

Tidal Marsh Qualitative Shoreline Survey

Barnegat Bay Partnership

Effective 1/2015 to 1/2021

Project Manager: Erin Reilly

QA Manager: James Vasslides

Version1.0 July 22 2015

Table of Contents	Page
2.0 Table of Contents	2
3.0 Distribution List	3
4.0 Project/Task Organization	3
5.0 Special Training Needs/Certification	4
6.0 Problem definition/Background	4
7.0 Project/Task Description	5
8.0 Quality Objectives and Criteria for Measurement Data	6
8.1 Precision	6
8.2 Bias	6
8.3 Representativeness	6
8.4 Comparability	7
8.5 Completeness	7
8.6 Sensitivity	7
9.0 Non Direct Measurement	7
10.0 Field Monitoring Requirements	7
10.1 Monitoring Process Design	7
10.2 Monitoring Methods	8
10.3 Field Quality Control	8
11.0 Analytical Requirements	8
11.1 Analytical Methods	8
11.2 Analytical Quality Control	8
12.0 Sample Handling and Custody Requirements	8
13.0 Testing, Inspection, Maintenance and Calibration Requirements	8
13.1 Instrument/Equipment Testing, Inspection, and Maintenance	8
13.2 Instrument/Equipment Calibration and Frequency	8
13.3 Inspection/Acceptance of Supplies and Consumables	8
14.0 Data Management	8
15.0 Assessments/Oversight	9
16.0 Data Review, Verification, Validation, Usability	9
16.1 Data Review, Verification and Validation	9
16.2 Reconciliation with User Requirements	9
17.0 Reporting, Documents and Records	9
18.0 References	10
Appendix A: National Wetlands Inventory maps for Barnegat Bay	11
Appendix B: Datasheet for Paper Surveyors	16
Appendix C: Training manual (in attached file)	

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1.0 Project Organization

As project manager, Erin will conduct the training of volunteers with assistance from BBP staff as needed. Erin will also be selecting and assigning sections of marsh to volunteers with the input of the Barnegat Bay Partnership Assistant Director Martha Maxwell Doyle. Data will be checked after collection by Erin, Martha or other BBP staff. Jim Vasslides will be responsible for ensuring that the proper QA/QC procedures are being followed by BBP staff and that data checking occurs each year.



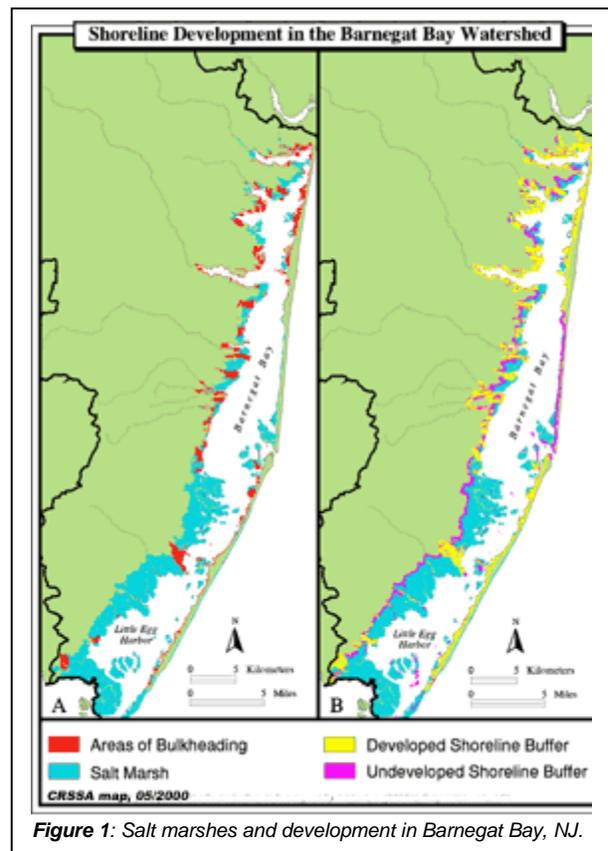
2.0 Special Training Needs/Certification:

There are no special certifications required for this project. Volunteers will be required to attend a training that will focus on terminology and use of the software used to collect data before having the ability to enter data into the system. After the pilot project, a discussion among BBP staff will occur to determine if volunteers will need to be trained each year taking into consideration the success of the pilot project as well as any changes that need to be made to the data being collected or the SOP. The BBP will maintain an internal list of those who have attended training.

3.0 Problem Definition/Background:

Fringing tidal marshes provide critical ecosystem services such as flood protection, carbon sequestration, food and habitat for fish and wildlife, and water quality enhancement. Fully functioning tidal marshes provide a critical line of defense to our coastal communities and sequester more carbon than any other habitat in our region. Losses of marshes have a “doubling effect” on carbon dioxide levels in the atmosphere, because marsh losses (1) increase the atmospheric carbon dioxide as the decaying marsh is metabolized by bacteria and (2) decrease future carbon sequestration from the atmosphere into wetlands.

The Barnegat Bay is a shallow lagoonal estuarine system, typical of estuaries along the Atlantic coast of New Jersey. In the Barnegat Bay estuary, most tidal wetlands have experienced significant human impacts and modifications over the last 100 years. It is clear that Barnegat Bay is losing salt marsh acreage at a rapid pace. Over 28% of Barnegat Bay's marshes have been lost to development; most of those wetland loss occurring between 1940 and 1970. Approximately 950 kilometers (590 miles) of parallel grid mosquito control ditches occur throughout roughly two-thirds of Barnegat marshes. Additionally, 71% (10,729 acres) of Barnegat buffer zones are presently developed and/or altered, leaving only 29% (4,406 acres) in natural land cover. Perhaps the most telling indicator of development shows that almost half (45%) of Barnegat Bay's shoreline is impacted by bulk-heading, (Lathrop et al. 1996, 2007; Figure 1). Tidal wetlands throughout the Bay continue to be lost and are increasingly threatened by ongoing development, degradation, sea level rise, sudden marsh dieback, and other factors (Lathrop 2007, PDE 2008).



In the 2012-2016 Strategic Plan, the Barnegat Bay Partnership prioritized tidal wetland assessment, protection and research. The core piece of this focus was the development and implementation of the Mid Atlantic Coastal Wetlands Assessment (MACWA), a 4 tiered approach to

assess New Jersey's wetlands from the landscape level to the site specific level. Through the course of the MACWA monitoring, shoreline retreat and erosion of marsh areas was identified as a significant issue in the Barnegat Bay. This has been confirmed by other remote sensing studies occurring throughout the bay comparing historical shorelines to present day ones (*unpublished data*). Remote sensing, while useful to indicate large scale, long term changes, is unable to describe the current condition of a shoreline edge in the way that direct observation can. Through direct observation of shoreline edges, it is possible to identify areas that are currently showing signs of erosion, classify physical, biological, or anthropogenic characteristics of banks that may prevent or contribute to erosion, and evaluate the ecological functionality of the edge.

The goal of this project is to evaluate the state of tidal saltmarsh shorelines across the entire bay on a rotating 3 year cycle; after 6 years long term trends may be analyzed. The initial period (June 2015) will be considered a pilot project to evaluate the feasibility and quality of the data collected. Each year one third of the bay will be surveyed, and the fourth year (2018), the sections of the bay that were surveyed in 2015 will be surveyed again.

4.0 Project Description:

Conducting a comprehensive survey of wetland shorelines for the entire Barnegat Bay would be an enormous task for any single organization to do on its own. Because of the large scale of this project the Barnegat Bay Partnership proposes to create this survey as an annual citizen science data collection project. By involving the community and providing the tools to increase the quality of the data collected and assist in its interpretation, it is possible to promote education and environmental stewardship while collecting useful data. Prior to any data collection, volunteers will undergo training in scientific terms and how to use the data collection software. After completing the training, volunteers will be assigned a section of the bay to survey and given a timeframe to conduct the survey. Areas to be surveyed over the course of a 3 year cycle were determined based on the National Wetlands Inventory conducted by USFWS (Appendix A). Volunteers may be given additional sections to survey during the event's timeframe after they successfully survey their first section.

Data collection will be done via the ESRI ArcGIS Collector App available for free on any smartphone, or using paper datasheets provided by the BBP (Appendix B). To complete their assigned section, volunteers will paddle or boat to their assignment and take random points every 30 m (100 ft.) along the shoreline. At each point along the shoreline, volunteers are asked about the condition of a 3m (10 ft.) segment of the shoreline. All answers are in a prescribed format with the exception of questions about the depth and recreational use of the area; these questions ask for integer values. A photo of the shoreline segment is also requested. Data from the ESRI Collector App are automatically entered into a database in real time. Data collected using the datasheets method will be entered into the database by BBP staff. A number of shoreline protocols and peer reviewed lists of wetland indicators were used to develop survey questions including: MidTRAM v3.0, Atlantic Slope Consortium, and the Comprehensive Coastal Inventory Program. The indicators used to develop the survey questions were focused on biological and physical edge processes that could be observed from the water and recreational use of the area. The resulting questions are largely qualitative and possible answers are given to simplify the data collection process, create a 'data dictionary' for quality control purposes, and allow for wide public participation.

Training and data collection will occur in the early summer. During mid-summer to early fall, 10% of the points collected will be revisited or analyzed using the attached photos by BBP staff. Data entry and analysis will take place in the fall/winter of each year. The first year of this project will act as a pilot study to refine the use of the technology, protocols, and survey questions. Following the pilot, it is hoped to survey all of the marsh shorelines in Barnegat Bay within 3 years, and have each section surveyed on a triennial basis.

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
2015					Training/Data Collection			Point visit & photo analysis		Data Analysis		
2016	Evaluation of pilot				Training/Data Collection			Point visit & photo analysis		Data Analysis		
2017					Training/Data Collection			Point visit & photo analysis		Data Analysis		
2018	Report on Baywide survey				Training/Data Collection			Point visit & photo analysis		Data Analysis		
2019					Training/Data Collection			Point visit & photo analysis		Data Analysis		
2020					Training/Data Collection			Point visit & photo analysis		Data Analysis		
2021	Report on Baywide Survey				Training/Data Collection			Point visit & photo analysis		Data Analysis		

5.0 Quality Objectives and Criteria:

5.1 Precision: The objectives of this shoreline survey are to evaluate the edge of salt marsh habitats in the Barnegat Bay watershed. Because the goals are to gain a sense of the condition/character of the shoreline, almost all of the data are structured qualitatively with prescribed answers to reduce variability in responses. The one measured value, location, will be measured by phone, handheld GPS or maritime navigation system. GPS locations determined via smartphone in the collector app are required to have a 5m accuracy before points are able to be taken. Most widely available geopositioning devices (smartphones, GPS, navigation systems) have accuracy between 5m and 8m in an area without canopy interference (Zandenbergh and Barbeau 2011). As this study is looking qualitatively at the condition of the shoreline, it is not necessary to return to the exact point; as such, the 5-8m accuracy is sufficient. Only the questions about structures would require strong locational precision and any of the structures of interest should be visible from 8m away.

5.2 Bias: Systematic or persistent distortion of a measurement process causing errors in one direction (bias) is not anticipated for this project. Volunteers will be trained in proper methodology as one way of limiting bias. Anyone wishing to be a data collector is required to go to a training conducted by the BBP staff. This mechanism is built into the ESRI collector software by requiring a username and subscription. Having BBP staff revisit or use photo analysis of 10% of collected points will ensure that the results are not biased by any individual or team.

5.3 Representativeness: Representativeness is the degree that the data collected represent the characteristics of the system investigated. This study seeks to find broad trends by waterway, and assigns

volunteers to a specific section of that waterway, where points are then taken semi-randomly along the shore. Because data is available in real time, it is possible to assign a second volunteer to an area if it is found that the variability is quite large or that a specific team of volunteers is taking points at a large distance. The first year of the project is designed to be a pilot study so the data collected from that year may inform changes to the sampling design for future years.

5.4 Comparability: Data comparability is an expression of the confidence with which one data set can be compared with another. Many of the questions for the survey are based off of other surveying programs and may be able to be compared. Seasonality may affect answers to the vegetation questions and the recreational use questions. At the moment the survey is designed to capture the marsh before peak growing season, but during summer months when recreational use is higher. If the survey were to be completed in the fall or winter, these factors would not prevent the data from being used, but would need to be noted and considered during data analysis.

5.5 Completeness: Assignments are given in 1 km increments with a goal of getting 30 points in that 1 km section of shoreline. For the purposes of the pilot study, assignments will be considered complete if 20 points are collected for each 1 km assignment. After reviewing the data from the pilot project the threshold for completeness may be revised.

5.6 Sensitivity: There is only one quantitative measurement taken in this project, the height of the bank. The sensitivity of this measurement is ± 1 in. The rest of the metrics are designed as simple presence/absence questions. The project has been designed in such a way that all metrics can be detected by a person trained to use the terminology and indicators.

6.0 Non-Direct Measurement:

There are no secondary data utilized as part of this project.

7.0 Field Monitoring Requirements:

7.1 Monitoring Process Design: Wetlands in the Barnegat Bay Watershed as tidal salt marsh habitat were identified from the National Wetlands Inventory. These maps can be found in Appendix A. These wetlands were then divided into sections approximately 1 km in length as measured along the shoreline except where the salt marsh shoreline is less than 1 km long. Trained volunteers will be assigned one or two of these sections depending on size of the shoreline section and accessibility. Volunteers are asked to take random points every 30 m or so along the shoreline of each section during a specified time window. For the pilot, this will encompass 9 days, though this may be expanded in subsequent years to no more than 16 days. These points will be taken via the ESRI Collector application off of the volunteer's smart phone which automatically logs GPS position within 5m of accuracy. If volunteers do not wish to use smart phones they are asked to record their position using a recreational or boating GPS. Most widely available geopositioning devices (smartphones, GPS, navigation systems) have accuracy between 5m and 8m in an area without canopy interference (Zandenberg and Barbeau 2011). The data form includes questions about tidal stage and weather to reduce variation due to temporal variability. The limited timeframe (9 – 16 days) that the form is available for data entry is designed to reduce seasonal variability.

7.2 Monitoring Methods: Training will occur before sampling. During training, volunteers are walked through the process step by step of taking a point on their smart phones with the Collector Application. They are also walked through the standard operating procedures such as distance between points, how large a section of shoreline they are examining, etc. The Training ends with definitions and examples of different terms and conditions that they are being asked about. Volunteers are given a training manual that details all aspects of the training to refer back to if there are questions. Sampling will follow the protocols set in the Training Manual which are attached in Appendix C. Because this project is designed as a qualitative citizen science survey, there are limited equipment requirements. Volunteers will need their smartphones with the collector app installed or paper data sheets in addition to a personal kayak, canoe, or paddleboard equipment and safety gear. Volunteers will be instructed at training to leave questions blank if they are not sure of the answers, to indicate any issues in the comments section of the form, or as a last resort to call or e-mail the project manager. Volunteers will also be given a paper copy of the form to refer to if necessary. The process of taking a point using the ESRI collector application has been tested by multiple members of the BBP staff on different phones and will also be tested by volunteers at training. The ESRI Collector application is a free app developed by ESRI that allows users to input point based geolocated information into a map and form designed by a subscriber. The Barnegat Bay Partnership purchased a subscription and will create a form in ArcMap to collect the data specific to this project. Access to the map and form, and subsequently the ability to create points can and will be limited to those whom the Barnegat Bay Partnership gives permission, limiting the survey to those who have undergone training.

7.3 Field Quality Control: Volunteers will be collecting visual data by looking at the shoreline and inputting the data into an electronic application on their phone. All questions have prescribed possible answers and automatic null values to indicate whether questions were answered. GPS locations will be plotted and examined to determine if they fall within the assigned segment. One of the questions on the survey, “Name the body of water” also serves as a way to ensure that the locations are correct.

8.0 Analytical Requirements:

8.1 Analytical Methods/Analytical Quality Control: All measurements and sampling data are collected and processed in the field. There are no analytical laboratory methods performed for this project; therefore, the use of blanks and standards is not appropriate.

9.0 Sample Handling and Custody Requirements: Since no samples are taken in this project there are no logistics of sample care to detail. .

10.0 Testing, Inspection, Maintenance and Calibration Requirements: This project requires no equipment that needs to be calibrated or inspected.

11.0 Data Management

Data collected using the smart phone form is automatically entered in real time into a database housed on ESRI’s arcgis.com cloud. Each subscriber can only edit their own points. At the conclusion of the data collection period, the data will be downloaded from the cloud and backed up on servers at the Barnegat Bay Partnership where they will be stored for archiving. Paper copies of the datasheets (found in Appendix B) are returned to the Barnegat Bay Partnership by volunteers. These datasheets will be

entered into the database by BBP staff within one week of collection and maintained there. All data will be spot checked for completeness and accuracy by the QA manager.

12.0 Assessments/Oversight

Volunteers will be instructed to contact the Project Manager if there are any issues while collecting data. These issues will be noted and fixed where possible. If issues or tips develop that could negatively impact or improve data collection by everyone, these will be shared with Volunteers as the project progresses. If there are any paper forms, following manual entry, the QA/QC officer will check 10% of the sheets to ensure they were entered correctly. Following the completion of the pilot project and the data collection period each subsequent year, the project manager, QA officer and science staff will meet to evaluate the project, identify shortcomings and deviations from the QAPP and ways to correct these issues in the future.

13.0 Data Review, Verification, Validation, Usability

13.1 Data Review, Verification, and Validation: Data verification will be completed by BBP staff as they check 10% of the collected points via site visitations or examining point photographs. Points that are not completely filled out will be flagged. Photos will be analyzed to see if incomplete data can be obtained from the visual record. If the photos do not provide sufficient evidence then incomplete points may be omitted from some of the data analyses; incompleteness does not automatically disqualify a point from all analyses. Records of incomplete points will be maintained.

13.2 Reconciliation with User Requirements: Following completion of data verification and validation, the Project Manager and QA Officer will meet to discuss if parts of any data need to be adjusted or discarded during data analysis or data sharing because of errors. Any alterations to data will be noted and disclosed to those using the data. The Project Manager and QA Officer will also discuss if there are any data quality issues that prevent the data from being used, and if the data is sufficient for its intended purpose of evaluating the state of the shorelines in Barnegat Bay. Reasons that may limit the data from being used as intended may include incomplete points, too few points per assignment, or frequent issues with data verification.

A long term bay wide evaluation of the condition of marsh shorelines has many possible additional uses. Any additional use of the data will need to separately evaluate whether the data collected via this QAPP meets the requirements for that particular use.

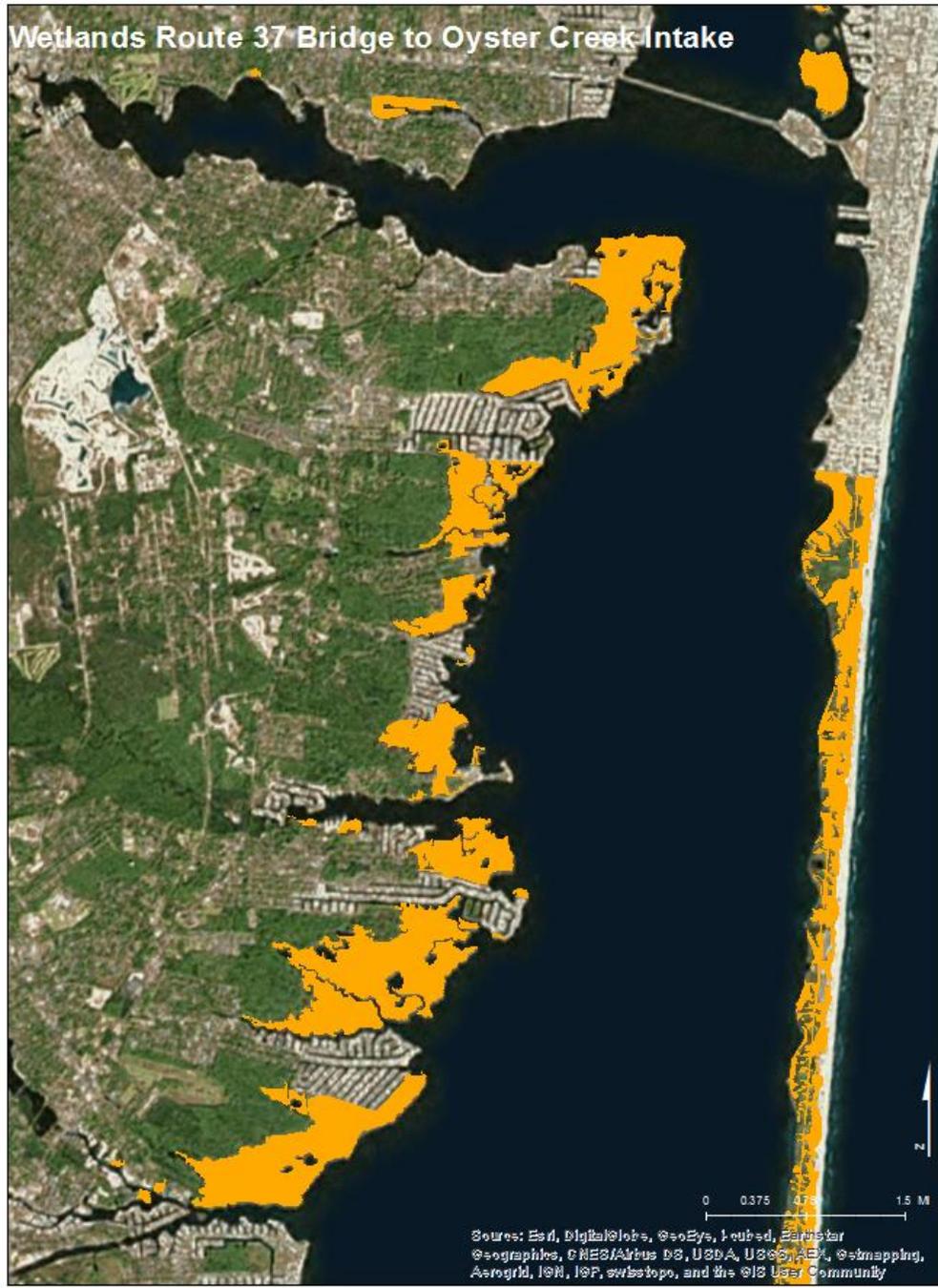
14.0 Reporting, Documents and Records: Raw and final electronic data will be stored on a server that is maintained and backed up every evening by Ocean County College. Electronic copies of the database will be used for data analysis so the original data remain uncompromised. Original paper datasheets will be maintained at the BBP offices. All data (electronic and paper) will be held for a minimum of 5 years after completion of a full survey cycle. Upon request electronic or paper copies of data will be given to partners. Exceptions to immediate release of the data will be made if data is being used as the basis for publication in peer-reviewed journals. A final report will be prepared at the end of the pilot project and each time the complete watershed is surveyed (approximately 3 years). Interim reports may be produced either internally or for partner distribution as necessary.

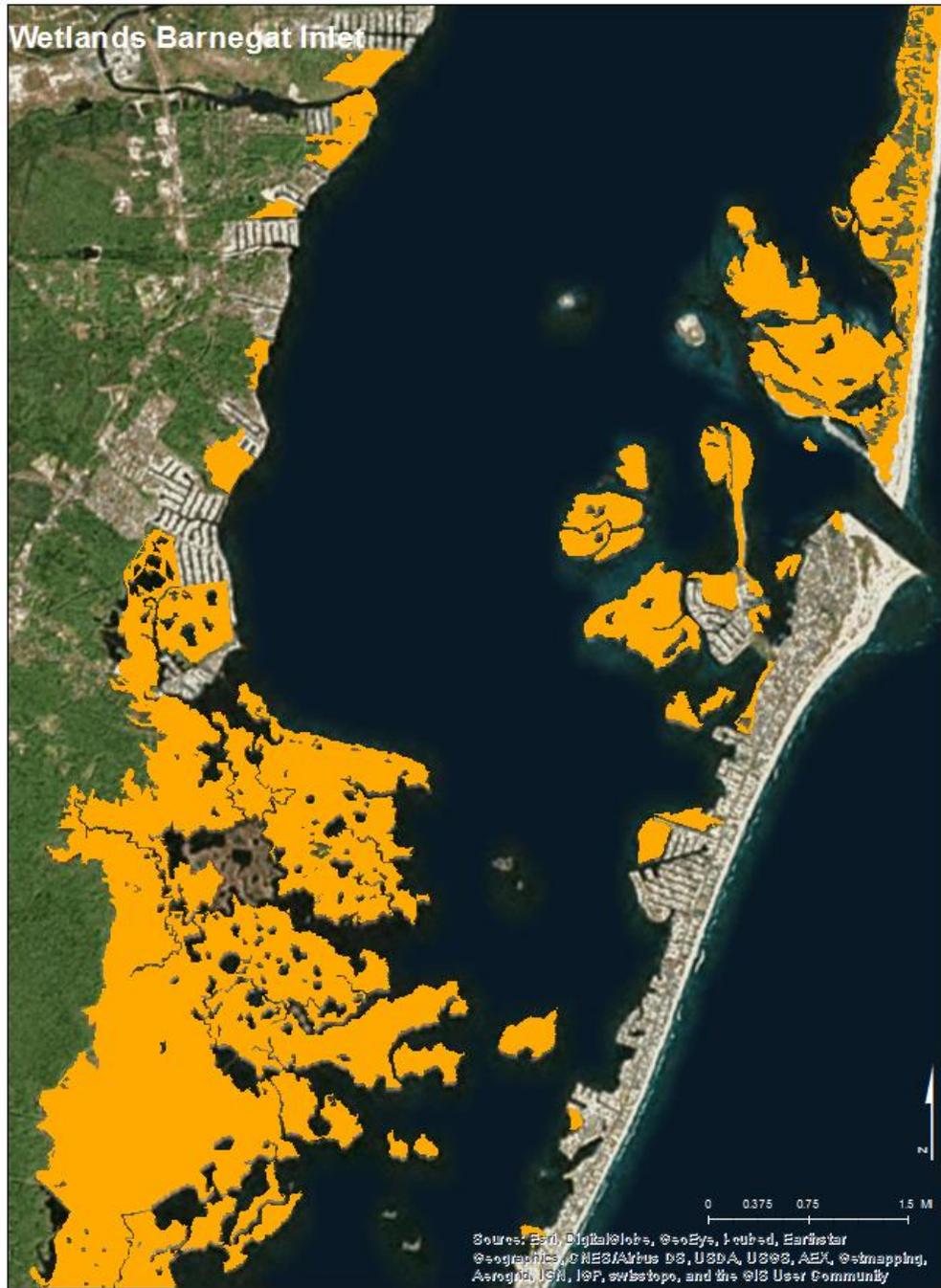
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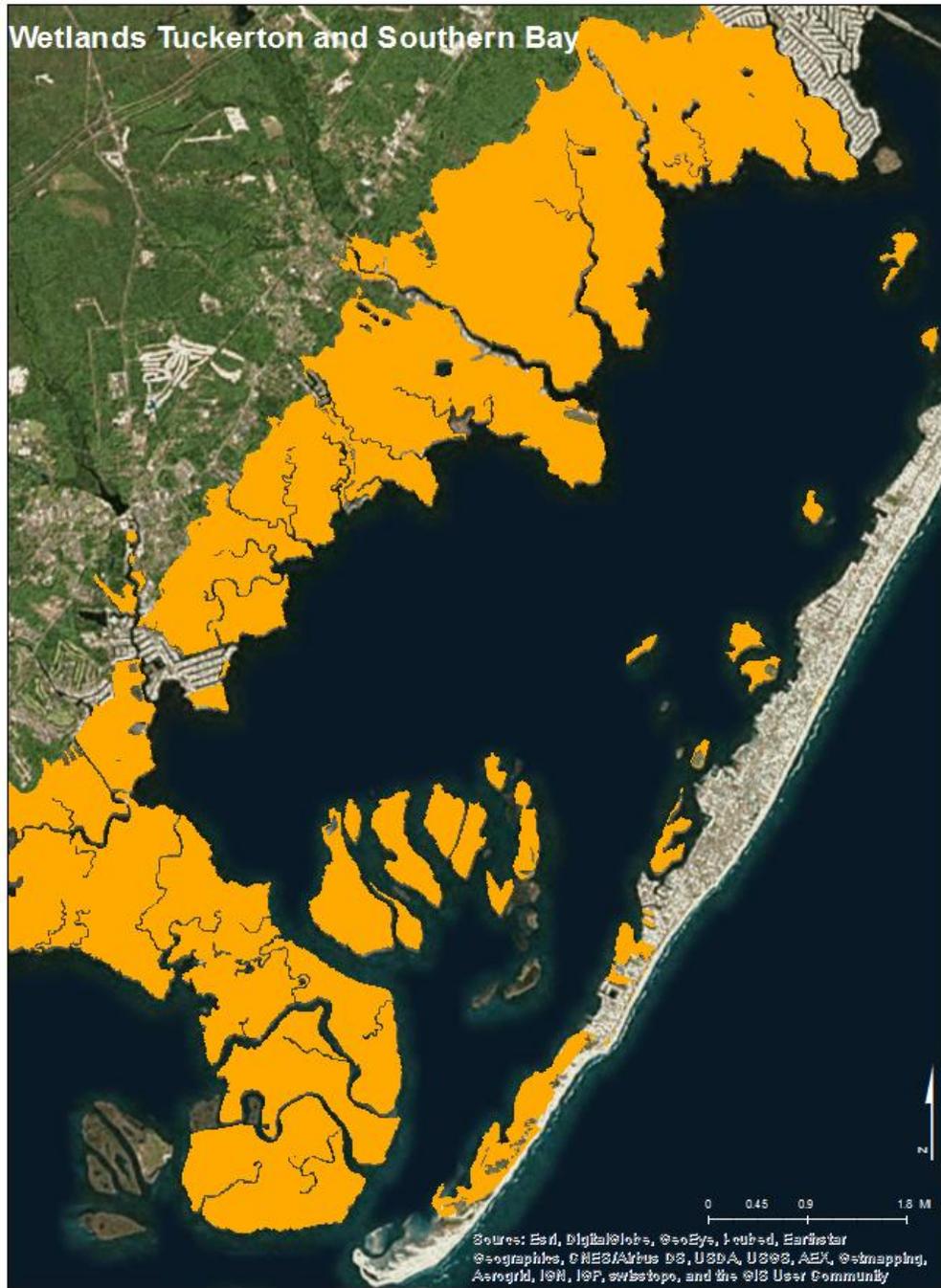
Appendix A: National Wetlands Inventory maps for Barnegat Bay











Appendix B: Data Sheet

Names of Surveyors: _____ Date: _____ Time: _____
 Name of Body of Water: _____ Point _____ of _____
 Photo Number: _____
 Tide: Slack High Ebb Slack Low Flood

Depth from Marsh Surface: _____
 Looking behind the edge, is the area: Undeveloped Mostly Residential Mostly Commercial
 Latitude (EX: 39°XX'XX.XX"N): _____ Longitude (EX: 74°XX'XX.XX"W): _____

VEGETATION (In the 10 ft section):

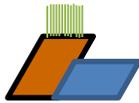
At your point, is the edge: Mostly Vegetated Mostly Hardened Mostly Bare Soil/Sand
 Describe the edge plants? TREES/BUSHES TALL GRASS (>1ft) SHORT GRASS (<1ft) PHRAGMITES

ANIMALS (In the 10 ft section):

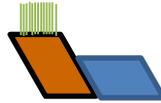
Estimate the number of Mussels you see: 0 1-10 10-100 100-1,000
 How are the Mussels distributed: SINGLES CLUMPED CONTINUOUS
 How Many Fiddler Crab burrows do you see: 0 1 or 2 Up to 10 LOOKS LIKE SWISS CHEESE
 Do you see any crabs on the bank? YES NO

EROSION (In the 10 ft section):

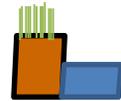
Describe the slope of the bank:



Undercutting



Washing Over



Perpendicular

Do you see any of the signs below:

Bare Soil Roots of Edge Plants Fragmented clumps of grass
 Cantilevered Banks Chunks or pieces of marsh in the water

STRUCTURES (In line of sight):

Do you see any manmade structures? YES NO
 What kind of structure do you see?
 RIPRAP BEACH BULKHEAD GRAVEL GROIN/JETTY PILINGS
 BARGE PIER MARINA BOAT RAMP
 What condition is the structure in? MAINTAINED FALLING APART REMNANT

Do you see any manmade ditches? YES NO If so, how many? _____

USE (In line of sight):

Do you see litter? YES NO
 How many people did you see doing each activity in the immediate vicinity?
 CRABBING/FISHING _____ BOATING(Motor) _____ SWIMMING/WADING/WALKING _____
 PADDLING/SAILING _____ JET SKIING _____ OTHER _____
 Do you see people on the marsh? YES NO

Additional Comments about the site:

Appendix C: Training Manual