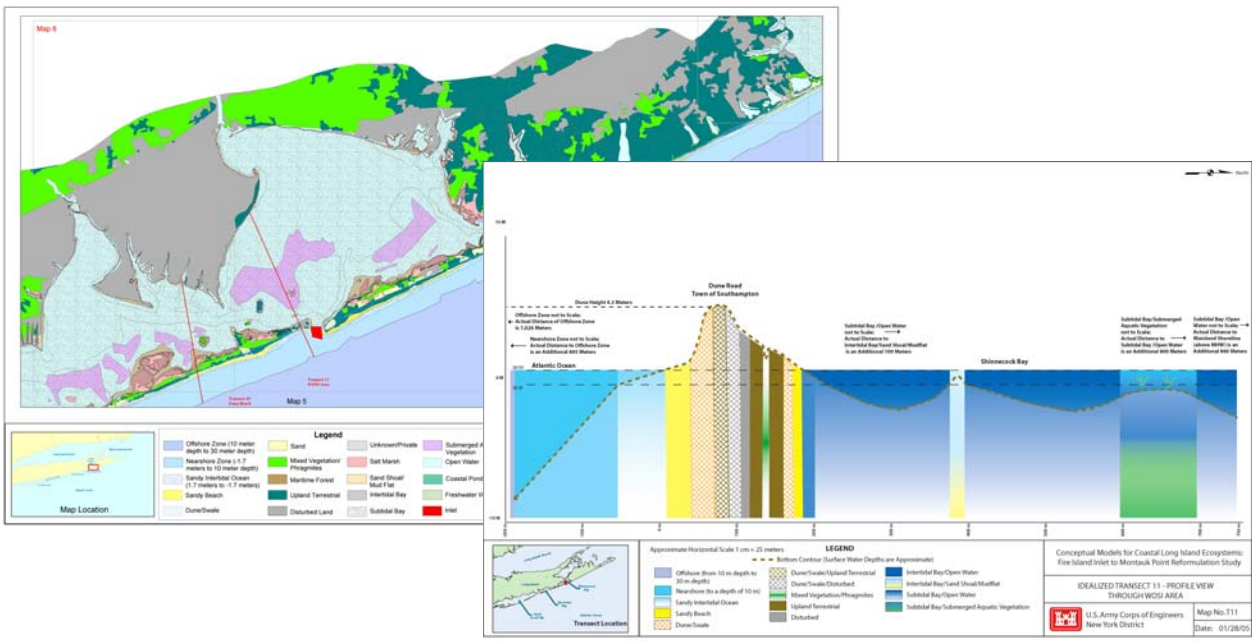
Conceptual Models for Coastal Long Island
Ecosystems: Fire Island to Montauk Point
Reformulation Study

# COVER TYPE MAP AND PROFILE VIEW ILLUSTRATION METHODOLOGY REPORT



**October 2005**

***Prepared for:***

U.S. Army Corps of Engineers
New York District (CENAN-PL-EA)
26 Federal Plaza
New York, New York 10278-0090

***Prepared by:***

NEA
NORTHERN ECOLOGICAL ASSOCIATES, INC.
451 Presumpscot Street
Portland, ME 04103

# Cover Type Map and Profile View Illustration Methodology Report

FOR THE

CONCEPTUAL MODELS FOR COASTAL LONG ISLAND ECOSYSTEMS: FIRE ISLAND TO MONTAUK POINT REFORMULATION STUDY

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## Scope of Report

This report describes the methodology used for both Phase I and Phase II of the Cover Type Map and Profile View Illustrations for Conceptual Model, Fire Island to Montauk Point reformulation Study (Contract No. DACW51-01-D-0017). Because the processes utilized in the creation of the Phase I and Phase II cover type maps were the same, these two reports were combined to minimize redundancies.

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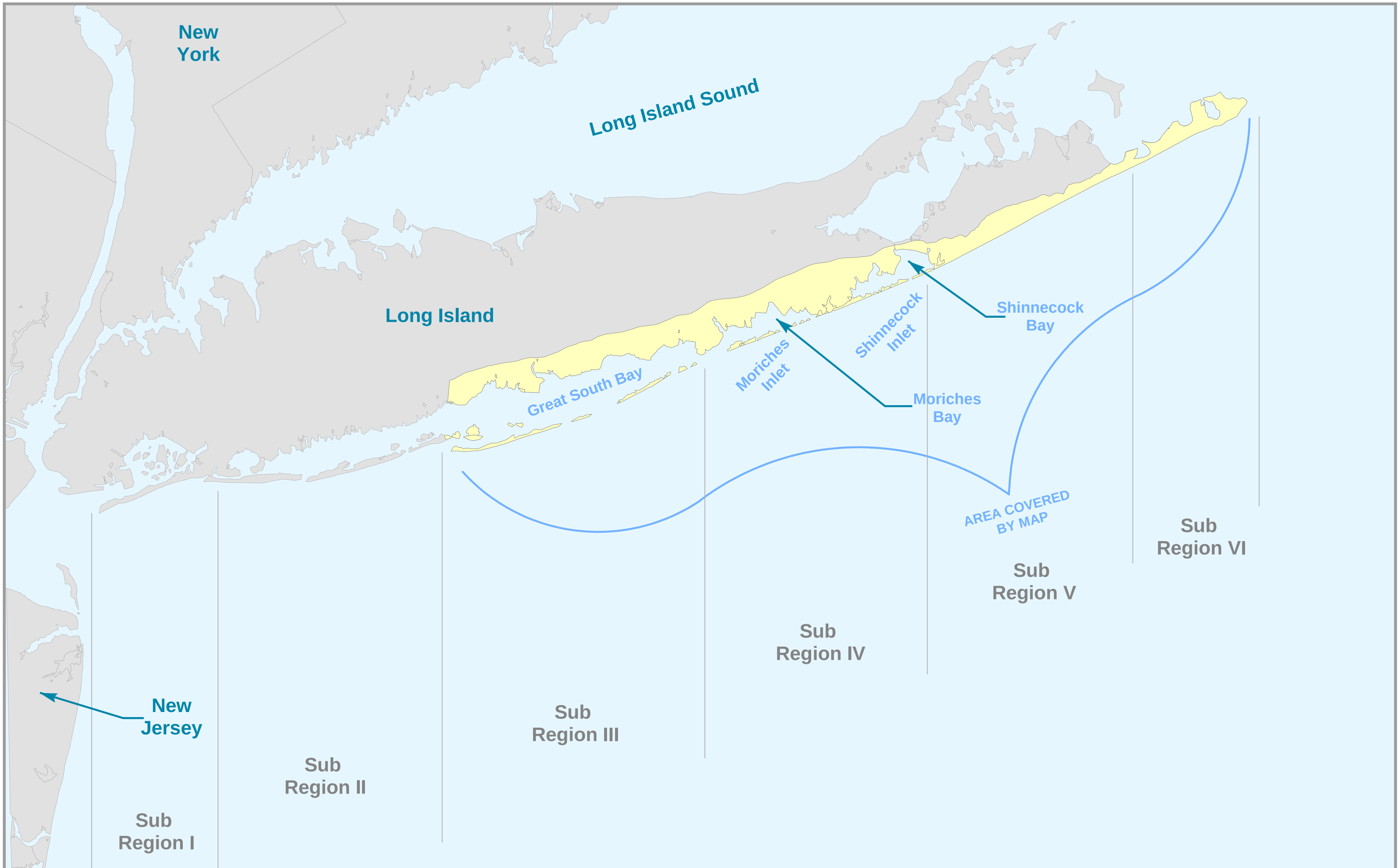
# 1.0 INTRODUCTION

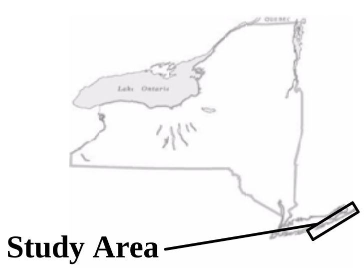
## 1.1 GENERAL PROJECT BACKGROUND

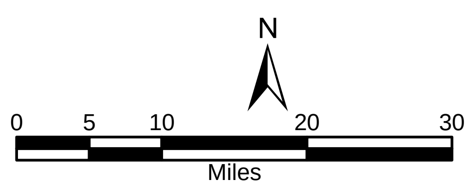
The U.S. Army Corps of Engineers (USACE), New York District, is conducting a comprehensive feasibility-level reformulation study of the Shore Protection and Storm Damage Reduction Project (Project) for the south shore of Long Island, New York, from Fire Island Inlet to Montauk Point (FIMP). This reformulation study was initiated in order to evaluate ways to prevent future damage. The Federally-authorized Project area extends west from Montauk Point to Fire Island Inlet along the Atlantic Coast of Suffolk County, Long Island, New York. Commercial, residential, public and other infrastructure in the study area are subject to economic losses (or damages) during severe storms. The principal problems are associated with extreme tides and waves that can cause extensive flooding and erosion within both barrier island and mainland communities. Breaching and/or inundation of the barrier islands also can lead to increased flood damages, especially along the mainland communities bordering Shinnecock, Moriches, and Great South bays.

The USACE is undertaking the process of plan formulation to evaluate the range of possible alternatives to address these problems, including a screening of alternatives, detailed design, design optimization, and final design. Concurrent with the development of plans, site-specific information is being developed to evaluate these alternatives, in order to identify the recommended plan of protection.

Much information on the extent and location of various cover types along the south shore of Long Island, New York, is readily available (USACE 2001, USGS 2001). However, a comprehensive map and/or Geographic Information System (GIS) that defines and identifies all the cover types was not available prior to this study. The USACE determined that a map was most critical for the area from Fire Island Inlet to Montauk Point (subregions III – VI on figure 1). Therefore the area of concern for this data set can be defined as the area from Fire Island Inlet to the west, and Montauk Point to the east. The northern extent of the cover type map is Route 27 for most of the area but includes all of the land area of Long Island beginning where the land mass narrows. The southern extent of the cover type map is the outer limit of the offshore zone. See Figure 1 for a general project area map.




Source: Atlantic Coast of New York Monitoring Program
Coastal View CD Baselayer Coast Oct 2001.

**Figure 1. Area of Cover Type Map with Sub Regions Identified for Fire Island to Montauk Point Reformulation Study.**

## 1.2 PHASE I MAPPING TASK

A task associated with development of site-specific information for use in evaluation of project alternatives was development of a comprehensive cover type map for the project area (Phase I). The first part of this Methodology report (Section 2.0) describes and documents the steps completed in preparing the cover type map that will be used as the basis for assessing the viability and impacts of the project alternatives. Specifically, the Phase I portion of this report identifies sources of information, defines the cover types selected for the map, and describes the steps in the reclassification of data from the original data sources.

The specific objectives of Phase I of this study were to identify the existing sources of cover type information, obtain the data, process it and spatially depict the cover types as defined by the conceptual modeling efforts on an appropriate base map. Ultimately, the cover type map will be used as a tool for further development and analysis of the spatially explicit subregion conceptual models.

The following five tasks were completed for Phase I:

**Data Identification –** Sources and applicability of data to the study goal were identified. The focus of this task was on existing sources of digital geo-spatial data.

**Data Acquisition/Processing –** Available data was acquired and processed into a unified GIS database and reclassified according to the cover type definitions set by the conceptual models. The cover types depicted were as follows: Offshore, Nearshore, Intertidal (Ocean and Bay), Beach (Ocean and Bay), Dune, Maritime Forests, Salt Marsh, Bay Intertidal (including sand and mud flats identified on charts) Submerged Aquatic Vegetation Beds, Bay Channels and Inlets.

**Map Creation –** A digital map series of the area of concern was created utilizing the cover type map and any additional appropriate layers. In addition, an interactive CD-ROM was created that allows a non-GIS user to access the maps for viewing and printing purposes.

**Attribute Updates –** The USACE modified attribute definitions to better match the habitat definitions used in the Conceptual Model. Generally, this task involved simply renaming the definitions (i.e. Intertidal Ocean became Marine Sandy Intertidal) or grouping existing definitions into one new definition to (i.e. Forest, Scrub-shrub, and Herbaceous became Terrestrial Upland).

**Map/Data Layer Revisions** – The GIS data layer was updated to incorporate habitat delineation edits provided by the USACE.

### 1.3 PHASE II MAPPING TASKS

The goal of Phase II of this project was to create a more useful tool for further analysis by updating and adding new information to the Phase I cover type map. Specifically, this section of the report (Section 3.0) documents the process that was undertaken to update the maps and create profile view illustrations of the 13 selected transect areas to be used for further development of spatially explicit subregion conceptual models (Phase II). The updates included the addition of transect lines to the new plan view map series, and changes to line work and habitat definitions. The updated map was then used as a basis for creating the profile view illustrations for each of the selected transect locations.

The specific objectives of Phase II of this study were to update the original cover type map created in Phase I, using information gathered from ground-truthing, review of the 2001 Digital Ortho-photo Quads, and to revise attribute definitions as defined by the USACE. Data from the updated cover type map were then processed and used to create the profile view illustrations.

The following four tasks were completed for Phase II:

**Addition of Transect Lines –** The USACE selected 13 representative areas within the study area for further analysis. Transect lines in the locations of the selected areas were then incorporated into the cover type map.

**Ground-truthing –** Each of the selected 13 transects were walked or accessed by boat, to obtain accurate field delineated cover type information. Notations were made on the hardcopy maps where boundaries and/or cover types needed to be altered.

**Map/Data Layer Revisions** – The GIS data layer was updated to incorporate changes found during ground-truthing of the 13 transects. In addition, one new definition was added (Fresh Water Wetlands) after a new cover type was discovered during ground truthing.

**Creation of Profile View Illustations –** A generalized profile view illustration was created for each Transect. Transects extended from the outer extent of the offshore zone to the landward extent of the bays. To facilitate the aditional required elements that would be needed to create profile view maps, additional data layers were analyzed and incorporated into the maps. These data sets included Channel Data, Nautical Charts, and LIDAR Data.

## 2.0 PHASE I - PLAN VIEW METHODOLOGY

The following sections provide the methodology used to identify, collect and process data used to create and update the GIS data layers, and design the final Phase I GIS layer and plan view maps. Methodology was designed based on specific project goals, target cover types, and an assessment of the available existing data. Table 1 outlines the data sets that were used in the creation of the Phase I Cover Type map, which was also used as a basis for all subsequent Phase II work.

**Table 1. Data sources utilized to develop original cover types for FIMP cover map.**

| DATA SET IDENTIFIER | DEVELOPING AGENCY | USE |
|---|---|---|
| Fire Island Vegetation Data | USACE | Highest priority for vegetation cover types |
| Tidelands Data | New York State District of State (NYSDOS) | Second highest priority for vegetation cover types and tidelands cover types |
| GAP/Land Use Layer | USGS | Lowest priority for vegetation cover types |
| Bathymetric and Topographic data | Moffatt & Nichol | Used to delineate inter tidal, nearshore, offshore zones |
| Beach/Dune Profile data points | Atlantic Coast of New York Monitoring Program (ACNYMP) | Used to delineate intertidal, nearshore, and offshore zones as well as dune and beach width. |
| Digital Ortho Photo Quarter Quads (1994-1999) | USGS/NYSDOS | Used where vector data was unavailable and for QAQC purposes. |
| Roads | Environmental Systems Research Institute (ESRI)/NYSDOS | Used in conjunction with GAP data to delineate Route 27. |
| Submerged Aquatic Vegetation (SAV) | USACE | Highest priority for SAV data cover types |
| Coastal Erosion Hazard Line | NYSDOS | Delineated offshore extent of the Dunes |
| Major Channels | USACE | Channels |
| Channels - NOAA Nautical Charts | NOAA | Digitized Channels not existing in Major Channels |
| Ground-Truthing | USACE | Verified cover type definitions and delineations in the specific area of the transects only |

## 2.1 Updates to Line Work

The GIS data layer was updated to incorporate habitat delineation edits provided by the USACE.. Changes to cover type boundaries were noted on hard copy maps. Additional line work was digitized in ArcView 3.2 at a scale no greater than 1:5,000. The line shapefile was then converted to an ArcInfo Coverage using ArcInfo 8.2. The line coverage was then incorporated into the cover type map and topology was reestablished using the ArcInfo BUILD command.

## 2.2 Attribute Updates

The USACE modified the attribute definitions originally used in the Phase I cover type map to better match the habitat definitions used in the conceptual model.

### 2.2.1 Attributes Nomenclature for the Cover Type Database

All fields and field definitions from the original Phase I GIS database were retained in the updated Phase I and Phase II databases. Values for the CTYPEE and CTYPEV fields were modified to include updated cover type definitions and the additional cover types. Table 2 provides a list of the final cover type map database fields and values.

**Table 2. Attribute Fields and Definitions of the Final Data Set.**

| FIELDS | DEFINITION | VALUES |
|---|---|---|
| AREA | Area in meters | Range of Values |
| PERIMETER | Perimeter in meters | Range of Values |
| ACRES | Area of polygon in acres | Range of Values |
| CTYPEE | Cover type is elevation dependent | Intertidal bay, Subtidal bay, Sandy intertidal ocean, Nearshore, Offshore, Dune, Sandy beach, Inlet |
| CTYPEV | Cover type is not elevation dependent | Salt Marsh, Maritime Forest, Mixed vegetation/*phragmites*, Upland terrestrial, Fresh Water Wetland. Coastal pond, Open water, Submerged aquatic vegetation, Sand, Sand shoal/mud flat, Disturbed, Unknown/Private |
| CTYPEO | Original Value | Listed in the metadata document (metadata) |

### 2.2.2 Designated Cover Types and Updated Attributes

During Phase I of the cover type map, the USACE established what cover types needed to be delineated on the map. Based on the importance of certain habitats to the conceptual models, the USACE selected the following cover types as being critical to the overall project: Offshore, Nearshore, Intertidal Ocean, Beach, Dune, Salt Marsh, Maritime Forest, Bay Intertidal, Inlets, Bay Subtidal, Submerged Aquatic Vegetation, Mud Flat and Shoals, and Bay Channels.

In addition to these cover types, the USACE determined that Herbaceous, Scrub-shrub, Forest, and Mixed Vegetation also should be delineated. Data for some areas were unavailable. As a result, the final cover type map also includes a code for unknown cover types.

The USACE determined that the cover type definitions should be modified to better match the conceptual model. Table 3 lists the updates that were made to the original habitat definitions.

**Table 3. Updates to Original Habitat Definitions for FIMP cover type map.**

| EXISTING COVER TYPE | UPDATED/ADDED COVER TYPE |
|---|---|
| Open Water | Open Water |
| Salt Marsh | Salt Marsh |
| Maritime Forest | Maritime Forest |
| Mixed Vegetation | Mixed Vegetation/*Phragmites* |
| SAV | SAV |
| Forest | Upland Terrestrial |
| Scrub-Shrub | Upland Terrestrial |
| Herbaceous | Upland Terrestrial |
| Sand | Sand |
| Sand Shoal/Mud Flat | Sand Shoal/Mud Flat |
| Intertidal Bay | Intertidal Bay |
| Subtidal Bay | Subtidal Bay |
| Intertidal Ocean | Sandy Intertidal Ocean |
| Nearshore Zone | Nearshore Zone |
| Offshore Zone | Offshore Zone |
| Dune | Dune/Swale |
| Beach | Sandy Beach |
| Disturbed Land | Disturbed Land |
| Unknown/Private | Unknown/Private |
| Inlet | Inlet |
| Added (after Phase II ground-truthing) | Coastal Pond |
| Added (after Phase II ground-truthing) | Fresh Water Wetland |

### 2.2.3 Cover Type Map Definitions

The following sections provide an overview of existing habitats that were mapped in the project area as defined by the conceptual models. "Habitats" as defined for this project encompass both biological (i.e., vegetation type or CTYPEV) and physical (i.e., tidal status or CTYPEE) classes of information. In some cases, these classes of information overlap.

#### Offshore

Offshore was defined as beginning at a depth of 30 meters, which may occur several miles offshore, and proceeding toward shore to a depth of 10 meters. The offshore zone was created from x, y, z point files in ASCII format obtained from Moffatt & Nichol point files that were converted to ArcInfo coverages using ESRI ArcInfo 8.1.2. The data were then queried to select all points within the range of 30 meter to 10 meter depth based on mean low water (MLW). These points were used to delineate the extent of the offshore zone in ArcInfo 8.1.2 at a scale no greater than 1:10,000.

#### Nearshore

The nearshore zone was defined as beginning at the mean low water (MLW) line (-1.7 meters) and continuing to a depth of 10 meters. The seaside extent of the nearshore zone was created as defined above in section 3.3.1. The landside extent of this cover type was created as defined below in section 3.3.3.

#### Sandy Intertidal Ocean

The area between MLW and Mean High Water (MHW) was defined as the intertidal area on beaches in the Project area. This was determined to be from –1.2 meters to 2.2 meters National Geodetic Vertical Datum 1929 (NGVD29) or –1.7 meters to 1.7 meters Mean Sea Level (MSL). A Long Island South Shore Database created as a part of the Atlantic Coast of New York Monitoring Project, and covering the years between 1995 and 2001, was used to delineate the intertidal ocean area. This database contained profile data for the study area. Locational information was queried from this database and points were created using ArcInfo 8.2. The intertidal ocean cover type was then delineated using these points in the same program. The entire database was used for most areas. However, as a result of beach filling post-1996 in an area of the Hamptons, only data from 1997 and later were used for this location. In all areas, the digital ortho-photo quarter quads (DOQQs) and topographic contours were used for reference.

#### Sandy Beach

The beach zone was defined as the area that exists between MHW (1.7 meters) and the dune and swale communities. The seaside extent of the beach zone was created as defined above in section 3.2.1. The landside extent of this cover type was created as defined below in section 3.3.5. Wherever a mapped vegetation cover type overlapped a beach area, the vegetation cover type took precedence.

### Dune/Swale

The dune zone is actually a complex of dunes. This habitat ranges from the lightly vegetated primary dune at the edge of the ocean beach to more stable vegetated dunes bayside, and it consists of grassy or shrubby vegetation and the lower lying swale areas in between. Where they existed, profile bearings and distances for seaward and landward toe of the dune were used to delineate this cover type. In those instances where one point was missing, the DOQQ and closest appropriate data points were used to delineate that extent. The dune/swale cover type occurs in combination with vegetation cover types including sand, upland terrestrial, mixed vegetation/*Phragmites*, and disturbed.

### Maritime Forest

Maritime Forest was defined as a unique assemblage of herbaceous, shrub, and tree species, many of which are adapted to the high salinity of the salt spray or soils and to wind from the ocean. The Project Area has only one geographic area where this cover type is found. This area, located within the bounds of the Fire Island National Seashore, is known as the Sunken Forest. Maritime Forest is present only in Transect 4.

### Salt Marsh

Salt Marsh is generally defined as communities dominated by salt-meadow grass (*Spartina patens*) or cordgrass (*Spartina alterniflora*). All three vegetation coverages were used to identify salt marsh, with the priority being as follows: first, Vegetation data set; second, Tidelands; and, third, GAP Analysis Landuse/Landcover. The USACE vegetation dataset has three polygon codes that fit the description of Salt Marsh. These codes, *Spartina alterniflora*, *Spartina patens* and *Distichlis spicata*, were labeled Salt Marsh. In polygons where these codes were combined with other non-salt marsh types, these polygons were added to the Mixed Vegetation cover type. Salt marsh can be seen on the cover type maps in combination with the elevation cover type intertidal bay.

### Intertidal Bay

Intertidal bay areas occur on both the Long Island and barrier island sides of the bays. These may be vegetated with salt marsh vegetation, or consist of un-vegetated bare sediment.

The intertidal range of each bay was established using data collected by NOAA researching stations. Once the tidal range had been determined, the bathymetric data was queried to provide all the points that fell within the subtidal and intertidal ranges. The usefulness of this method was limited due to the fact that the data were sparse. To augment this method, the tidelands dataset and DOQQs also were used.

**Subtidal Bay**

Subtidal bay is defined as the area within the bay where the elevation is below the lower limit of the intertidal range. The same data used to determine the intertidal range were used to determine this cover type. (see section 3.3.8 above). This cover type may be incomplete in this data set, however, because data was unavailable for some inlets, bays, and channels. Subtidal bay areas may be vegetated with submerged aquatic vegetation.

**Open Water**

Open water was defined as Intertidal or Subtidal areas where there is no Submerged Aquatic Vegetaion, Sand Shoal, or Mudflat present.

**Submerged Aquatic Vegetation (SAV)**

Rooted SAV grows in bay areas below MLW to depths of up to 4 m. USACE provided SAV data, which was developed through aerial photo interpretation and field verification.

**Bay Channels**

The Bay Channels were defined as areas in the bay where channels are maintained for commercial and recreational boat traffic as part of the USACE Inter-coastal Waterway, as well as maintained channels to other harbors along Long Island. Existing channel data for this area were quite limited. DGN files were used as received from USACE. This data set was used in conjunction with NOAA nautical charts to delineate dredged channels in the bays. The DGN file was converted to an ArcInfo coverage. NOAA nautical charts were delineated in ESRI ArcView 3.2 at a scale of no greater than 1:5,000.

**Inlets**

Inlets are areas of water interchange between the bays and the ocean zones. Inlets to the channels were defined as the area between the shoreline of the barrier islands at the locations of the Shinnecock Inlet, Moriches Inlet and Fire Island Inlet. These polygons represent approximate location and size of the inlet waterways; exact information was not available.

**Sand Shoals and Mudflats**

Sand Shoals and Mudflat habitats are found predominantly in intertidal areas. These two cover types were combined in the Tidelands data and therefore are mostly combined and classified as Sand Shoals/Mudflat. In other data sets, Sand was separated out, and this separation was maintained in the final data set. The original cover type from the Tidelands data defines these shoals, bars and mudflats as the tidal wetland zone that at high tide is covered by water, at low tide is exposed or is covered by water to a maximum depth of approximately one foot, and is not vegetated by low cordgrass, *Spartina alterniflora*.

**Upland Terrestrial**

All areas that did not fall within one of the defined categories were delineated based on vegetation class as either herbaceous, scrub-shrub and/or forest. These codes were then grouped together and classified as Upland Terrestrial.

**Mixed Vegetation/*Phragmites***

In some instances, vegetation of more than one class was grouped together in the original data. These areas were reclassified as Mixed Vegetation. Areas that were coded as *Phragmites* were also included in this cover type.

**Fresh Water Wetlands**

During field verification of the specific transect areas, Fresh Water wetlands were delineated and added to the GIS database and maps. This cover type was identified during ground-truthing of the 13 selected transects for Phase II of the project

**Coastal Ponds**

The Coastal Ponds habitat type was added to the GIS database to more realistically depict the conditions in certain areas where water bodies did not wholly fit into the Marine, Intertidal or Subtidal category. Coastal ponds are found in Transects 12 and 13.

**Disturbed**

Disturbed habitats include upland developed areas with roads, houses, or other upland structures. The Disturbed habitat does not include disturbed vegetated areas.

**Unknown/Private**

The Unknown/Private classification was used in areas where vegetation and/or elevation data were not available.

### 2.2.4 Populate Attribute Fields

The addition of the new line work to the cover type map left new polygons with no values in the CTYPEE and CTYPEV fields of the database. To populate these fields and update all polygons with the updated cover type definitions a number of queries were performed on the updated GIS Database. The queries used include selecting all uncoded polygons to code their CTYPEE and/or CTYPEV fields, and selecting existing cover types and combinations of cover types to code them with updated attribute values.

### 2.2.5 Additional updates to existing data

During the process of updating the data layer, the USACE determined that certain assumptions regarding the relationship between the CTYPEV and the CTYPEE attribute definitions could be made. As a result of these assumptions, additional coding was completed for polygons that had a blank code in the CTYPEV field of the original cover type map. Table 4 summaries the changes that were made.

**Table 4. Attribute Field Updates for FIMP Cover Type Map.**

| CTYPE V | CTYPEE | Updated to |
|---|---|---|
| Blank | Intertidal Ocean | CTYPEV changed to Sand |
| Blank | Sandy Beach | CTYPEV changed to Sand |
| Blank | Sub Tidal Bay | CTYPEV changed to Open Water |
| Blank | Inlet | CTYPEV changed to Open Water |

## 2.3 DATA GAPS/CONFLICTS AND CONVERSIONS

### 2.3.1 Data Gaps

Vector/Raster

Vector data were unavailable for certain components of the cover type map therefore it was necessary to use existing raster imagery. This was the case for the intertidal/subtidal bay cover types and for the bay channels.

A resolution of how to fill data gaps was achieved through careful consideration of all options. In the case of conflicts, decisions were made by choosing the feature(s) of the data set that were determined to have the best accuracy and based on professional opinion of wetland scientists familiar with the ecosystems. All decisions were approved by the USACE Project Biologist.

### 2.3.2 Data Conflicts

Overlapping Data Sets

In some cases, the Tidelands data and the Vegetation data overlapped. The Vegetation data set was determined to be more accurate than the Tidelands data set on the basis that the data were produced from rectified aerial photography and had been ground-truthed. This data set was prioritized over the tidelands data.

Grouped Cover Types

Cover type classifications in the Vegetation data sets were often grouped as containing more than one cover type. In cases where salt marsh species existed in the same polygon as a non-salt marsh species, the cover type was reclassified as Mixed Vegetation.

Multiple Source Attribute Conflicts

As a result of the establishment of two different Cover Type Fields (CTYPEV and CTYPEE) it is possible in the dataset to have a single polygon that was attributed by two disparate data sources. For example, the source of a polygon of Sand Shoal/Mudflat in the interior of a Bay may have been a polygon of Sand Shoal/Mudflat from the Tidelands dataset. This same polygon may be classified as Sub Tidal Bay as a result of the elevation from the point data set matching the criteria outlined for that classification. In many cases these two codes do not match when assessed together. For example, a polygon may be coded as CTYPEV = SAV and CTYPEE = Intertidal Marsh. It is obvious that one of the codes is incorrect. These conflicts can not be resolved fully without making certain assumptions based on the accuracy of the data sources used to create the final dataset or by a review of the aerial photography in all areas where these conflicts exist. Completion of this task would increase the utility and accuracy of this data set.

### 2.3.3 Projection and Datum Conversions

Horizontal

The data sources acquired and utilized in the creation of the cover type map were in disparate horizontal datums. ArcInfo 8.1.2 was used to convert all input data to reference the coordinate system Universal Transverse Mercator (UTM), Zone 18 North, North American Datum 1983 (NAD83), Meters.

Vertical

The plan view cover type map data set does not maintain a z coordinate value. However many of the defined cover types reference MHW and MLW. It was necessary to convert many of the input data sources from one datum to match the cover type definitions. For engineering purposes, USACE uses a conversion of MSL = 0.5 ft National Geodetic Vertical Datum (NGVD). This conversion factor was used in all cases where a conversion needed to be made for the creation of the cover type map.

## 2.4 DATA MANAGEMENT

The following sections describe the development and management of the database that was utilized for creation of the Phase I and Phase II cover type maps and profile view illustrations. These processes include compilation of disparate data sources, rational for data base attributes and definitions, and metadata standards.

### 2.4.1 Compilation of data sets

One of the challenges of this project was to compile the data sources into a single GIS data layer. The original data sets existed in various formats, including: AutoCAD, Microstation, ESRI shape files and coverages, text files, and Microsoft Access Databases containing x, y, and z coordinate data. ArcInfo 8.1.2 was used to accomplish these tasks, which included the following: conversion of data type from native data format to an ArcInfo coverage; spatial re-projection of data to a common coordinate system (UTM), and horizontal and vertical datum; and a data merge of all data sets (using ArcInfo UNION, UPDATE, and APPEND).

In addition to compiling the data sets, the attributes and attribute definitions of each data set were compared and re-defined to conform to project specifications. Wherever possible, the source and original attribute information were retained as feature level metadata. This information was not maintained in all cases as a result of certain GIS processing steps (s.a., DISSOLVE, ELIMINATE) that made it impossible to retain the information.

### 2.4.2 Content Standards for Digital Geo-spatial Metadata

Metadata for the resulting coverage was created using CorpsMet95 to assure compatibility with USACE digital data standards. Corpsmet95 is compliant with the Federal Geographic Data Committee (FGDC) Content Standards for Digital Geo-spatial Metadata. Metadata documentation was created first in ArcInfo 8.1.2 during the development of the dataset and then converted to Corpsmet95.

### 2.4.3 Quality Assurance/Quality Control Procedures

The NEA Project Manager (PM)/Database Manager (DM) and the Supervisory Biologist (SB) were responsible for conducting various aspects of Quality Assurance/Quality Control (QA/QC) procedures. The following list outlines the QA/QC procedures that were implemented to ensure accurate data entry and processing:

- ✓ Whenever possible, an AML was used for each stage in processing the data. This minimized the potential for human error and enabled an independent QA/QC of processes even after they were completed.

- ✓ ESRI workspaces (directories) maintain automatic log files that log important processing steps.

- ✓ In order to be able to track and retrace each step of the process, automatic ‘watch files’ were generated wherever possible.

- ✓ A log book was maintained to record important decisions and processing steps.

- ✓ Close contact with ESRI technical support was maintained to establish a comfort level that the most reliable and efficient processes were being utilized.

- ✓ To ensure the highest accuracy of the data, all features of the output coverages were maintained and verified for each step. These features included, but were not limited to:

    - Tolerances
    - Item codes and definitions
    - Precision (double precision was maintained)
    - Topology
    - Label errors (No duplicate labels or polygons without labels)

- ✓ The Project Manager (PM) and Database Manager (DM) ensured that database queries, and analysis were properly structured, and reflected the appropriate data needs of the project.

## 3.0 PHASE II - PLAN AND PROFILE VIEW METHODOLOGY

The following sections provide the methodology used to select the 13 transects, update the Phase I GIS data layers, and create the profile view illustrations.

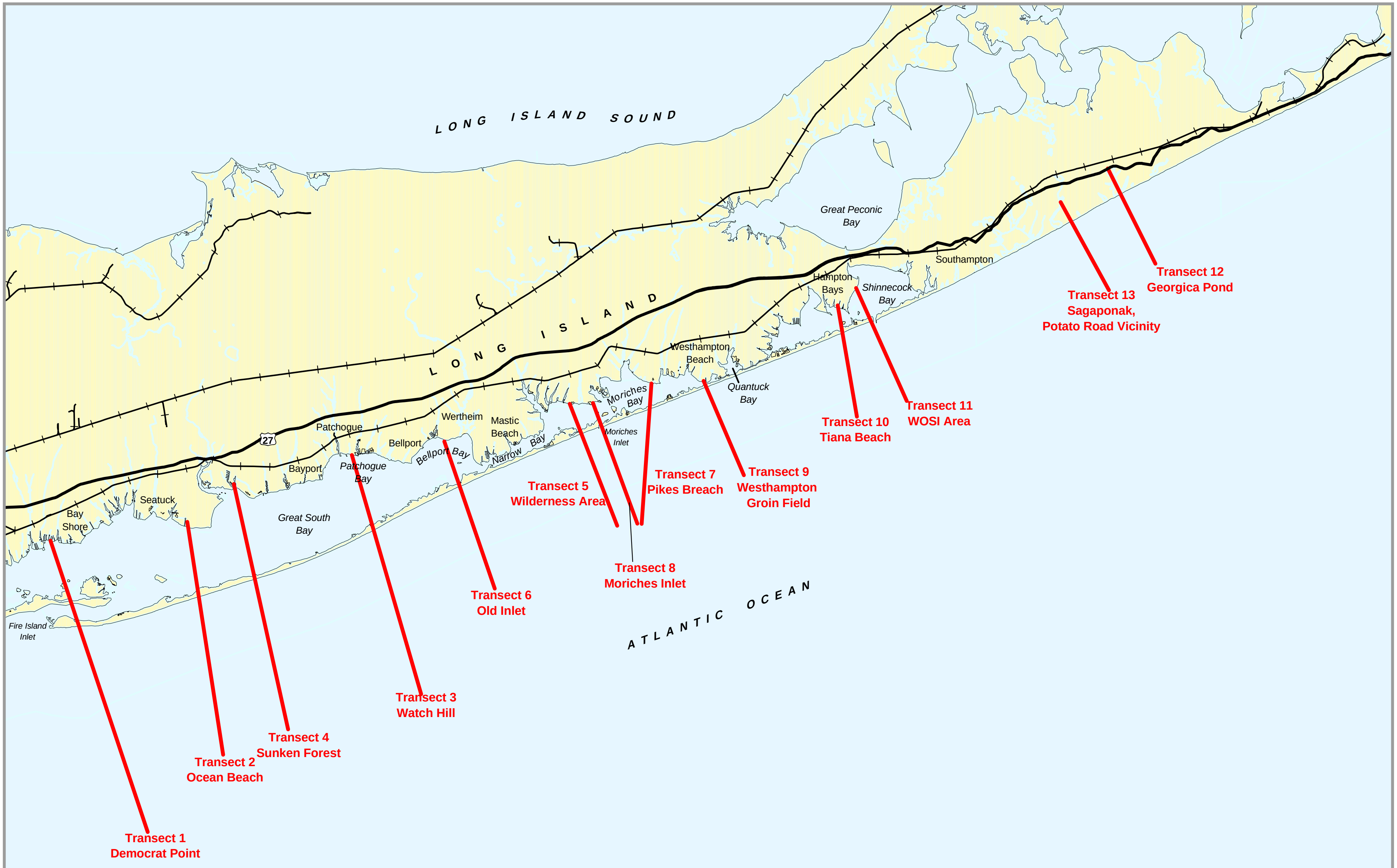
### 3.1 ADDITION OF 13 SELECTED TRANSECTS

For the second phase of the Conceptual Model, the USACE selected 13 areas within which idealized transects would be located. Areas were chosen that represented various ecological communities present in the study area. The spatial location of each transect was then added to the original cover type map. Figure 2 shows the location of the selected transects.

Transects extend from the outer limit of the offshore zone (30 meter depth), landward to Route 27 at the farthest northern extent and cover an area 30 meters wide. The northern extent of the transects vary, depending on what the USACE considered to be important habitats to be included for each individual transect. Table 5 lists the selected transects and their names.

**Table 5. Names of the 13 Selected Transects.**

| Transect | Name |
|---|---|
| Transect 1 | Democrat Point |
| Transect 2 | Ocean Beach |
| Transect 3 | Watch Hill |
| Transect 4 | Sunken Forest |
| Transect 5 | Wilderness Area |
| Transect 6 | Old Inlet |
| Transect 7 | Pikes Breach |
| Transect 8 | Moriches Inlet |
| Transect 9 | Westhampton Groin Field |
| Transect 10 | Tiana Beach |
| Transect 11 | WOSI Area |
| Transect 12 | Georgica Pond |
| Transect 13 | Sagaponak, Potato Road Vicinity |



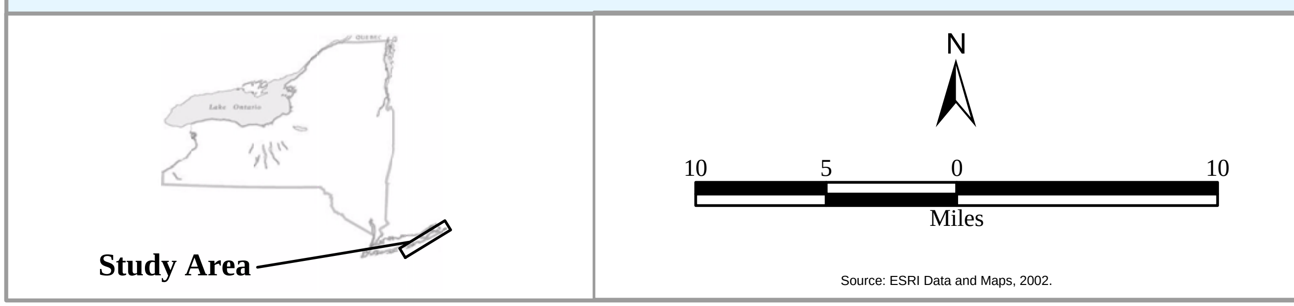




**Figure 2. Location of 13 Selected Transects for Fire Island to Montauk Point Reformulation Study.**

## 3.2 GROUND-TRUTHING 13 SELECTED TRANSECTS

To better suit the model, the USACE determined that it was necessary to further refine the cover type map in the 13 selected areas to more accurately depict habitat conditions at the time of the survey. To accomplish this task, these areas were field surveyed by the USACE.

Additionally, the 2001 Natural Color Digital Ortho-photo Quads that were available at the time of the survey were reviewed and used to augment the field survey. During the course of ground-truthing the USACE discovered two cover types that were not present in the Phase I cover type map: Fresh Water Wetlands and Coastal Ponds. Changes that resulted from the fieldwork, including line work and attribute codes, were added to the Phase I GIS database using ArcInfo 8.2.

## 3.3 UPDATE GIS DATABASE

The USACE walked or accessed by boat each of the selected 13 transects to obtain accurate field delineated cover type information. Changes to cover type boundaries were noted on hard copy maps. An extensive Aerial Photo Interpretation was also conducted to verify and update the existing data. Additional line work was digitized in ArcView 3.2 at a scale no greater than 1:5,000. The line shapefile was then converted to an ArcInfo Coverage using ArcInfo 8.2. The line coverage was then incorporated into the Phase I cover type map and topology was reestablished using the ArcInfo BUILD command. Metadata creation standards and Quality Assurance/Quality Control Procedures were adhered to as outlined in sections 2.4.2 and 2.4.3 above.

## 3.4 PROFILE VIEW METHODOLOGY

Profile view illustrations were created for each of the 13 Transect locations after updates to the cover type map were completed. These profiles were created so any user can view vegetation characteristics in combination with elevation in an easily understandable format to help simplify the decision making process. Figure 3 represents an idealized transect of ecosystems in the project area. Additional data processing and review was required to generate the data for the profiles. Below are the steps used to generate the required data and create the profile view illustrations.

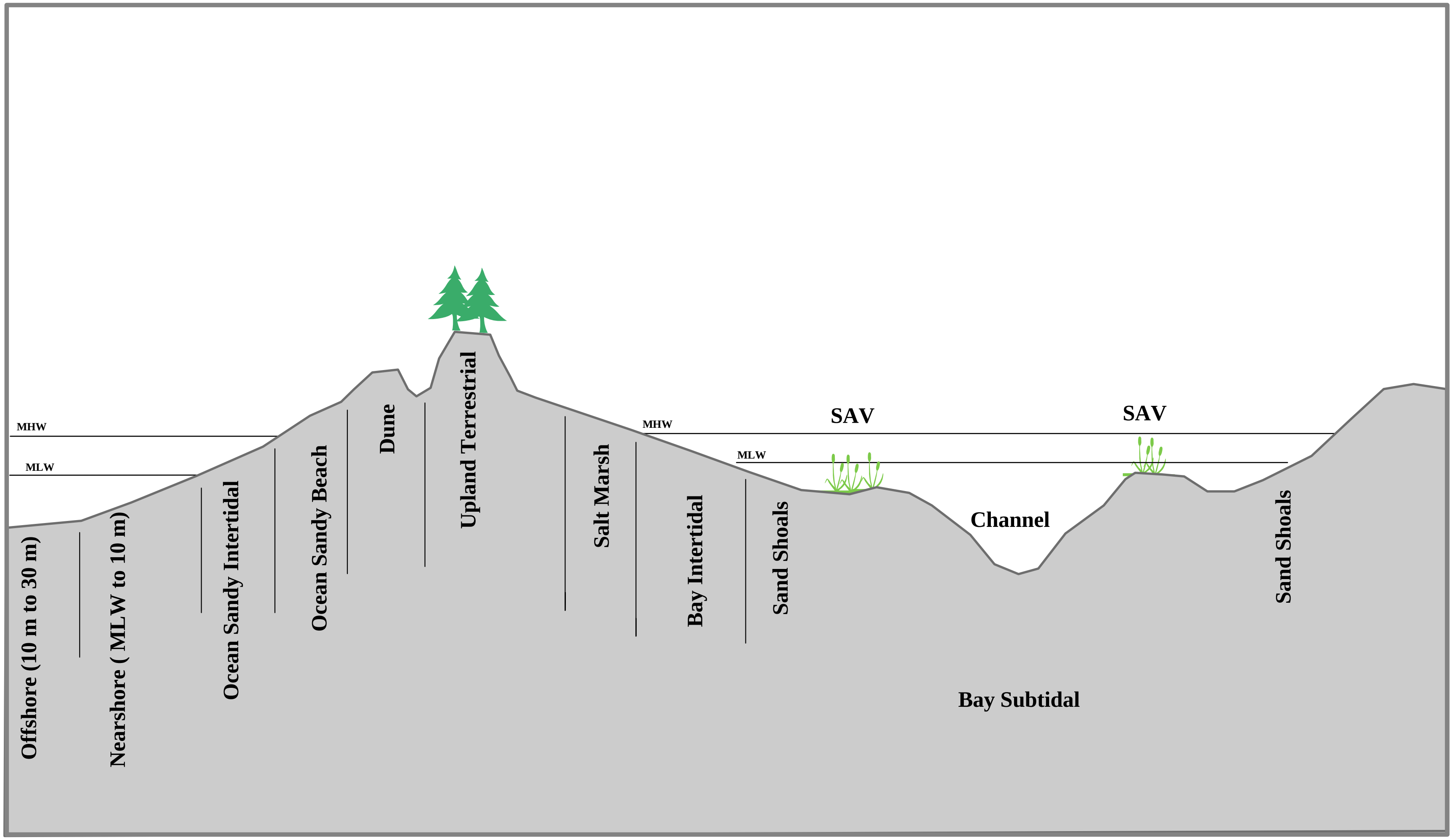
### 3.4.1 Table Creation

After updates to the cover type map were completed, tables with the distances of each cover type along each transect were generated by creating routes and using polygon events in ArcInfo 8.2. This process generated tables with the linear distances of each cover type crossed by the center of the transect.

### 3.4.2 Data Processing

As a result of the detail (scale and accuracy) of the cover type map it was necessary to process the data from the tables in order to simplify it for inclusion in the profile drawings. The following is a list of each step that was taken during this process.

- Data were rounded to the nearest 10-meter interval. Anything less than this would be less than 0.1 cm on the profile map and would be unreadable.
- Where CTYPEE and CTYPEV fields overlap, they were combined into one field to get a full description of the habitat type. See table 6 for all cover type combinations seen in the profile view maps.
- In some cases, if there was a reoccurring pattern between two cover types (UTERR, DEV, UTERR, DEV) then the distances were combined and shown as only two polygons. Only distances < 10 meters were combined
- Total distance was divided by 100 to convert meters to centimeters (distance on land to distance on paper).
- These tables were then visually compared to the full 30 meter wide swath covered by the transect on the cover type map to see if any critical habitat characteristics in the vicinity were omitted from the tables, i.e., not directly on the center line of the transect.




Drawing Not to Scale

**Figure 3. Idealized Transect of Ecosystems for Fire Island to Montauk Point Reformulation Study.**

**Table 6. Possible Cover Type Combinations in Profile View Maps.**

| CTYPEE | CTYPEV | COMBINED COVER TYPE |
|---|---|---|
| Offshore | None | Offshore |
| Nearshore | None | Nearshore |
| Sandy Intertidal Ocean | None | Sandy Intertidal Ocean |
| Sandy Beach | None | Sandy Beach |
| Dune Swale | Mixed Vegetation/*Phragmites*, Sand | Dune/Swale |
| Dune Swale | Upland Terrestrial | Dune/Swale/Upland Terrestrial, |
| Dune Swale | Disturbed | Dune/Swale/Disturbed |
| None | Mixed Vegetation/*Phragmites* | Mixed Vegetation/*Phragmites* |
| None | Maritime Forest | Maritime Forest |
| None | Upland Terrestrial | Upland Terrestrial |
| None | Disturbed | Disturbed |
| Intertidal Bay/None | Salt Marsh | Salt Marsh |
| Intertidal Bay | Sand Shoal/Mudflat | Intertidal Bay/Sand Shoal/Mudflat |
| Intertidal Bay | Open Water | Intertidal Bay/Open Water |
| Subtidal Bay | Open Water | Subtidal Bay/Open Water |
| Subtidal Bay | Submerged Aquatic Vegetation | Subtidal Bay/ Submerged Aquatic Vegetation |
| None | Coastal Pond | Coastal Pond |
| None | Fresh Water Wetland | Fresh Water Wetland |
| Inlet | None | Inlet |

### 3.4.3 Horizontal Scale

It was technically not possible to show different distances on the same page size at the same scale because of differences in the size of the geographic area covered, the size of the paper, and the scale of the drawing. Two of these things can be constant but not all three. The following options were assessed to determine the horizontal scale:

1. Use 11 x 17 inch paper for each drawing, show exactly the same data on each map (from offshore to landward edge of bay where there is no change in cover type), and change the scale to fit the data.

2. Use 11 x 17 inch paper for each drawing, show different data on each map (i.e., show as much or as little of the offshore zone, nearshore zone, and the bay as needed), and leave the scale as a constant.

3. Use different paper sizes but show the same data on each map at the same scale.

4. Use 11 x 17 inch paper or 8 ½ x 11 inch paper depending on the transect length. Show different data on each map (Show as much or as little of the offshore zone and the bay as needed), and leave the scale as a constant.

The USACE decided to use a combination of options 1 and 2, as that was the best way to show the variation in cover types along transects of varying lengths. The horizontal scale of the profile view maps is as follows:

- ✓ Use 11 x 17 inch paper for each drawing, show as much or as little of the Nearshore zone, and the bay as needed, and change the scale to fit the data. All transects are displayed only to the inner extent of the offshore zone so that the variation of cover types on the barrier island can be seen in more detail.

### 3.4.4 Vertical Scale

The vertical scale of the illustrations was set based on the difference in elevation between different cover types. Table 7 depicts the elevation range that different cover types would be found at on Fire Island.

Some of the cover types have absolute elevation data inherent in their definition, i.e., Offshore, Nearshore, and Intertidal. For cover types that have only relative elevations, i.e., elevation is higher or lower than another cover type but no absolute elevation was previously defined, additional data was reviewed to obtain absolute elevations where possible. Additional data sources reviewed include Channel Data, Nautical Charts, and LIDAR Data. In cases where there was no elevation data available, the elevation of the cover type was drawn as the average between the surrounding cover types.

### 3.4.5 Profile View Illustrations

Profile view illustrations were created using Adobe Illustrator 10. A blank template, at a scale of 1 cm = 100 meters, was created as a starting point. Using the data from the tables generated from the cover type map, vertical lines were drawn on the template to denote the horizontal distances of each cover type. After the horizontal distances of the cover types were drawn in, each profile was assessed to choose which scale would be best for each individual profile. There were a total of three different scales used for the profiles: 1 cm = 100 meters, 1 cm = 50 meters, and 1 cm = 25

**Table 7. Elevation Ranges of Different Cover Types On Fire Island.**

| UPDATES COVER TYPE | ELEVATION RANGE OR RELATIVE ELEVATION |
|---|---|
| Salt Marsh | Within Intertidal Zones |
| Maritime Forest | Above Mixed Vegetation/*Phragmites*, Below Terrestrial Upland |
| Mixed Vegetation/*Phragmites* | Above Salt Marsh, Below Maritime Forest |
| Submerged Aquatic Vegetation | MLW to depths of up to -4 m MSL |
| Terrestrial Upland | Highest vegetation cover type; disturbed, could be higher |
| Sand | Subtidal, Intertidal, Dune |
| Sand Shoal/Mud Flat | Subtidal, Intertidal, lower than Salt Marsh |
| Intertidal Bay | TBD – Higher than Subtidal Bay |
| Subtidal Bay | TBD – lower than Intertidal Bay |
| Marine Sandy Intertidal | -1.7 to 1.7 MSL |
| Nearshore Zone | -30 m to -7 m MSL |
| Offshore Zone | -30 m and lower MSL |
| Dune/Swale | Above Sandy Beach |
| Sandy Beach | Above Intertidal/Below Dune |
| Disturbed Land | Higher than Intertidal |
| Unknown/Private | Higher than Intertidal |
| Inlet | Same as Intertidal Ocean |

meters. The selected scale of each profile was based on the variation in the cover types and the length of the transect.

Because of the different variations of cover types and the different lengths from transect to transect, a few other modifications had to be made to fit each profile on 11 x 17 inch paper at the selected scale. All transects are displayed only to the inner extent of the offshore zone so that the variation of cover types on the barrier island can be seen in more detail. The nearshore zone and subtidal bay are frequently not shown to scale. There also is one instance where Submerged Aquatic Vegetation is not shown to scale (transect 11). Wherever a cover type is not shown to scale, a note was added above it with the actual distance.

After all horizontal distances of the cover types were drawn in for each transect at the selected scales, elevation data was used to create a surface contour. For a list of elevation data, see section 4.4 above. The elevation contour shows water depths for open water cover types (Offshore, Nearshore, intertidal ocean, salt marsh, inlet, coastal pond, and all intertidal and subtidal bay cover type combinations) and elevations for landmasses (sandy beach, all dune/swale cover type combinations, mixed vegetation, and disturbed).

Completed profile view transects were reviewed by the USACE Project Biologist for accuracy and usefulness. After the USACE review, minor updates cover types, distances of cover types, and elevation were incorporated first into the profile view illustrations, and subsequently into the plan view cover type maps. These updates are not necessarily based on actual ground conditions, but on what important characteristics needed to be shown in each transect area for use in the conceptual model.

## 4.0 CONCLUSIONS

The profile view illustrations were created as a tool to be used with the conceptual model. Though data is accurate as per this scope, it is not intended for other uses. The transects actually represent a composite of a larger area (approximately 100 meters wide). This was done to give an overall impression of the general area, e.g., if a fresh water wetland existed nearby it was included. The profile view transects were simplified to facilitate a better understanding of the entire study area, and these transect areas in particular.

## 5.0 REFERENCES

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