.00	0.27
3	80.00	0.29
4	90.00	0.90
5	100.00	1.07
6	110.00	31.56
7	120.00	23.52
8	130.00	16.58
9	140.00	13.84
10	150.00	15.50
11	160.00	15.38
12	170.00	14.97
13	180.00	13.66
14	190.00	13.70
18	230.00	0.07

Figure 4: ACES Model Results for Offshore Design Wave 5-yr

The design offshore wave height and period were computed to be H_{mo} = 9.02 ft and T_p = 5.72 sec for the 10-yr case and H_{mo} = 6.83 ft and T_p = 5.03 sec for the 5-yr case. These wave heights and periods were compared to the computed wave heights and periods at the other four Fairfield Town beaches Jennings, South Pine Creek, Penfield, and Sasco Beach. Since the wave height and periods of each of the beaches were within a few 100ths of each other for each beach, the maximum (H_{mo} = 9.04 ft and T_p = 5.73 sec for the 10-yr case and H_{mo} = 6.85 ft and T_p = 5.04 sec for the 5-yr case) was used as a conservative design wave such that there was consistency at each beach. The modeling methodology that was employed is typically acceptable for FEMA wave and flood analyses.

As waves travel over and through Long Island Sound they will be modified by the effects of reduced depths and variations in shoreline and bottom configurations. The effects of these physical constraints will transform the incoming waves and effectively change the incident wave height, length and direction at the nearshore site. These incident waves were further transformed as the waves propagate up and over the beach and backshore and continue inland. The numerical model SBEACH (Ref 7) was used to simulate the wave conditions as the waves moved inland.

3.4. Design Storm

The SBEACH modeling was employed to estimate the quantities and limits of anticipated beach and backshore erosion that will result during the simulated storm events. A synthetic storm was generated to simulate a Nor'easter for both the 5-yr and 10-yr storm using the design waves and water levels described above. The design synthetic storm surge took the shape of a cosine squared function (COS^2) and was added on to normal tides experienced at the site expressed as a sine function. Mean high water (El. +3.2 ft NAVD 88), the mean tide level (El. – 0.2 ft NAVD 88), and mean low water (El. -3.6 ft NAVD 88) were obtained determined using information from the NOAA's Southport and Bridgeport Tide Station (Ref 2) and were used to generate the normal tide function. The time series of the synthetic storms for the 10-yr and 5-yr events are displayed below in Figures 5 and 6, respectively.

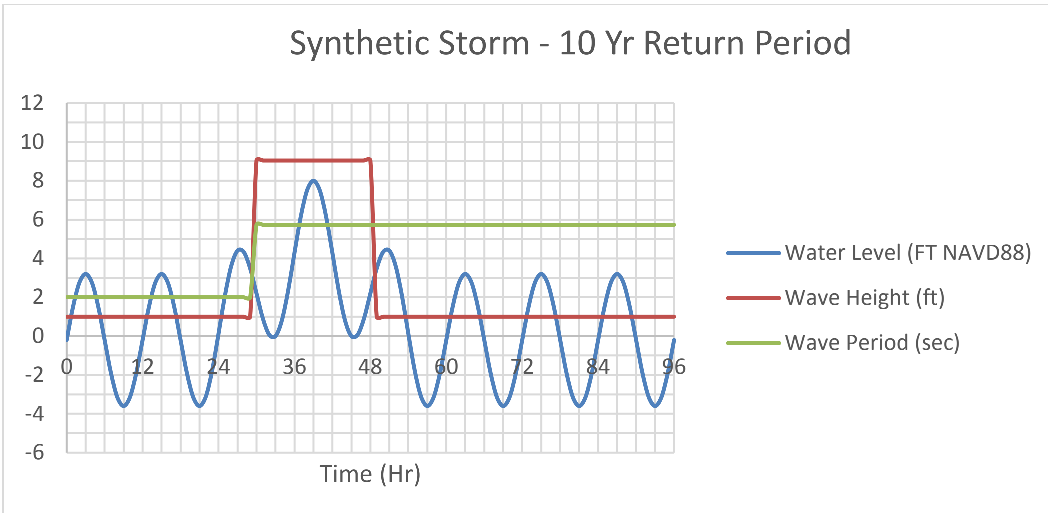


Figure 5: 10-yr Design Storm

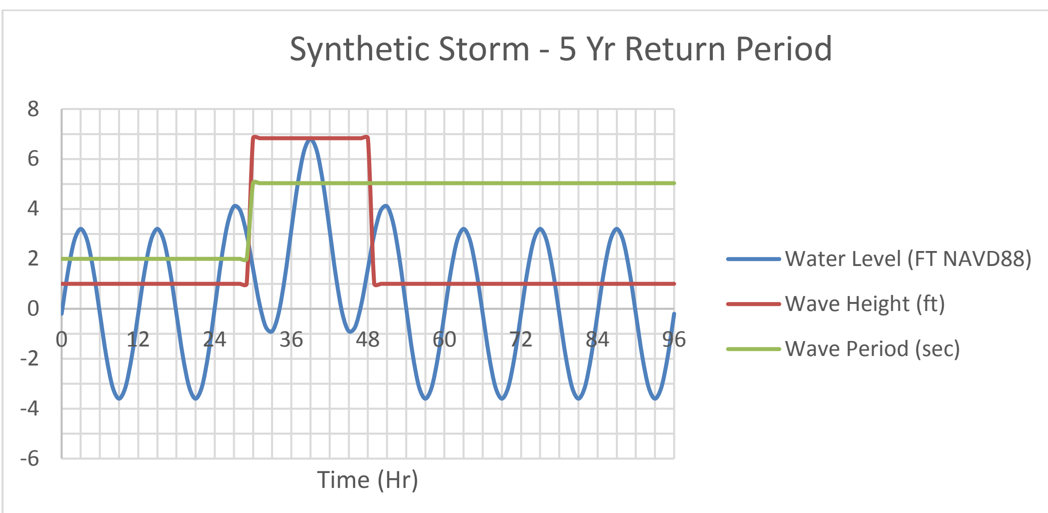


Figure 6: 10-yr Design Storm

The design storm was input into SBEACH along two transects across the site. The model transformed the storm waves along the profile and the results were used to assess the beach conditions and site resiliency during these events.

3.5. FEMA Flood Map Data

The currently effective FEMA Flood Insurance Rate Maps (FIRM) Panel Numbers are 90001C0418G and 090001C0556G, revision date July 8, 2013, shows the site to be primarily mapped as a Zone VE with a Base Flood Elevation (BFE) of El. +14' (NAVD 88). These areas are shown on the segment of the FIRM panel included in Figure 7 (Ref 8).

Figure 7: Flood Insurance Rate Map of Study Area

The BFE and flood zone designations shown on the 2013 FIRM are based on beach and backshore/dune grade elevations that were available to FEMA at the time that the FIRM was produced. The effects of any beach morphology, i.e. erosion and accretion, since that time are not reflected on the FIRM. The entire site is considered by FEMA to be located within a Special Flood Hazard Area (SFHA) that can be inundated during storm events. Waves in excess of 3 ft in height with periods on the order of 6 seconds can and will impact this site during large return period events. Proper design, using appropriate coastal engineering tools, of any beach and/or backshore improvement at this site is critical to meeting the resilient, sustainable and environmentally responsible goals established by FEMA and other agencies.

4. Site Resiliency & Shoreline Design

The site is an unprotected beach composed of unconsolidated sand that is subject to the whims of winds, tides, currents, and waves. Storms have the potential to cause dramatic changes to the beach system resulting in changes in the beach profile that are not recoverable by natural processes. The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), 42 U.S.C. 5121-5206, as amended, Sections 403 and 406; and 44 Code of Federal Regulations (CFR) §§ 206.225, Emergency work, and 206.226, Restoration of damaged facilities, authorized FEMA's Public Assistance (PA) Program to fund replacement of sand on damaged public beaches under the conditions that include (Ref 9):

Emergency Work:

- Eliminate or lessen immediate threats to life, public health, or safety
- Eliminate or lessen immediate threats of significant additional damage to improved property
  - Immediate threat means that there is a threat of additional damage or destruction from an event which can reasonably be expected to occur within five years
  - Emergency work to eliminate or lessen immediate threats of additional damage to improve the property must be cost effective

Permanent Work:

- The beach was constructed by the placement of imported sand (of proper grain size) to a designed elevation, width, and slope
- A maintenance program involving periodic nourishment with imported sand has been established and adhered to by the applicant
- The maintenance programs preserve the original design

4.1. Design of Beach Fill

A variety of beach profiles and grain size distributions were analyzed in order to determine the optimal profile design for the Southport Beach site. The Storm-induced Beach Change Model (SBEACH) was used to simulate potential cross-shore beach erosion of the representative beach profiles. The design storms, cross-shore topography, and grain size were input into the model. Winds, waves, and stillwater elevations that are typical of the 10-yr and 5-yr return periods were used to develop design storms as described in Section 3.4 and the effects these storms would have on cross section profiles were modeled.

The model also calls for additional parameters including maximum slope prior to avalanching, transport rate coefficient, overwash transport parameter, coefficient for slope-dependent term, and transport rate decay coefficient multiplier to be input. These parameters may be manipulated such that the model may be calibrated for site specific cases. Site specific calibration of the model was difficult due to lack of pre-and post-storm profiles, and as such, these parameters were determined from the USACE's calibration of SBEACH based on field data in Duck, NC, Manasquan, NJ, Point Pleasant, NJ and Torrey Pines, CA. These parameters were determined to be the best available data (ref 7). As Jennings Beach is maintained, pre-and post-storm data for the site may become available, and model calibration may be improved. The SBEACH input is tabulated below in Table 3.

SBEACH Parameter	Value	
Effective Grain Size	1	mm
Maximum slope prior to avalanching	30	deg
Transport rate coefficient	1.75E-06	m^4/N
Overwash transport parameter (Kb)	0.005	
Coefficient for slope-dependent term	0.002	m^2/S
Transport rate decay coefficient multiplier	0.5	
Water temperature	20	deg C
Topographic Data	Varies per transect	

Table 3: SBEACH Parameters

The dimensions of the beach cross-sectional design profile and the volumes of sand required to obtain the design profiles are discussed in the following sections. The beach profile is defined to include the backshore / berm elevation, berm width, dune dimension, profile shape, and volume of cross-sectional fill (Ref 10).

4.1.1 FEMA Considerations

In order for a permanent work site to be eligible for Emergency Assistance, the beach must be designed to include the placement of imported sand of a proper grain size to a designed elevation, width, and slope. A maintenance plan that involves the periodic nourishment to preserve the original design must also be in place for the site to be eligible for Emergency Assistance.

The Applicant must provide FEMA with design studies, plans, construction documents, and as-built record drawings for the original nourishment as well as for every subsequent nourishment operation. It is further necessary that documentation and a detailed description of the maintenance plan, including how the need for nourishment is determined and funded be provided to FEMA. The plan must include pre- and post- storm beach profiles that extend at least to the seaward edge of the sub-aqueous nearshore zone. In order to obtain FEMA funding, the beach must be continually monitored and maintained.

Only sand that is lost during a disaster event is eligible for funding. The cost to replace sand eroded prior to the disaster is not eligible for FEMA funding. “One-time” nourishments are not eligible for funding. The beach must be continually maintained. In addition, partial renourishments or “hot-spot” nourishments are not considered maintenance and therefore are not eligible for funding. Sand not selected to meet compatibility design criteria (i.e. sand from a channel maintenance project) is also not eligible (Ref 9).

4.1.2 Engineering Analysis

Engineering analyses were performed to determine the optimum beach profile shape, backshore / berm and dune geometry, sand grain size distribution, and required volume of fill. The Storm-induced Beach Change Model (SBEACH) was used to simulate cross-shore transport of two profiles along the project site. These profiles are referred to as the Southport Transect 1 (S-1) and Southport Transect 2 (S-2). Both transects were located east of the jetty due to the small size of the beach to the west. S-1 was located at the western portion extending over the sandy forshore berm section. S-2 was located on the eastern portion of the site and extended over the rock wall. The locations of these transects are displayed on the Site Plan included in Appendix D. Wind, waves, and stillwater elevations that are typical of the 10-yr and 5-yr return periods were modeled to gain an understanding of the beach system’s response to storms with these return periods. The results of the SBEACH model simulations are also provided in Appendix D.

The SBEACH modeling demonstrated that Transects S-1 was most susceptible to damage during the design storms, particularly during the 10-yr. Transect S-2 performed well during the design storms, and was chosen as the design profile. The design profile was used to regrade the beach. Sediment trapped up against the east side of the jetty creating a steep/less stable profile in the vicinity to transect S-1. The design template calls for sand to be relocated from the area adjacent to the jetty and redistributed along the profile. Since the crest of S-2 is less than that of S-1, the crest of S-1 shall remain, and just the foreshore slope will be modified. It is common practice to determine the design profile by mimicking a beach profile that is preforming well during design storms. A design profile may be planned by translating an average profile shape from a healthy beach condition (Ref 10).

<u>Grain Size</u>

The median grain size of sand found on the beach was 2.01 mm. Mean grain size influences the generalized beach slope. Coarser grain size is generally seen on beach profiles with steeper beach slopes, while beaches with more mild slopes tend to have finer grain sand (Ref 11).

It is preferred that fill material used in a beach nourishment program be as similar in grain size to the native beach as possible (Ref 11). Borrow material, i.e. sand borrowed from sources other than the beach, for beach fill that is identical to the natural material is usually not available. After a source of borrow material is identified, the design volume of fill is typically adjusted by a "fill" and/or "nourishment" factor. Essentially, these factors allow the designer to estimate the relative performance of borrow materials with respect to the native materials. Volume factors are used to calculate a required overfill to compensate for the volume of undersized borrow material that will be lost due to erosion, following both initial placement and to increase project longevity. Essentially, larger grain sand remains on the beach longer than fine sand. The construction documents in Appendix B take this into account, and require the contractor to submit grain size of import material to the engineer for approval.

Berm

The *Coastal Engineering Manual* (Ref 10) recommends that the elevation of the nourished berm or backshore area correspond to the natural berm crest. Field observations and measurements at the site revealed that the natural berm crest at the Southport Beach site varied from approximately in elevation from El. +7' to El. +8' (NAVD 88). The higher section of berm or backshore was found in the general vicinity of Transect S-1.

The model results show that, during the 5-yr event, the parking lot would not likely be damaged as a result of erosion and that the current berm width is sufficient to manage the effects of the design storm events, but that the 10-yr event may cause the foreshore in the vicinity of Transect S-1 to experance damage due to its steep slope. The model results also show that during the 5-yr and 10-yr events, sand may be pushed into the parking lot.

The designed beach includes plans to redistribute sand that is trapped against the jetty and make the beach less steep. The engineering plans enclosed have been designed to minimize the amount of fill necessary and to avoid placing sand below mean low water as this would be subject to stricter regulatory requirements, and as such, do not extend the width of the berm. A broader berm width may be desired by the Town to protect from storms of a greater intensity or for complementary reasons such as providing a more spacious beach for public enjoyment. It should be noted that even structures that are located outside of the potentially eroded berm area may be susceptible to scour imposed damage if they are lower than the 100-yr total water level.

Dune

Dunes protect upland property against waves, erosion, and flooding during storm events. There is no natural dune system at the Southport Beach site. The engineering plans enclosed have been designed to minimize the amount of fill necessary, and as such do not include specifications for dune construction. In addition, the adjacent road leaves little room for a dune to be constructed, and as such there is not much practicality in constructiong a dune at this location. An alternative would be to extend the existing rock wall/wave breakers on the eastern side of the site across the property for better protection.

4.1.3 Beach Profile Design

In a situation where the median grain size of the fill material is the same as that of the native beach sand, the beach profile may be obtained by translating an average profile shape from a healthy beach condition (Ref 10). Sand must be placed to nourish the entire profile extending waterward to the depth of closure. The depth of closure is generally considered to be the seaward limit of the littoral zone. Kraus, et al. (Ref 11) more generally describe the depth of closure for a characteristic time interval to be the most landward depth, seaward of which there is no significant change in bottom elevation and no significant net sediment transport between the nearshore and the offshore. The depth of closure was determined for the Southport Beach system using the *Coastal Engineering Manual* (Ref 10) Eq. III-3-9. The depth of closure for the 5-yr event was conservatively determined to be 13.1'. This depth corresponds to El. -6.3'. This closure analysis shows that the two profiles are healthy sections of the beach, exhibiting minimal offshore movement of sand.

The SBEACH analysis demonstrated that the profile of S-2 behaves most favorably under 5-yr and 10-yr conditions. It is, therefore, recommended that this profile be translated throughout the site and established as the optimal design profile. Extending this optimum nourishment profile template across the entire 900± linear feet of Southport Beach could be accomplished by regrading the beach. There is excess sand that is built up against the eastern side of the jetty. This excess sand shall be stockpiled or redistributed throughout the site. The design template produces an excess of 400 C.Y. of material based on conditions at the time of survey. The beach should be nourished every few years to maintain this profile. Import material shall match the grain size of the native beach sand per the specifications on the construction drawings. A maintenance plan is detailed below in section 4.2.

For the case where the median grain size of the sand material from a borrow site that is not identical to the natural beach's median grain size, the volume of sand used to nourish the beach must be adjusted by a fill factor such that the equilibrium profile is that which is desired (Ref 12). The contractor shall inform the engineer if import material differs from native beach sand. A fill factor can be determined using the *Beach Nourishment Overfill Ration and Volume* module of the *Automated Coastal Engineering System (ACES).*

4.2. Operation and Maintenance Plan

As part of this study, vertical and horizontal control was established at the site. These include three (3) monuments with brass disc and punch set into the ground in accordance with land survey standards. Documentation of these benchmarks is included in Appendix C of this report. Maintenance and periodic confirmation of these benchmark stations should be performed.

Regular maintenance of beach nourishment projects is important to maintain the beach profile and prevent erosion and damage. The level of protection in the aftermath of a major storm will be decreased if proper maintenance is not performed. Beaches that have eroded to a critical condition are not eligible for FEMA funding. The beach must be maintained through scheduled renourishments (Ref 9). Maintenance includes periodic nourishment, advance nourishment, and emergency maintenance. The SBEACH model simulations demonstrated that a modest amount of sand will be lost during storm events and that will need to be replaced.

The volume of import material will need to be adjusted by the fill factor based upon the grain size determination of the borrow material. The necessary volume of import sand should be adjusted as the monitoring program continues and an historical record of the actual beach response is established.

It is critical to the successful operation and maintenance of the Southport Beach management plan that a monitoring plan be established that will serve as a basis for determining when and how much maintenance is required (Ref 10). The quantity of sand that is eligible for FEMA funding for replacement is limited to the volume lost during a disaster event. It is essential that pre- and post- storm profiles of the beach be determined by survey so as to establish a basis for claims to FEMA.

The pre- and post- storm profiles are used to determine the volume of sand (Ref 9) that is lost. In order to establish a pre- storm profile, it is recommended that, as a minimum, the beach be surveyed and mapped biennially or more frequently if conditions warrant. The design beach profile, described in the body of this report, should be established as a baseline to be reestablished after any major storm event. Monitoring and historical record keeping is an essential part of the Operation and Maintenance Plan so the Town can evaluate the volume of sand necessary for historical maintenance and that volume may be adjusted.

In addition to biennial beach monitoring surveys, hydrographic surveys of the subtidal area located seaward of Southport Beach should be performed at nominal three year intervals. These surveys will allow the Town to determine the fate of sand that is eroded during storm events and to verify the depth of closure.

5. Conclusions & Recommendations

Southport Beach is a sandy beach site exposed to the waters of Long Island Sound. The site is dynamic in nature and is subject to erosion that results from wind and wave action during storms that frequent the region. The field studies and engineering analysis described herein demonstrate that the beach is in a fairly healthy state and that a modest beach maintenance program will serve to provide added protection against coastal storms as well as maintain the beach for recreational use by residents and visitors.

The studies, performed by **RACE** and described herein, establish a clear basis for specific recommendations and actions regarding Southport Beach. These include:

- The Town of Fairfield should establish a Southport Beach Management Program to be implemented on a biennial basis and in response to significant storm events;

- It was demonstrated that the Management program should accommodate a beach profile sufficient to manage a coastal storm with a typical 10-year return period;

- The Management Program should establish the foreshore slope of the S-2 Profile, as determined by these analyses, as the optimum design profile to be maintained along the approximate 900 linear feet of Southport Beach;

- The Town should regrade Southport Beach, based upon the latest topographic survey of the beach and backshore, to establish the foreshore slope of the S-2 Profile geometry throughout the project area of Southport Beach. Import material, should it be necessary, shall be properly sized per the construction drawing specifications. If grain size of native material cannot be matched, fill amounts shall be adjusted with a properly designed fill factor;

- The Management Program should focus on the beach and backshore / berm areas and NOT include the establishment of a dune system at this site. The dune may be enhanced should the Town want additional protection from wave action;

- The Town should establish, as a part of the Southport Beach Management Program, a beach monitoring program to include, but not necessarily be limited to (1) a biennial survey of Southport Beach to assess beach resiliency and variations of the beach profile(s) from the optimum design profile, (2) post-storm event beach survey(s) to assess the impact of the storm on the beach profile, and (3) periodic hydrographic surveys of the area seaward of Southport Beach to identify and quantify the fate of sand that is eroded from Southport Beach;

- Anticipate that periodic nourishment of Southport Beach will be necessitated by the cumulative erosion of the beach caused by storm events.

References

1. Connecticut Department of Energy & Environmental Protection, *Coastal Policies and Use Guidelines, Planning Report No. 30*. Hartford, CT, December 1979.

2. National Oceanic and Atmospheric Administration (NOAA),"NOAA Tides and Currents." *NOAA Tides and Currents - Home*. Web. 2013.

3. Federal Emergency Management Agency (FEMA), *Flood Insurance Study No. 09001CV001C.* October 16, 2013.

4. Federal Emergency Management Agency (FEMA), *Fairfield_Summary_9_26_11.* Sept 26, 2011.

5. American Society of Civil Engineers (ASCE), *Minimum Design Loads for Buildings and Other Structures*. ASCE 7-05, 2006.

6. “Automated Coastal Engineering System (ACES)” in “Coastal Engineering Design & Analysis System (CEDAS).” Version 4.03. Vicksburg, MS, 2013.

7. Larson, et. Al. “SBEACH: Numerical Model for Simulating Storm-Induced Beach Change- Report 2” Department of the Army – Waterways Experiment Station. Vicksburg, MS, May 1990.

8. Federal Emergency Management Agency (FEMA), *Flood Insurance Rate Map No. 090001C0438G.* July 8, 2013.

9. Federal Emergency Management Agency (FEMA), Memorandum: *Disaster Assistance Fact Sheet DAP9580.8 Eligible Sand Replacement on Public Beaches*, October 1, 2009.

10. U.S. Army Corps of Engineers. “Coastal Engineering Manual.” Vicksburg, MS, 2002.

11. Kraus, N.C., Larson, M. and Wise, R.A, “Depth of Closure in Beach-fill Design,” Coastal Engineering Technical Note CETN II-40, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS, March 1998.

12. Donald K. Stauble, Ph.D., PG, “A Review of the Role of Grain Size in Beach Nourishment Projects.” U.S. Army Research and Development Center Coastal Hydraulics Laboratory. Vicksburg, MS.

Appendix A: Site Photographs

Source: Google Earth, 2016

Photo 1: Aerial Photograph – Southport Beach

Photo 2: Site Looking East

Photo 3: Site Looking West

Photo 4: Existing Jetty Area May 2016

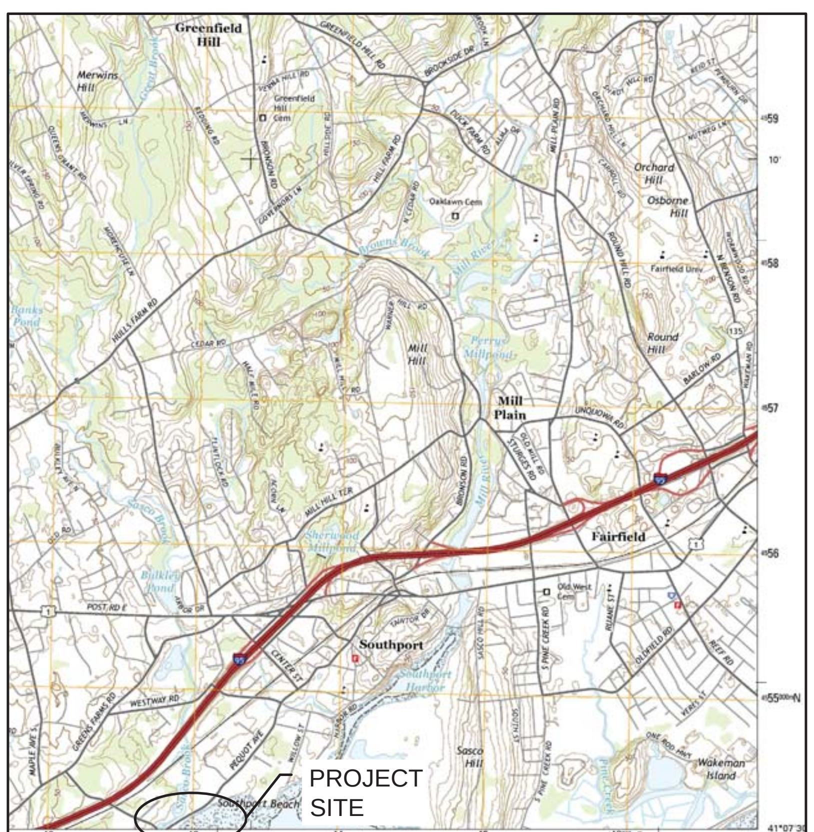
Appendix B: Construction Drawings

SOUTHPORT BEACH
ENGINEERED BEACH DESIGN
PEQUOT AVE
FAIRFIELD, CT

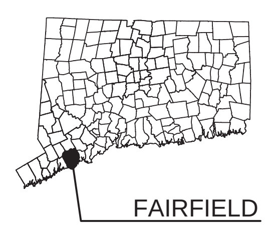
3/22/2017

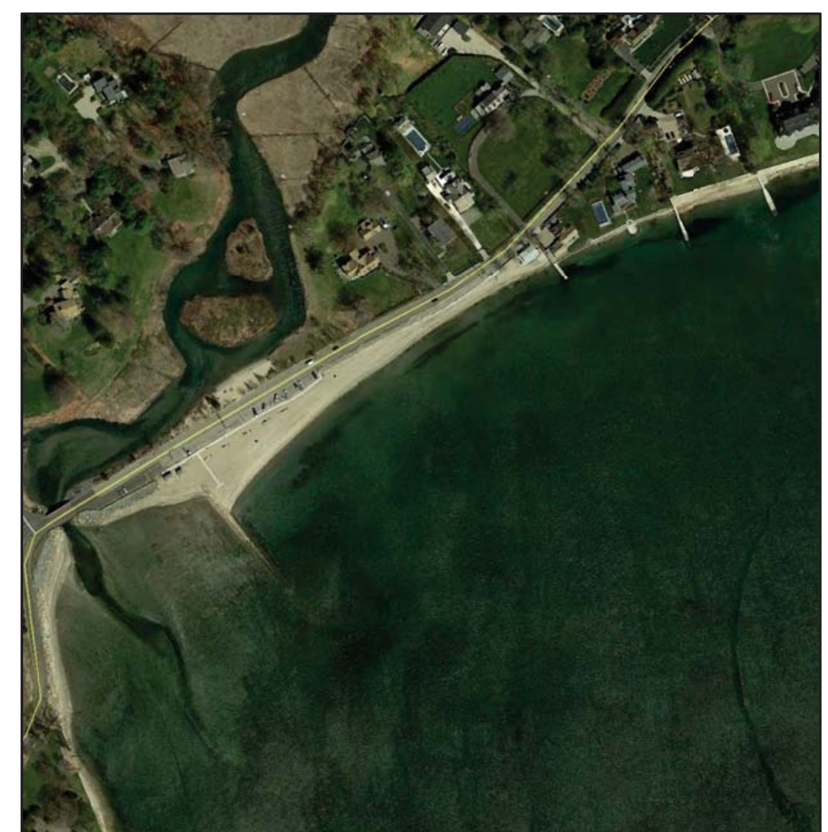
LIST OF DRAWINGS

DRAWING NO.	DRAWING NAME
1	TITLE SHEET, DRAWING LIST & VICINITY MAP
2	PROJECT NOTES
3	SITE PLAN
4	GRADING PLAN
5	SECTIONS



VICINITY MAP





AERIAL PHOTO

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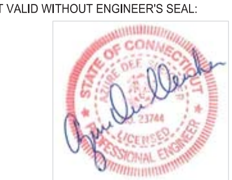

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PREPARED FOR:

CONSERVATION DEPT
TOWN OF FAIRFIELD
725 OLD POST RD
FAIRFIELD, CT 06824

PROJECT:

SOUTHPORT BEACH
ENGINEERED BEACH DESIGN
PEQUOT AVE
FAIRFIELD, CT

DRAWING:

TITLE SHEET, DRAWING LIST & VICINITY MAP

Designed By: JAP	Date: 3/22/2017
Drawn By: JAP	Scale: As Noted
Checked By: ADS	Project Number: 201644
CAD File: SOUTHPORT REPORT DRAWINGS.DWG	Drawing No.: 1 of 05

PROJECT NOTES

DESCRIPTION OF WORK:

THE WORK COVERED UNDER THESE CONTRACT DOCUMENTS, INCLUDING THE DRAWINGS, GENERAL NOTES, AND SPECIFICATIONS AND ALL AMENDMENTS, CONSISTS OF PROVIDING ALL LABOR, SUPERVISION, EQUIPMENT, APPLIANCES AND MATERIALS AND IN PERFORMING ALL OPERATIONS IN CONNECTION WITH AT LEAST, BUT NOT NECESSARILY LIMITED TO, THE FOLLOWING ITEMS:

* REGRADE BEACH TO ENGINEERED SLOPES AND SPECIFICATIONS.

THE CONTRACTOR SHALL PROVIDE ALL ITEMS AND ACCESSORIES REQUIRED TO COMPLETE ALL ASPECTS OF THE WORK NEEDED FOR A COMPLETE AND PROPER INSTALLATION. ALL WORK SHALL BE PERFORMED IN STRICT ACCORDANCE WITH THE PROJECT CONTRACT DOCUMENTS.

GENERAL NOTES:

1. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
2. TOPOGRAPHY TAKEN IN PART FROM DRAWING TITLED "TOPOGRAPHIC SURVEY," DATED JULY 12, 2016 PREPARED BY GESICK & ASSOCIATES, P.C.
3. SUPPLEMENTAL SITE INFORMATION OBTAINED BY RACE COASTAL ENGINEERING, LLC ON MAY 25, 2016.
4. HYDROGRAPHIC SURVEY DATA OBTAINED BY RACE COASTAL ENGINEERING, LLC ON JUNE 16, 2016 AND ONLY REPRESENTS THE SITE CONDITIONS AT THAT TIME.
5. WORK SHALL COMPLY WITH FEDERAL, STATE, AND LOCAL LAWS AND STATUTES AND THE REQUIREMENTS AND CONDITIONS OF ALL REGULATORY PERMITS ISSUED FOR THE WORK.
6. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO MEET LINES AND GRADES DEPICTED WITHIN THESE CONTRACT DRAWINGS.
7. THESE DRAWINGS SHALL BE USED IN CONJUNCTION WITH THE PROJECT REGULATORY PERMITS AND ALL CONDITIONS OF THOSE PERMITS. THE CONTRACTOR IS ADVISED THAT THE REGULATORY PERMITS FOR THIS PROJECT MAY CONTAIN ADDITIONAL REQUIREMENTS THAT, AFTER ANY ADDENDUM, SUPERSEDE THE DRAWING NOTES. THE CONTRACTOR IS FURTHER ADVISED THAT IN THE CASE OF ANY DISCREPANCIES WITHIN THE CONTRACT DOCUMENTS FOUND BEFORE CONSTRUCTION, THE FINAL DECISION AS TO WHAT INFORMATION TAKES PRECEDENCE WILL BE MADE BY THE ENGINEER OF RECORD ON THE BASIS OF THAT INTENT.
8. EXISTING CONDITIONS AND DIMENSIONS SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION AND FABRICATION OR ORDERING OF ANY CONSTRUCTION MATERIALS.
9. SECTIONS AND DETAILS APPLY TO SAME AND SIMILAR CONDITIONS UNLESS SPECIFICALLY NOTED OTHERWISE HEREIN.
10. DAMAGE TO ANY PROPERTY, PRIVATE OR OF PUBLIC TRUST, OCCURRING DURING THE CONSTRUCTION BY THE CONTRACTOR, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND SHALL BE REPAIRED TO THE SATISFACTION OF THE OWNER AT THE EXPENSE OF THE CONTRACTOR.
11. THE CONTRACTOR SHALL SAFEGUARD AND PROTECT ALL EXCAVATIONS.
12. THE CONTRACTOR SHALL USE ADEQUATE NUMBERS OF SKILLED WORKMEN WHO ARE THOROUGHLY TRAINED AND EXPERIENCED IN THE NECESSARY CRAFTS AND WHO ARE COMPLETELY FAMILIAR WITH THE SPECIFIED REQUIREMENTS AND METHODS NEEDED FOR PROPER PERFORMANCE OF THE WORK.
13. THE CONTRACTOR SHALL USE EQUIPMENT ADEQUATE IN SIZE, CAPACITY, AND NUMBERS, AND MAINTAINED TO THE REQUIREMENTS OF ALL FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS TO ACCOMPLISH THE WORK.
14. THE CONTRACTOR SHALL PROTECT WETLANDS AND COASTAL RESOURCES FROM INTRUSION BY TURBID WATERS, CONSTRUCTION DEBRIS, CONSTRUCTION EQUIPMENT, OR PERSONNEL DURING WORK ACTIVITIES.
15. THE CONTRACTOR SHALL INCLUDE IN HIS CONTRACT SUM THE COST FOR ALL NECESSARY PERMITS, LICENSES, CERTIFICATES OF INSPECTION, AND ALL LEGAL FEES IN CONNECTION WITH THE WORK OF THIS CONTRACT. THE OWNER IS TO OBTAIN NECESSARY REGULATORY PERMITS REQUIRED FOR THE WORK IN REGULATED AREAS. THE CONTRACTOR SHALL REQUEST COPIES OF THOSE REGULATORY PERMITS AND MAKE PROVISION IN THIS WORK AND IN THE COST OF THE WORK FOR APPLICABLE CONDITIONS OF THOSE PERMITS. FAILURE TO CONSIDER ANY CONDITION OF THE REGULATORY PERMITS AS A PART OF THE BID SHALL NOT RELIEVE THE CONTRACTOR FROM HIS RESPONSIBILITY TO APPLY THOSE CONDITIONS TO HIS WORK AT NO ADDITIONAL COST TO THE OWNER.
16. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO LOCATE AND PROTECT FROM DAMAGE UTILITIES, UTILITY STRUCTURES, FUEL LINES & TANKS OR ANY UNKNOWN UTILITIES OR STRUCTURES PRIOR TO ANY WORK.
17. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO KEEP A CLEAN & TIDY WORK SITE. THE SITE SHALL BE LEFT NEAT & CLEAN AT THE END OF EACH WORK DAY
18. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO RESTORE LANDSCAPING, INCLUDING BUT NOT LIMITED TO LAWN, TREES, PLANTINGS, ETC. DAMAGED BY THE CONTRACTOR DURING THE COURSE OF THE PROJECT.
19. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR ANY DAMAGED PROPERTY CAUSED BY THE CONTRACTOR, INCLUDING BUT NOT LIMITED TO PAVEMENT, CURBING, FENCING, ETC. DAMAGED ITEMS SHALL BE REPAIRED IN KIND.

BEACH NOURISHMENT:

1. MATERIAL SHALL BE DRY BEACH SAND FURNISHED BY THE CONTRACTOR.
2. MATERIAL SHALL BE PROCESSED OR UNPROCESSED BANK RUN SAND OR BEACH SAND FREE OF ROOTS, ORGANIC MATTER, FROZEN LUMPS, TRASH OR OTHER DEBRIS.
3. SAND SHALL MATCH THE COLOR AT THE SITE.
4. ALL IMPORTED SAND SHALL MEET THE FOLLOWING GRADATION (ASTM D 422):

SPECIFICATIONS FOR DRY BEACH SAND NOURISHMENT	
U.S. STANDARD (SIEVE SIZE)	PERCENT PASSING BY (WEIGHT)
3/8"	100
1/4"	100-95
#4	95-90
#10	90-75
#40	75-40
#100	40-0
#200	0

5. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO LOCATE A SAND SOURCE.
6. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PERFORM MATERIAL TESTING TO ENSURE THAT MATERIAL SOURCE MATCHES THE COLOR, GRAIN SIZE, AND DISTRIBUTION OF THE SAND ON THE COASTAL BEACH.
7. THE SOIL PARTICLES SHALL BE ANGULAR TO SUB-ROUNDED AND CLASSIFIED SW.
8. THE MINIMUM SPECIFIC GRAVITY OF SOIL PARTIALS SHALL BE 2.65.
9. THE CONTRACTOR SHALL SUBMIT LABORATORY CERTIFICATION FOR EACH 1,000 C.Y. DELIVERED OR FOR EACH CHANGE OF MATERIAL SOURCE THAT CERTIFIES THE SOIL PROPOSED FOR BEACH FILL SATISFIES THE MINIM STATED HEREIN INCLUDING GRADATION CURVES AND COMPUTATION SHEETS.
10. SAND SHALL BE FREE OF CONTAMINANTS: PCB'S, DIOXINS, HYDROCARBONS, OR OTHER TOXIC CHEMICALS & CONTRACTOR SHALL PROVIDE CERTIFICATION.
11. CONTRACTOR SHALL PROVIDE SAMPLE AND TEST RESULTS TO THE ENGINEER FOR APPROVAL. ANY VARIATION IN THE SPECIFIED GRADATION MAY REQUIRE PLACEMENT OF ADDITIONAL FILL VOLUME BASED ON ENGINEERING ANALYSIS.

SELECTIVE DEMOLITION

1. DEMOLISHED MATERIAL, DEEMED UNACCEPTABLE FOR REUSE, SHALL BECOME THE PROPERTY OF THE CONTRACTOR AND SHALL BE COMPLETELY REMOVED FROM THE JOBSITE AND DISPOSED OF IN A SAFE AND LEGAL MANNER.
2. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING THE BID TO BECOME FAMILIAR WITH EXISTING CONDITIONS FOUND ONSITE.

EROSION & SEDIMENTATION CONTROLS

1. LAND DISTURBANCE WILL BE KEPT TO A MINIMUM.
2. PRIOR TO MOBILIZATION, EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED.
3. WHENEVER POSSIBLE, EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO CONSTRUCTION.
4. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF THE "2002 CONNECTICUT GUIDELINES FOR SOIL EROSION AND SEDIMENT CONTROL", MAY 2002.
5. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED IN EFFECTIVE CONDITION THROUGHOUT THE CONSTRUCTION PERIOD.
6. ADDITIONAL CONTROL MEASURES SHALL BE INSTALLED DURING THE CONSTRUCTION PERIOD AS NECESSARY AND REQUIRED.
7. THE GENERAL CONTRACTOR SHALL UTILIZE APPROVED METHODS/MATERIALS FOR PREVENTING THE BLOWING AND MOVEMENT OF DUST FROM EXPOSED SOIL SURFACES ONTO ADJACENT PROPERTIES AND SITE AREAS.
8. THE GENERAL CONTRACTOR SHALL MAINTAIN A SUPPLY OF SILT FENCE (100' MIN.) ON SITE FOR EMERGENCY PURPOSES.
9. ALL DISTURBED LAWN AREAS OUT OF THE MAJOR CONSTRUCTION AREA THAT ARE TO BE LEFT EXPOSED FOR MORE THAN 30 DAYS SHALL BE PROTECTED WITH A TEMPORARY VEGETATIVE COVER, SEED THESE AREAS WITH PERENNIAL RYE GRASS AT THE RATE OF 40 LBS, PER ACRE (1 LB PER 1,000 SQ. FT.).
10. THE GENERAL CONTRACTOR IS ASSIGNED THE RESPONSIBILITY FOR IMPLEMENTING THIS EROSION AND SEDIMENT CONTROL PLAN. THE RESPONSIBILITY INCLUDES SUPERVISING THE INSTALLATION AND MAINTENANCE OF CONTROL MEASURES, INFORMING ALL PARTIES ENGAGED ON THE CONSTRUCTION SITE OF THE REQUIREMENTS AND OBJECTIVES OF THE PLAN, NOTIFYING THE CONSERVATION STAFF PERSON OF ANY TRANSFER OF THIS RESPONSIBILITY AND CONVEYING A COPY OF THE CONTROL PLAN IF THE TITLE TO THE LAND IS TRANSFERRED.

EXCAVATION AND BACKFILLING

1. THE CONTRACTOR SHALL EXCAVATE, BACKFILL, AND GRADE THE SITE TO THE ELEVATIONS AND LIMITS SHOWN AND NEEDED TO MEET THE REQUIREMENTS OF THE CONSTRUCTION.
2. GRADE THE AREAS ADJACENT TO BUILDINGS TO ACHIEVE DRAINAGE AWAY FROM THE STRUCTURES AND PREVENT PONDING.

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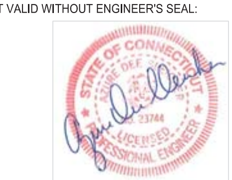

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PREPARED FOR:

CONSERVATION DEPT
TOWN OF FAIRFIELD
725 OLD POST RD
FAIRFIELD, CT 06824

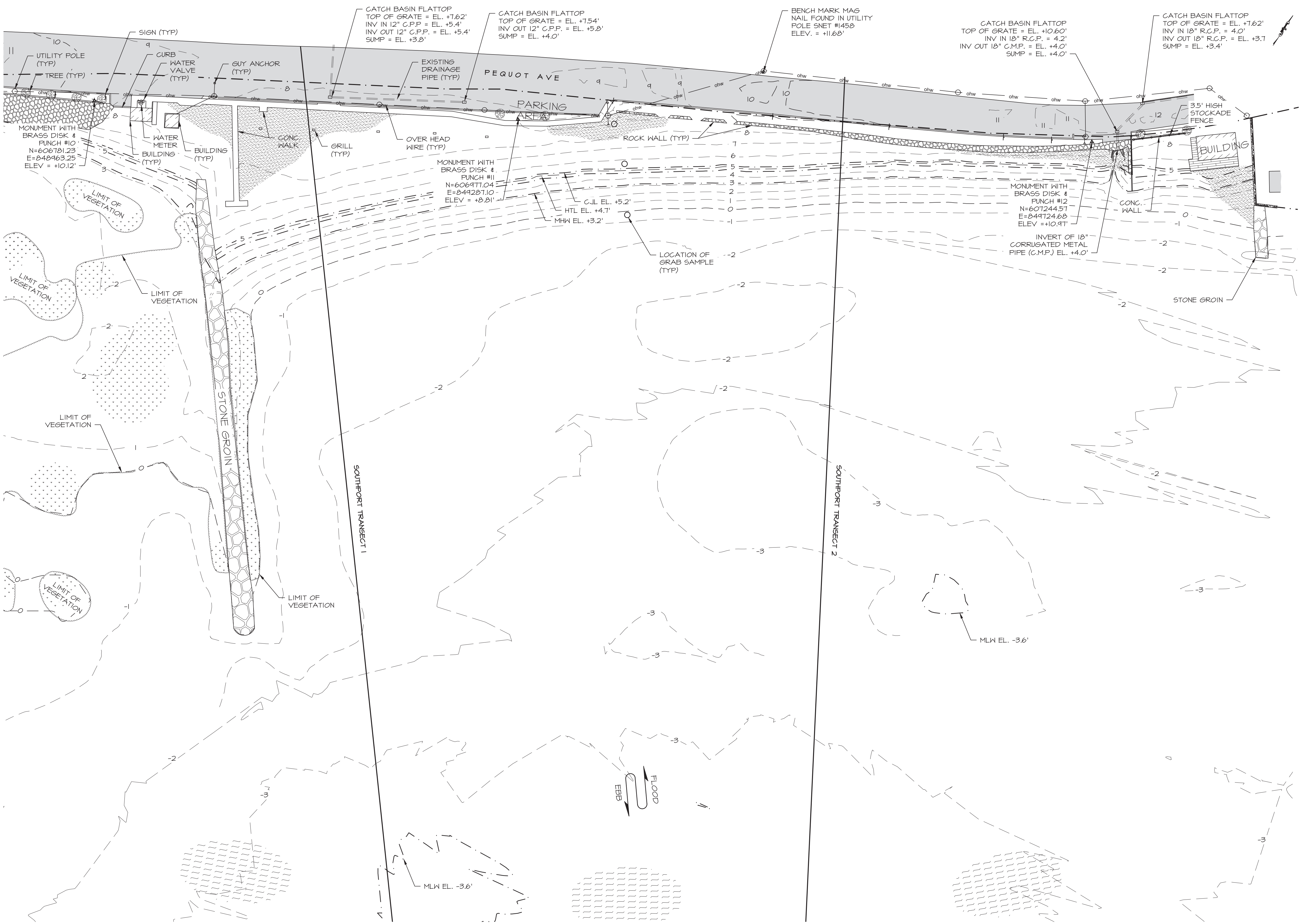
PROJECT:

SOUTHPORT BEACH
ENGINEERED BEACH DESIGN
PEQUOT AVE
FAIRFIELD, CT

DRAWING:

PROJECT NOTES

Designed By: JAP	Date: 3/22/2017
Drawn By: JAP	Scale: As Noted
Checked By: ADS	Project Number: 201644
CAD File: SOUTHPORT REPORT DRAWINGS.DWG	Drawing No.: 2 of 05



SITE PLAN

SCALE: 1" = 40'-0"

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FAIRFIELD, CT 06824

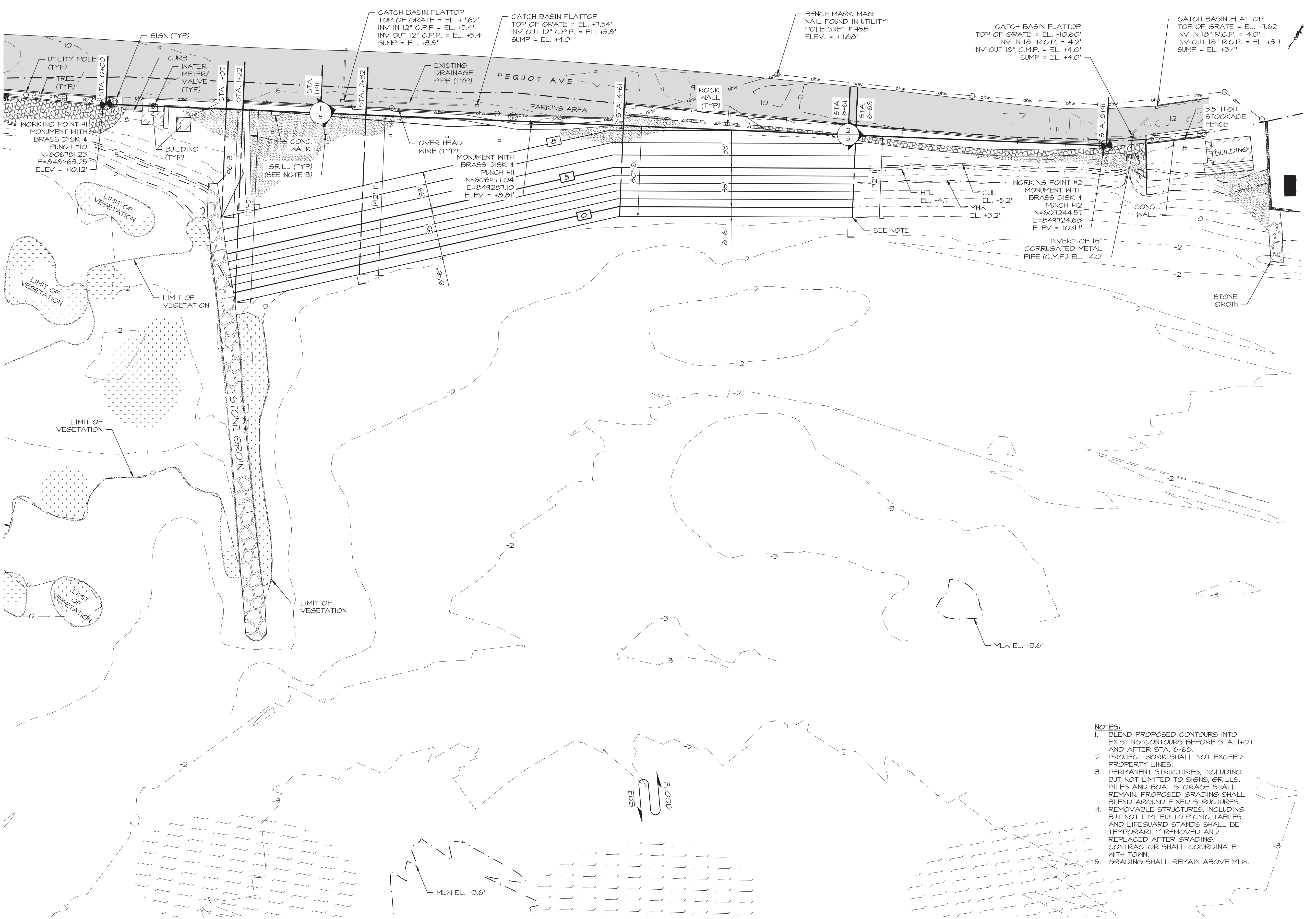
PROJECT:

SOUTHPORT BEACH
ENGINEERED BEACH DESIGN
PEQUOT AVE
FAIRFIELD, CT

DRAWING:

SITE PLAN

Designed By: JAP	Date: 3/22/2017
Drawn By: JAP	Scale: As Noted
Checked By: ADS	Project Number: 201644
CAD File: SOUTHPORT REPORT DRAWINGS.DWG	Drawing No.: 3 of 05



NOTES:
1. BLEND PROPOSED CONTOURS INTO EXISTING CONTOURS BEFORE STA. 1+07 AND AFTER STA. 6+68.
2. PROJECT WORK SHALL NOT EXCEED PROPERTY LINES.
3. PERMANENT STRUCTURES, INCLUDING BUT NOT LIMITED TO SIGNS, GRILLS, PILES AND BOAT STORAGE SHALL REMAIN. PROPOSED GRADING SHALL BLEND AROUND FIXED STRUCTURES.
4. REMOVABLE STRUCTURES, INCLUDING BUT NOT LIMITED TO PICNIC TABLES AND LIFEGUARD STANDS SHALL BE TEMPORARILY REMOVED AND REPLACED AFTER GRADING. CONTRACTOR SHALL COORDINATE WITH TOWN.
5. GRADING SHALL REMAIN ABOVE MLW.

GRADING PLAN

SCALE: 1" = 80'-0"

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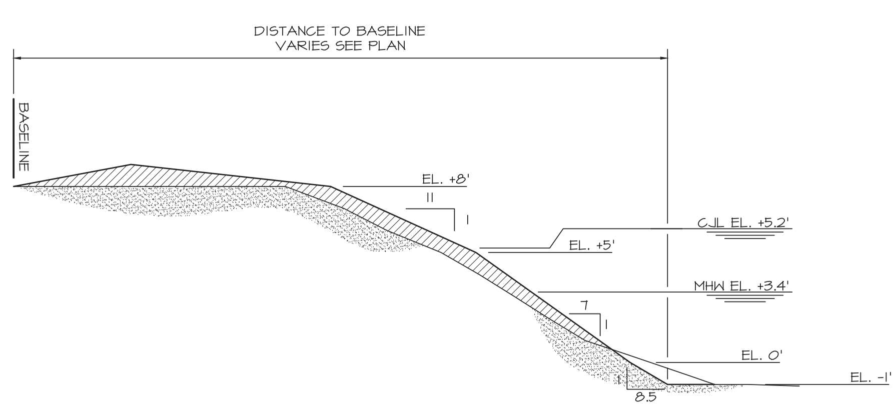
SOUTHPORT BEACH
ENGINEERED BEACH DESIGN
PEQUOT AVE
FAIRFIELD, CT

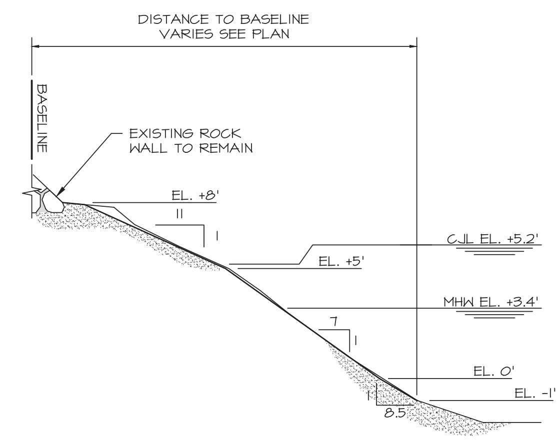
DRAWING:

GRADING PLAN

Designed By: JAP	Date: 3/22/2017
Drawn By: JAP	Scale: As Noted
Checked By: ADS	Project Number: 201644
CAD File: SOUTHPORT REPORT DRAWINGS.DWG	Drawing No.: 4 of 05



SECTION
1/5
VERTICAL SCALE 1"=4'– HORIZONTAL SCALE 1"=20'



SECTION
2/5
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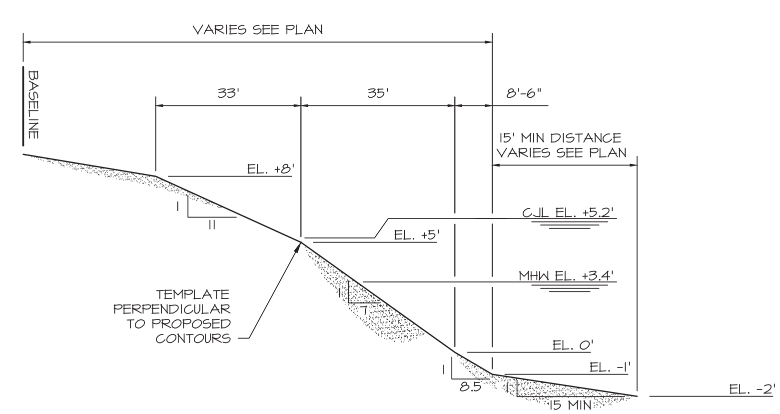

PROPOSED TEMPLATE
VERTICAL SCALE 1"=4'– HORIZONTAL SCALE 1"=20'

NOTE:
1. PROFILE WEST OF JETTY TO BE MAINTAINED.
2. PROFILE EAST OF JETTY (STA. 1+07 TO STA. 6+68) TO BE GRADED TO MEET TEMPLATE. EXCESS MATERIAL TO BE STOCKPILED ON SITE. TEMPLATE PRODUCES 400 C.Y. ±.
3. PERMANENT STRUCTURES, INCLUDING BUT NOT LIMITED TO SIGNS, GRILLS, PILES AND BOAT STORAGE SHALL REMAIN. PROPOSED GRADING SHALL BLEND AROUND FIXED STRUCTURES.
4. REMOVABLE STRUCTURES, INCLUDING BUT NOT LIMITED TO PICNIC TABLES AND LIFEGUARD STANDS SHALL BE TEMPORARILY REMOVED AND REPLACED AFTER GRADING. CONTRACTOR SHALL COORDINATE WITH TOWN.

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TOWN OF FAIRFIELD
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FAIRFIELD, CT 06824

PROJECT:

SOUTHPORT BEACH
ENGINEERED BEACH DESIGN
PEQUOT AVE
FAIRFIELD, CT

DRAWING:

SECTIONS

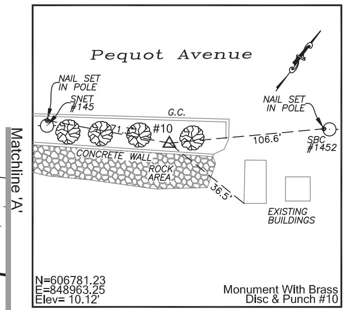
Designed By: JAP	Date: 3/22/2017
Drawn By: JAP	Scale: As Noted
Checked By: ADS	Project Number: 201644
CAD File: SOUTHPORT REPORT DRAWINGS.DWG	Drawing No.: 5 of 05

Appendix C: Survey

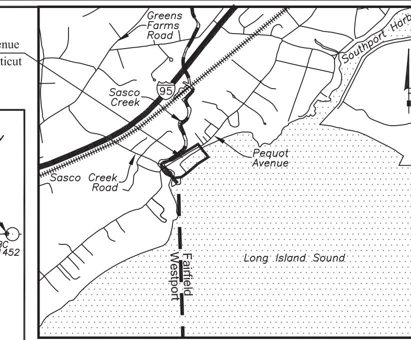
Reference Maps

1. "CONNECTICUT STATE HIGHWAY DEPARTMENT RIGHT OF WAY MAP TOWN OF FAIRFIELD PEQUOT AVENUE FROM SASCO CREEK EASTERLY TO SOUTHPORT BRIDGE ROUTE No 136" PREPARED BY THE CONNECTICUT STATE HIGHWAY DEPARTMENT DATED OCTOBER 30, 1936 SCALE 1"=40'
2. "MAP OF PROPERTY FOR RICHARD W. LUCE SOUTHPORT, CONNECTICUT" PREPARED BY ANDREW S. HUNTINGTON DATED AUGUST 1942 SCALE 1"=20' (TOWN CLERK MAP #1226)

1505 Pequot Avenue
Fairfield, Connecticut



Not To Scale



Location Map

Scale: 1"=2000'

Legend

SYMBOL	DESCRIPTION
	PROPERTY CORNER
	IP / REBAR
	MON / MERESTONE
	BENCH MARK
	UTILITY POLE
	UTILITY POLE W/ LIGHT
	GUY WIRE
	FIRE HYDRANT
	CATCH BASIN
	MANHOLE
	DECIDUOUS TREE
	SIGN
	WATER METER
	WATER VALVE
	WOOD POST
	FLAGPOLE
	PILE
	TOWN LINE
	FENCE LINE
	OVERHEAD WIRES
	PROPERTY LINE
	PROPERTY LINE OTHER
	INDEX CONTOUR
	INTERMEDIATE CONTOUR
	COASTAL JURISDICTION LINE
	HIGH TIDE LINE
	MEAN LOW WATER
	FEMA ZONE LINE
	EDGE OF WATER
X.X'	SPOT ELEVATION
	EXISTING BUILDING
N/F	NOW OR FORMERLY
ELEV / EL	ELEVATION
(TYP)	TYPICAL
(FC)	FACE OF CURB
(TC)	TOP OF CURB
E.O.P.	EDGE OF PAVEMENT
B.C.L.C.	BITUMINOUS CONCRETE LIP CURB
C.C.	CONCRETE CURB
G.C.	GRANITE CURB
C.J.L.	COASTAL JURISDICTION LINE
H.T.L.	HIGH TIDE LINE
M.H.W.	MEAN HIGH WATER
M.L.W.	MEAN LOW WATER
E.M.	ELECTRIC METER
INV	INVERT
F.F.	FINISHED FLOOR
R.C.P.	REINFORCED CONCRETE PIPE
C.M.P.	CORRUGATED METAL PIPE
C.P.P.	CORRUGATED PLASTIC PIPE

Notes

1) THIS SURVEY PLAN HAS BEEN PREPARED PURSUANT TO THE REGULATIONS OF CONNECTICUT STATE AGENCIES SECTION 20–300B–1 THROUGH 20–300B–20 AND THE "STANDARDS FOR SURVEYS AND MAPS IN THE STATE OF CONNECTICUT" AS ADOPTED BY THE CONNECTICUT ASSOCIATION OF THE LAND SURVEYORS, INC. ON SEPTEMBER 26, 1996.
A. TYPE OF SURVEY: TOPOGRAPHIC SURVEY
B. WITH RESPECT TO THE PERIMETER OF THE PROPERTY THE BOUNDARY DETERMINATION IS BASED UPON A FIRST SURVEY.
C. THIS SURVEY CONFORMS TO THE STANDARDS AND THE ACCURACY OF CLASS: A–2 HORIZONTAL & T–2 TOPOGRAPHIC ACCURACY.
D. BEARINGS AS DEPICTED ARE BASED UPON THE CONNECTICUT GRID SYSTEM NORTH AMERICAN DATUM OF 1983
E. ELEVATIONS BASED UPON NORTH AMERICAN VERTICAL DATUM 1988
F. CONTOUR INTERVAL = 1'
G. THE INTENT OF THIS MAP IS TO DEPICT THE EXISTING CONDITIONS OF THE PROPERTY

2) BOUNDARY LINES OF ADJOINING PROPERTIES ARE SHOWN FOR GENERAL INFORMATIONAL PURPOSES ONLY AND ARE NOT TO BE CONSTRUED AS BEING ACCURATELY LOCATED OR DEPICTED.

3) THE WORD "CERTIFY" AS USED IS UNDERSTOOD TO BE AN EXPRESSION OF PROFESSIONAL OPINION BY THE SURVEYOR. IT IS A DECLARATORY STATEMENT, WHICH IS BASED ON HIS BEST KNOWLEDGE, INFORMATION AND BELIEF. AS SUCH IT CONSTITUTES NEITHER GUARANTEE NOR WARRANTY, EXPRESSED OR IMPLIED, OF ANY INFORMATION CONTAINED HEREON. NO CERTIFICATION IS EXPRESSED OR IMPLIED ON ANY ORIGINAL OR ANY DUPLICATE OF THIS MAP UNLESS IT BEARS AN ORIGINAL STAMP OR SEAL AND ORIGINAL SIGNATURE OF THE INDIVIDUAL WHOSE REGISTRATION NUMBER APPEARS HEREON.

4) THIS MAP IS THE PROPERTY OF GESICK & ASSOCIATES P.C. AND HAS BEEN SPECIFICALLY PREPARED FOR THE OWNER OF THIS PROJECT OR PROPERTY. IT IS NOT TO BE DUPLICATED OR USED IN PART OR WHOLE FOR ANY OTHER PURPOSE, PROJECT, LOCATION, OR OWNER WITHOUT THE EXPRESS WRITTEN CONSENT OF GESICK & ASSOCIATES P.C.

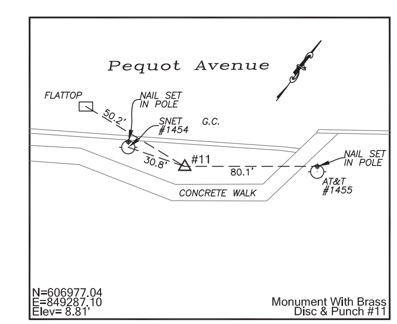
5) BASE MAPPING PREPARED BY GESICK & ASSOCIATES P.C. FROM A 7/5/2016 THRU 7/6/2016 FIELD SURVEYS.

6) THE FLOOD ZONE BOUNDARIES SHOWN WERE DERIVED UTILIZING FLOOD INSURANCE RATE MAPS. THE FLOOD ZONE BOUNDARIES WERE DIGITIZED AND ARE TO BE CONSIDERED AS APPROXIMATE ONLY AND FOR INFORMATIONAL PURPOSES ONLY. DATUM = NAVD 1988.

7) UNDERGROUND UTILITY, STRUCTURE AND FACILITY LOCATIONS DEPICTED AND NOTED HEREON HAVE BEEN COMPILED, IN PART, FROM RECORD MAPPING AND LIMITED FIELD MEASUREMENTS. THESE LOCATIONS MUST BE CONSIDERED AS APPROXIMATE IN NATURE. ADDITIONALLY, OTHER SUCH FEATURES MAY EXIST ON THE SITE, THE EXISTENCE OF WHICH ARE UNKNOWN TO GESICK & ASSOCIATES. P.C. THE SIZE LOCATION AND EXISTENCE OF ALL SUCH FEATURES MUST BE FIELD DETERMINED AND VERIFIED BY THE APPROPRIATE AUTHORITIES PRIOR TO CONSTRUCTION. CALL BEFORE YOU DIG 1–800–922–4455.

8) TREES SHOWN ON THIS MAP WERE FIELD LOCATED BUT ARE NOT SHOWN TO SCALE

9) SURVEY TIE LINE FOR MATHEMATICAL CLOSURE OF SURVEY, NOT PROPERTY LINE. SURVEY TIE LINE Ⓐ→Ⓑ N 60°37'17" E – 1106.86'



Not To Scale

Subject Parcel Information

OWNER:	TOWN OF FAIRFIELD
PARCEL ADDRESS:	1505 PEQUOT AVENUE FAIRFIELD, CONNECTICUT 06824
MAILING ADDRESS:	725 OLD POST ROAD FAIRFIELD, CONNECTICUT 06824
PARCEL ID:	MAP 281 LOT 21
DEED:	VOLUME 213 PAGE 262
LAND USE ZONE:	R3
AREA:	86733.59 SQ. FT. ± OR 2.0 ACRES ±
FLOOD ZONE:	ZONES X, AE (EL 12), & VE (EL 14) PER FIRM MAP COMMUNITY PANEL #S 09001C0556G & 09001C0418G DATED JULY 8, 2013 (SEE NOTE #6)

Scale: 1"=30'

Copies of this survey map not bearing the Land Surveyor's Embossed Seal shall not be considered to be valid copies. Certifications indicated or implied hereon shall run only to the party for whom the Survey is prepared, and on his/her behalf to the title company, governmental agency and lending institution listed hereon. Certifications are not transferable to additional parties, or subsequent owners not listed hereon.

To the best of my knowledge and belief this map is substantially correct as noted hereon.

Donald L. Gesick Jr., L.S
Reg. No. 18417

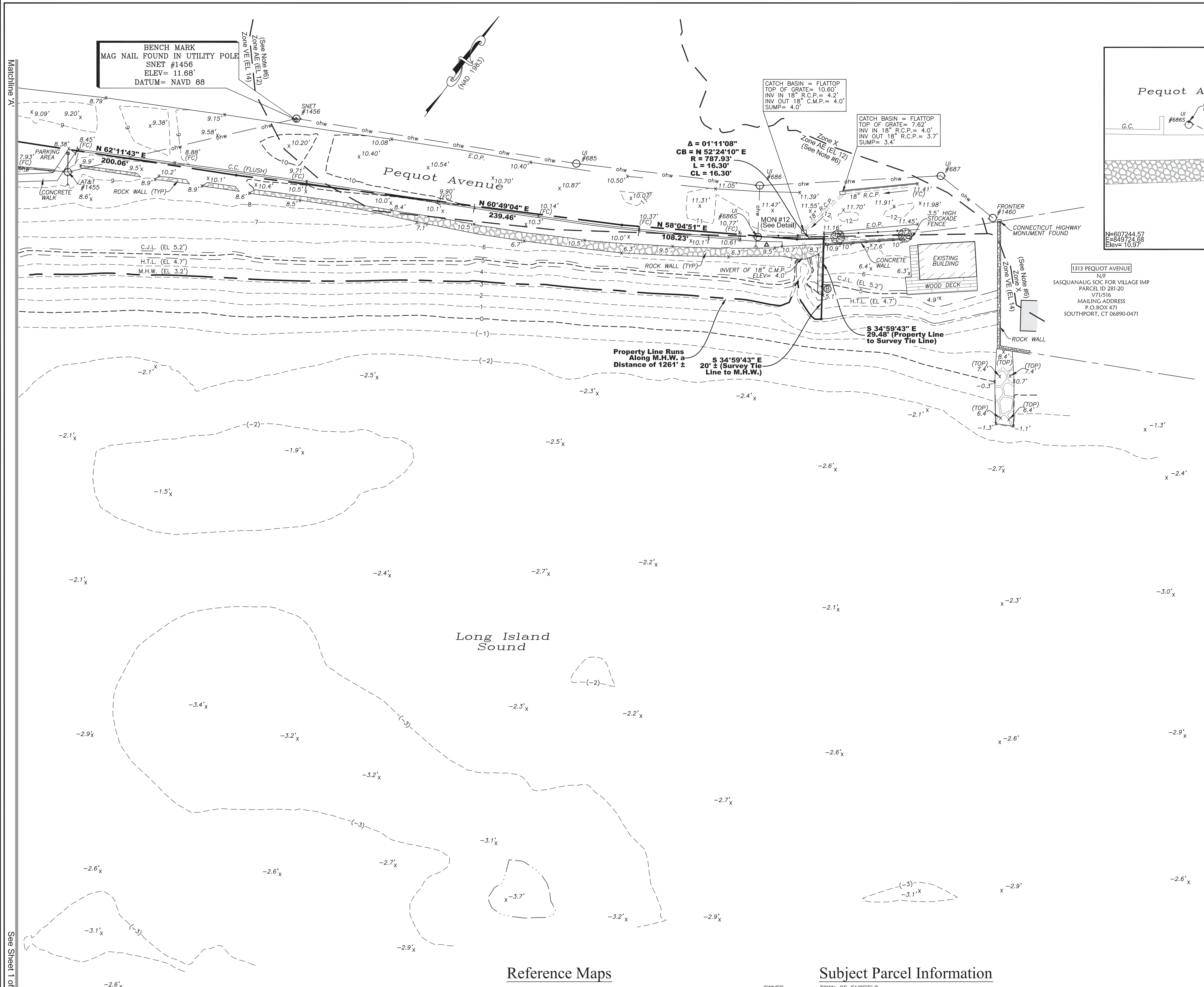
GESICK & ASSOCIATES, P.C.
SURVEYORS † MAPPERS † PLANNERS
19 CEDAR ISLAND AVE.
CLINTON, CONNECTICUT 06413
OFFICE: 860–669–7799 FAX: 860–669–5833
www.gesicksurveyors.com

Topographic Survey

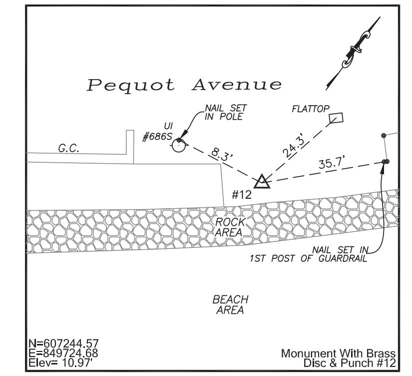
of
Southport Beach
1505 Pequot Avenue
Fairfield, Connecticut
Prepared for
Roberge Associates Coastal Engineers, LLC

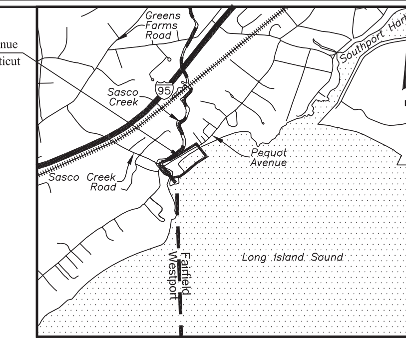
Revisions

Date: July 12, 2016
Drawing: 16-056a
Drawn: P.H.



1505 Pequot Avenue
Fairfield, Connecticut





Location Map

Scale: 1"=2000'

0 1000 2000 4000

Notes

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Legend

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	PROPERTY CORNER		COASTAL JURISDICTION LINE
	IP / REBAR		HIGH TIDE LINE
	MON / MERESTONE		MEAN LOW WATER
	BENCH MARK	x X.X'	SPOT ELEVATION
	UTILITY POLE		EXISTING BUILDING
	UTILITY POLE W/ LIGHT	N/F	NOW OR FORMERLY
	GUY WIRE	ELEV / EL	ELEVATION
	FIRE HYDRANT	(TYP)	TYPICAL
	CATCH BASIN	(FC)	FACE OF CURB
	MANHOLE	(TC)	TOP OF CURB
	DECIDUOUS TREE	E.O.P.	EDGE OF PAVEMENT
	SIGN	B.C.L.C.	BITUMINOUS CONCRETE LIP CURB
	WATER METER	C.C.	CONCRETE CURB
	WATER VALVE	G.C.	GRANITE CURB
	WOOD POST	C.J.L.	COASTAL JURISDICTION LINE
	FLAGPOLE	H.T.L.	HIGH TIDE LINE
	PILE	M.H.W.	MEAN HIGH WATER
	TOWN LINE	M.L.W.	MEAN LOW WATER
	FENCE LINE	E.M.	ELECTRIC METER
ohw	OVERHEAD WIRES	INV	INVERT
	PROPERTY LINE	F.F.	FINISHED FLOOR
	PROPERTY LINE OTHER	R.C.P.	REINFORCED CONCRETE PIPE
	INDEX CONTOUR	C.M.P.	CORRUGATED METAL PIPE
	INTERMEDIATE CONTOUR	C.P.P.	CORRUGATED PLASTIC PIPE
	FEMA ZONE LINE		
	EDGE OF WATER		

Reference Maps

1. "CONNECTICUT STATE HIGHWAY DEPARTMENT RIGHT OF WAY MAP TOWN OF FAIRFIELD PEQUOT AVENUE FROM SASCO CREEK EASTERLY TO SOUTHPORT BRIDGE ROUTE No 136" PREPARED BY THE CONNECTICUT STATE HIGHWAY DEPARTMENT DATED OCTOBER 30, 1936 SCALE 1"=40'
2. "MAP OF PROPERTY FOR RICHARD W. LUCE SOUTHPORT, CONNECTICUT" PREPARED BY ANDREW S. HUNTINGTON DATED AUGUST 1942 SCALE 1"=20' (TOWN CLERK MAP #1226)

Subject Parcel Information

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DEED:	VOLUME 213 PAGE 262
LAND USE ZONE:	R3
AREA:	86733.59 SQ. FT. ± OR 2.0 ACRES ±
FLOOD ZONE:	ZONES X, AE (EL 12), & VE (EL 14) PER FIRM MAP COMMUNITY PANEL #S 09001C0556G & 09001C0418G DATED JULY 8, 2013 (SEE NOTE #6)

Scale: 1"=30'

0 15 30 60

To the best of my knowledge and belief this map is substantially correct as noted hereon.

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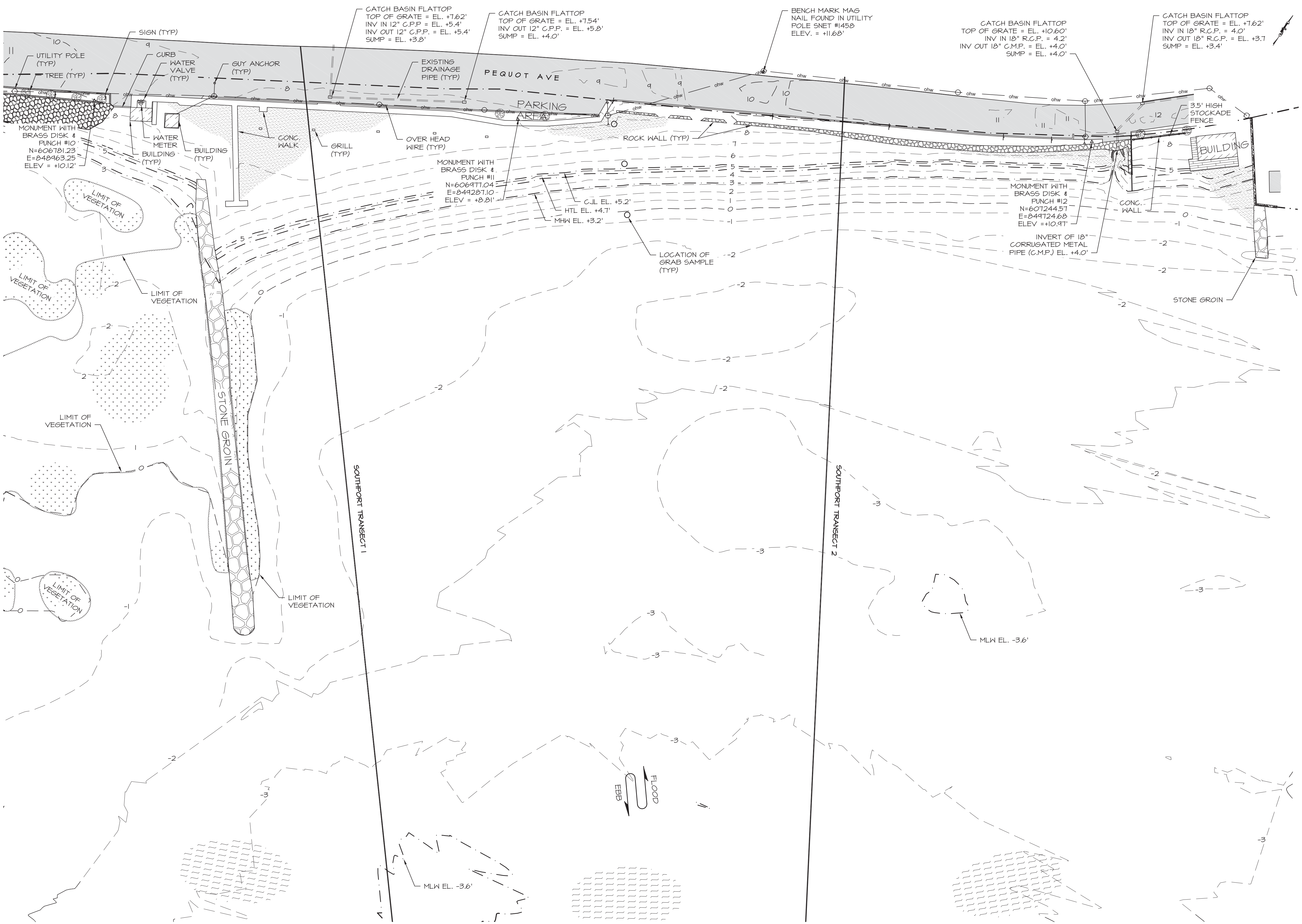
Topographic Survey
of
Southport Beach
1505 Pequot Avenue
Fairfield, Connecticut
Prepared for
Roberge Associates Coastal Engineers, LLC

Revisions

Date: July 12, 2016
Drawing: 16-056a
Drawn: P.H.

Appendix D: SBEACH Model Results



TRANSECT LOCATION MAP

SCALE: 1" = 40'-0"

REDUCED COPY - DO NOT SCALE

RACE COASTAL ENGINEERING

611 Access Road Stratford, CT 06615
Tel: 203-377-0663 www.racecoastal.com

REVISIONS:

NO.	DESCRIPTION	BY	DATE

NOT VALID WITHOUT ENGINEER'S SEAL:

CLIENT REVIEW ONLY
NOT FOR CONSTRUCTION

PREPARED FOR:

CONSERVATION DEPT
TOWN OF FAIRFIELD
725 OLD POST RD
FAIRFIELD, CT 06824

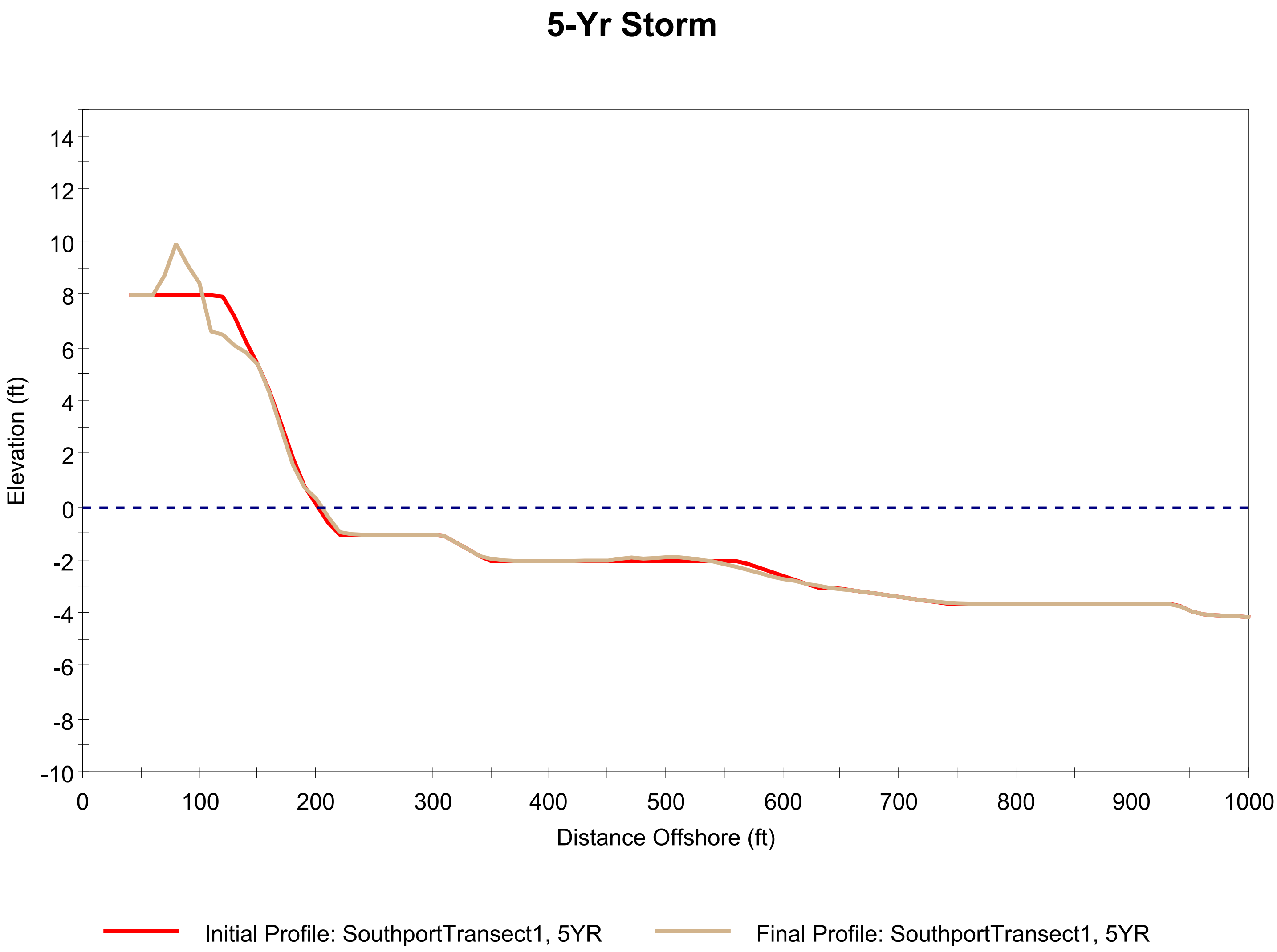
PROJECT:

SOUTHPORT BEACH
ENGINEERED BEACH DESIGN
PEQUOT AVE
FAIRFIELD, CT

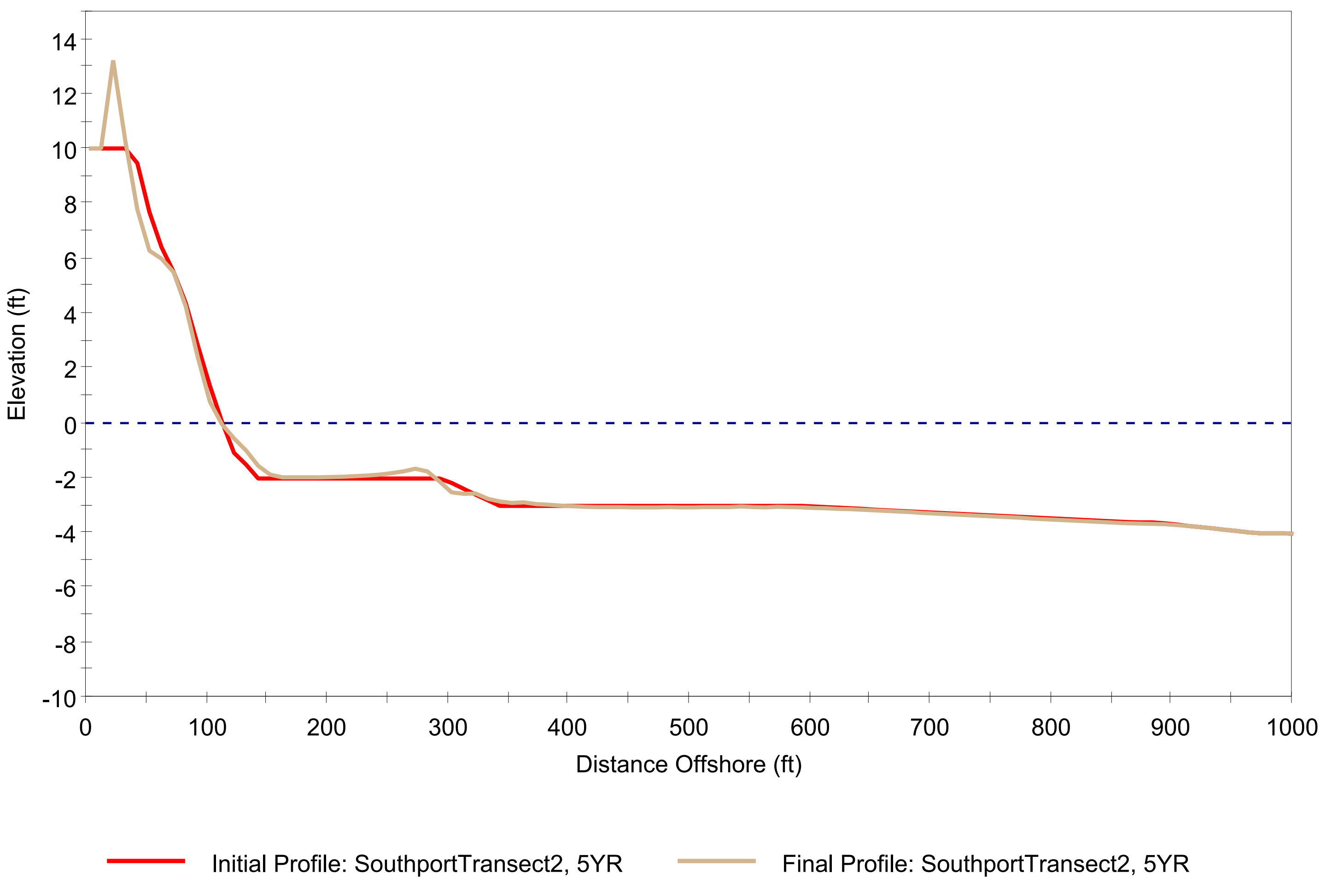
DRAWING:

TRANSECT LOCATION MAP

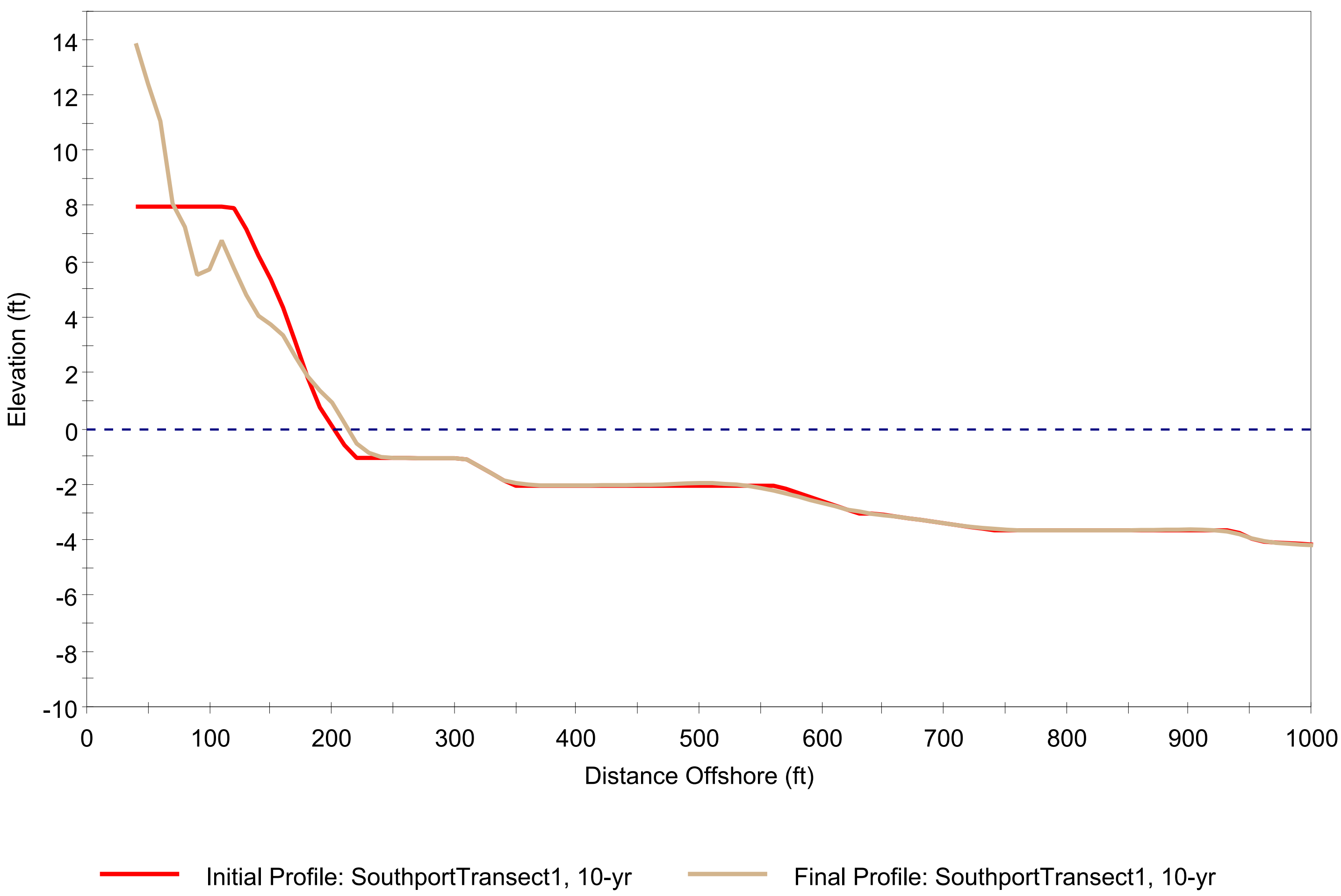
Designed By: JAP	Date: 3/22/2017
Drawn By: JAP	Scale: As Noted
Checked By: ADS	Project Number: 201644
CAD File: SOUTHPORT REPORT DRAWINGS.DWG	Drawing No.: 1 of 01

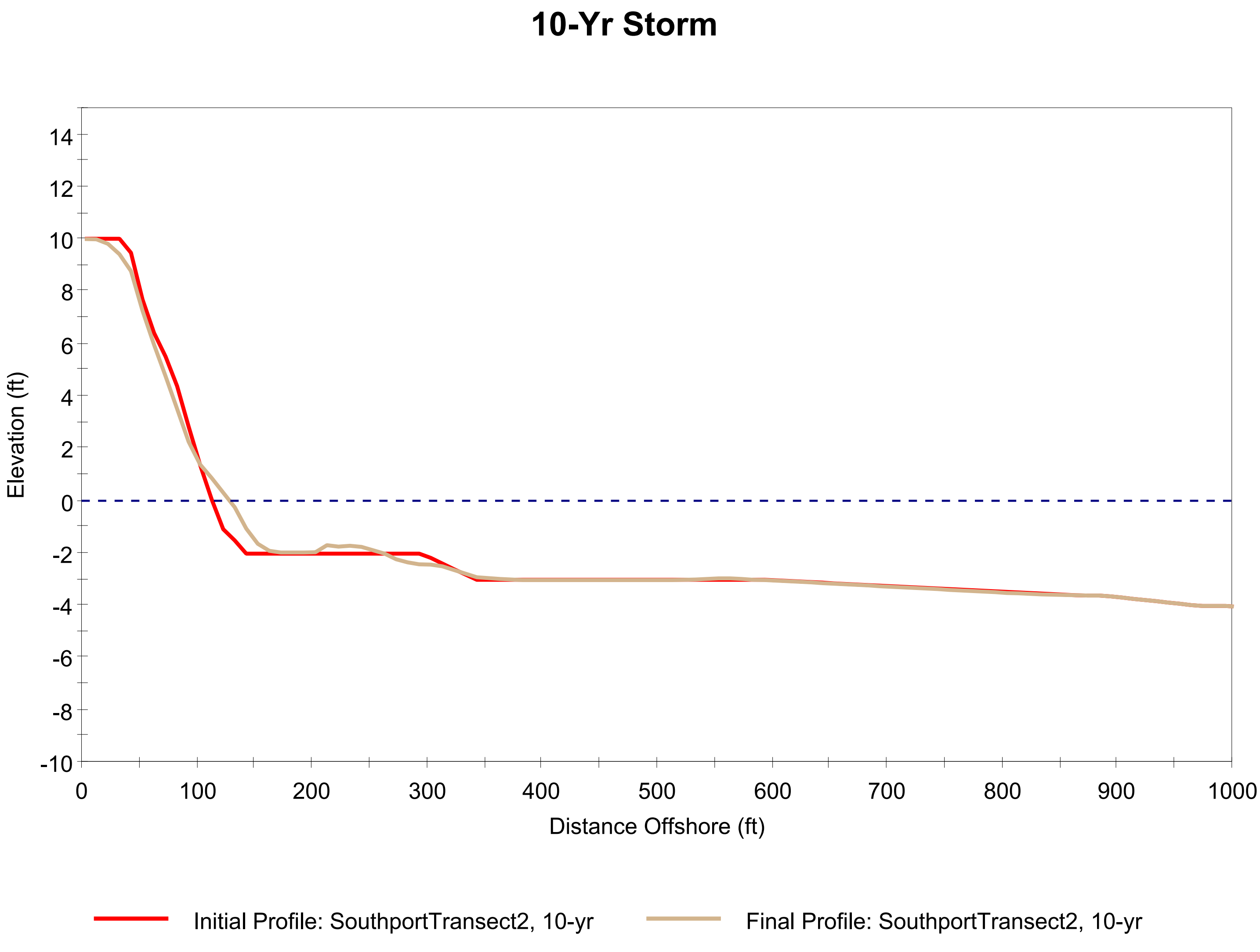

5-Yr Storm
Elevation (ft)
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
100
200
300
400
500
600
700
800
900
1000
Distance Offshore (ft)
Initial Profile: SouthportTransect1, 5YR
Final Profile: SouthportTransect1, 5YR

5-Yr Storm


Elevation (ft)
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
100
200
300
400
500
600
700
800
900
1000
Distance Offshore (ft)
Initial Profile: SouthportTransect2, 5YR
Final Profile: SouthportTransect2, 5YR

10-Yr Storm


Elevation (ft)
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
100
200
300
400
500
600
700
800
900
1000
Distance Offshore (ft)
Initial Profile: SouthportTransect1, 10-yr
Final Profile: SouthportTransect1, 10-yr


10-Yr Storm
Elevation (ft)
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
0
100
200
300
400
500
600
700
800
900
1000
Distance Offshore (ft)
Initial Profile: SouthportTransect2, 10-yr
Final Profile: SouthportTransect2, 10-yr