



ENVIRONMENTAL RESOURCE INVENTORY

FOR THE BOROUGH OF BAY HEAD

February 2021



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1 INTRODUCTION

1.1 What is an ERI?

This **Environmental Resource Inventory** (ERI) is a compilation of text and visual information about the natural resource characteristics and environmental features in the Borough of Bay Head including the infrastructure and man-made physical features of the Borough. The ERI, also called a *Natural Resource Inventory* (NRI), or *Index of Natural Resources*, provides a comprehensive and integrated collection of data previously available from multiple independent sources. As such, the ERI provides baseline documentation for measuring and evaluating resource maintenance and protection issues in Bay Head, now and in the future.

An important goal of this inventory is to provide an in-depth reference source and index of features and their functions, rather than providing recommendation, interpretation, or planning objectives. As such, this ERI includes text, maps, tables, figures, and graphics that describe and compare information on the natural and environmental characteristics and physical features of Bay Head.

This ERI for Bay Head is expected to be a dynamic document that will be extended and revised over time as new information is collected and circumstances change. It is further hoped that this document will facilitate a better understanding and appreciation of the environmental resources in Bay Head, and thereby encourage the protection and appropriate use of these resources in the future.

The *Bay Head Environmental Commission* (BHEC) would like to recognize all those who assisted in preparing this inventory and to especially thank Courtney Jacobs for her hard work, dedication, and leadership in authoring this report.

1.2 About the Borough of Bay Head

The Borough of Bay Head is a seasonal shore community located in the northeast corner of Ocean County.

Bordered by Point Pleasant Beach, Point Pleasant Borough, Barnegat Bay, Mantoloking, and the Atlantic Ocean, Bay Head is situated entirely on the Barnegat Bay Peninsula (colloquially called the “Barrier Island”) and is disconnected from the mainland by the Point Pleasant Canal and Bay Head Harbor/ Barnegat Bay to the west.

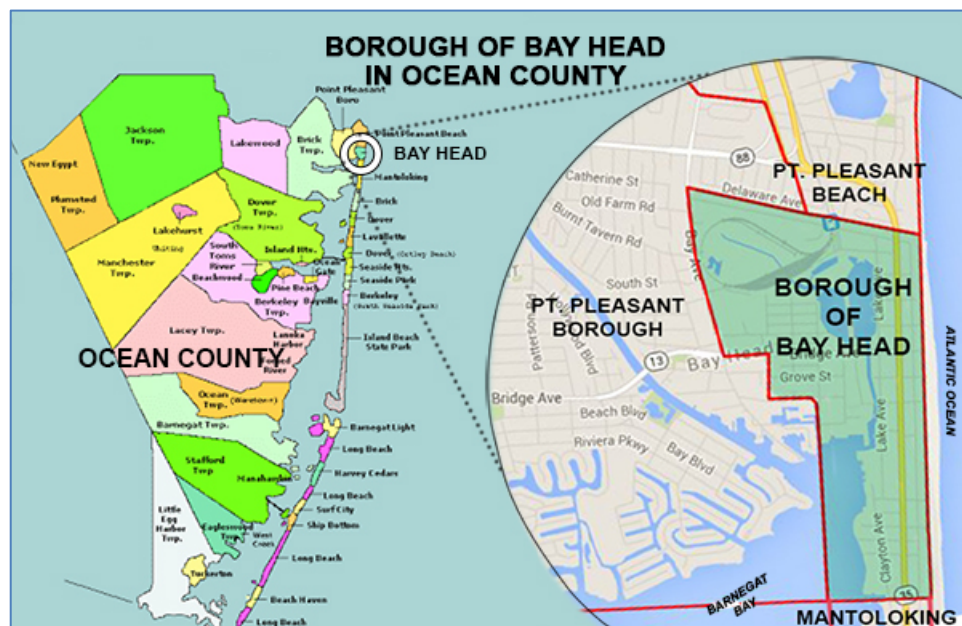


Figure 1. Ocean County and the Borough of Bay Head.

Bay Head’s name itself is a concise description: the place which it designates lies at the head of Barnegat Bay, New Jersey’s premier inland water body.

A predominant physiographical characteristic of Bay Head is water. In addition to frontage along the Atlantic Ocean and Barnegat Bay, Bay Head is also the home of Twilight Lake and Scow Ditch, a narrow channel which connects the brackish waters of Twilight Lake to the Bay. Bay Head's natural resources are both beautiful and environmentally sensitive, instilling within the Bay Head community both an appreciation of these surroundings and an awareness of the need to preserve and protect them.

Bay Head has approximately 1,000 year-round residents, four churches, three hotels/B&B's, a public library, and an award-winning K through 8th grade elementary school. The Borough maintains its own Police and Fire Departments as well as a Public Works and recycling center facility. The residences are primarily of detached single-family structures, many dating to before the mid-1900's. With over 550 historically significant structures, Bay Head has one of the largest historic districts in New Jersey.

Bay Head has two small commercial districts that offer over 40 specialty shops that provide goods and services, comfortable inns and hotels, and a range of dining choices. Bordered by Twilight Lake on the north, the shops and restaurants in the town center of Bay Head are the primary focal point of Bay Head's commercial activity.

During the summer months, Bay Head's quiet beaches, quaint shops, charming historic district, and natural resources make Bay Head a popular vacation destination for visitors and for summer residents owning a second home. Recently, Bay Head has also attracted younger families wishing to exit urban settings and enabled to work remotely by means of virtual communication technology.

1.3 Changes in the Natural Environment Through Time

The Borough of Bay Head's coastal location on a barrier island has subjected it to the impact of hurricanes, tropical storms, and nor'easters. These storms over the years have resulted in wind-driven movement in the bodies of water of the Borough, surges of water above normal tidal cycles, and overall high-water levels. Moreover, some events have resulted in significant flooding and shifts in natural features such as dunes and shorelines which has in-turn, naturally altered the Bay Head landscape over time.

Table 1 provides a historical timeline of hurricanes and other tropical storms in Bay Head, beginning with the founding of the Borough in 1886, providing insight into some of the prominent natural forces which have shaped Bay Head's natural environment.¹

Table 1. Historical Storms in Bay Head, NJ.

Date	Storm	Details
September 10, 1889	Hurricane	Stalled offshore with resultant high winds and beach erosion due to high tides.
August 24, 1893	Hurricane	Passed along the coast producing strong winds and heavy rainfall.
September 16, 1903	Hurricane Vagabond	Made landfall at Atlantic City with winds of over 75 mph; strong surf caused erosion but limited damage due to minimal construction in the area.
August 23, 1933	Hurricane	Made landfall in North Carolina and produced heavy rainfall, high waves and hurricane-force wind gusts.
September 19, 1936	Hurricane	Offshore Category 2 hurricane which cause severe beach erosion along the coast.
September 21, 1938	Hurricane Long Island Express	Caused winds of up to 100 mph and powerful waves along the entire coastline.
August 1, 1944	Tropical Storm	Caused severe beach erosion and high tides.
September 13, 1944	The Great Atlantic Hurricane	Caused severe flooding, a storm surge of up to 9.6 feet, and intense waves of up to 40 feet, massive erosion along the beaches.

¹ Borough of Bay Head, *Coastal Vulnerability Assessment Report*, (2019).

Date	Storm	Details
August 31, 1954	Hurricane Carol	Gusty winds along the coast and moderate damage.
September 12, 1960	Hurricane Donna	Caused heavy damage along the coast and 105 mph winds.
September 20, 1961	Hurricane Esther	Caused high surf and 70 mph winds along the beaches.
September 16, 1967	Hurricane Dorian	Caused minor damage along the coast.
August 10, 1976	Hurricane Belle	Caused winds of 65 mph and gusts of up to 90 mph as well as a storm surge of 8.85 feet in Atlantic City.
October 14, 1984	Hurricane Josephine	Caused minor damage and coastal flooding.
September 27, 1985	Hurricane Gloria	Category 2 hurricane, paralleled the New Jersey coastline just offshore.
September, 1989	Hurricane Gabrielle	Produced large waves of up to 16 feet.
October 31, 1991	The Halloween Nor'easter	Caused strong waves of up to 30 feet; high tides along the shore were only surpassed by the 1944 hurricane; significant Bay flooding occurred; strong waves and persistent intense winds caused extreme beach erosion.
September, 1992	Tropical Storm Danielle	Caused beach erosion and tidal flooding.
mid-August, 1995	Hurricane Felix	Caused extensive beach erosion.
August 23, 1998	Hurricane Bonnie	Hurricane Bonnie produced rough waves and rip currents.
September 16, 1999	Hurricane Floyd	Produced an exceptionally high storm surge.
September 19, 2003	Hurricane Isabel	Caused storm surges of 10.6 feet and persistent strong waves that severely erode beaches along the coast.
August 11, 2005	Hurricane Irene	Passed offshore and caused rip currents and strong waves.
August 22, 2009	Hurricane Bill	Passed offshore and caused 10 ft waves and beach erosion.
August 29, 2009	Tropical Storm Danny	Produced high waves and beach erosion.
August 27, 2011	Tropical Storm Irene	Beach erosion and sustained winds of 59 mph in Cape May prompted residents of coastal communities to evacuate.
October 29, 2012	Hurricane Sandy	Most destructive hurricane ever recorded in New Jersey; brought hurricane-force winds, record low pressure, and a momentous storm surge along the coast estimated to be 13 – 18 feet along Bay Head; widespread devastation is noted on the Barnegat Peninsula.
July 4, 2014	Hurricane Arthur	Produced strong waves that buffeted the coastline.
August, 2014	Hurricane Cristobal	Passed well offshore but generated strong waves.
September 5, 2016	Hurricane Hermine	Generated strong waves and minor coastal flooding.
September 19, 2017	Hurricane Jose	Caused beach erosion.

Sea Rise

Sea level is another component of Bay Head's natural environment which has changed over time. There are two sea-level height measuring sites along the Atlantic Coastline of New Jersey - Atlantic City and Cape May.

Data regarding the sea level at Atlantic City was collected monthly from 1991 through 2018. Over this period, the average rise in sea level was 4.09 millimeters (which is 0.16 of an inch) a year, corresponding to 1.34 feet sea rise per hundred years.²

² Borough of Bay Head, *Coastal Vulnerability Assessment Report*, (2019).

2 NATURAL RESOURCES

2.1 Physiography

Physiography is the study of a location in relation to its underlying geology. New Jersey is characterized by four physiographic provinces as indicated in Figure 2. Each province has a different geology, landforms, and relief from that of adjoining and nearby regions. The rocky terrain of the Appalachian Province is at one extreme and the sands of the coast are at the other.

The New Jersey Coastal Plain (yellow area) is the largest physiographic province in the state, extending from Sandy Hook to Cape May and inland to the Delaware River³. Consisting largely of unconsolidated sands, silts, and clays, the Coastal Plain is prone to erosion and generally characterized by regions of low topography and gently rolling hills less than 100 feet above sea level.

In the eastern part of the Coastal Plain, the landscape consists of pine forests and salt marshes. Closer to the Atlantic coast, the salt marshes are more plentiful and shallow lagoons and meadows characterize the area.

The Borough of Bay Head is located entirely within the Coastal Plain physiographic province of New Jersey.⁴

2.2 Topography and Geography

The Borough of Bay Head is a coastal municipality of 0.71 square miles⁵, with approximately 0.59 square miles⁶ of land, located in northern Ocean County, New Jersey. The Borough has Bay frontage to the west on Bay Head Harbor and Barnegat Bay and ocean frontage to the east along the Atlantic Ocean.

The entirety of Bay Head rests on a barrier island and is disconnected from the mainland by the Point Pleasant Canal and Barnegat Bay to the west. A small canal, Scow Ditch, connects Twilight Lake to Barnegat Bay on the south.

The Borough is further bisected by its main road, New Jersey Route 35/Main Avenue which runs north-south across the Barrier Island, entering Bay Head from the Borough of Point Pleasant Beach on the north and continuing through Bay Head to the border of the Borough of Mantoloking on the south. This corridor creates the “bayfront” and the “oceanfront” of the barrier island.

Bridge Avenue runs east-west through the center of Bay Head, connecting to Point Pleasant Borough to the west and Route 35 to the east.⁷

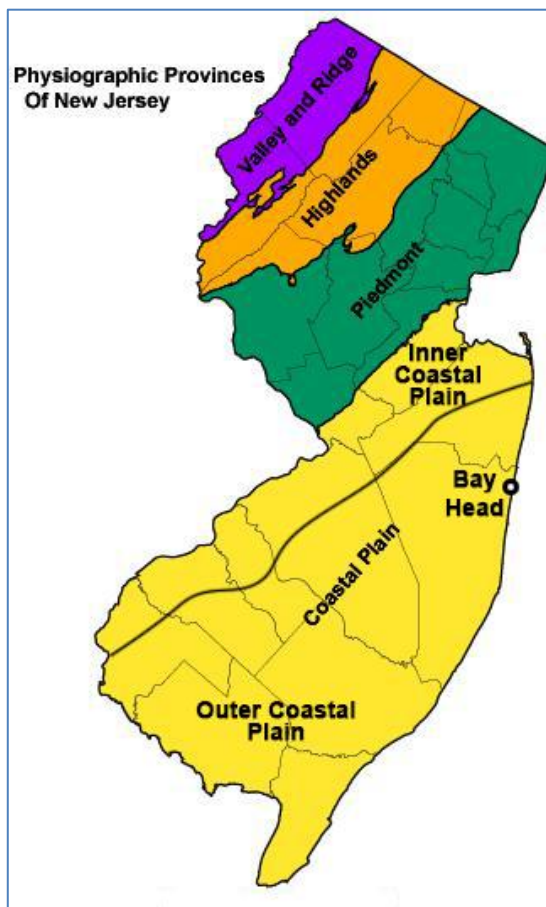


Figure 2. Physiographic Provinces of New Jersey

³ Rutgers School of Arts and Science, “NJ Coastal Plain”, (2020)

⁴ NJDEP Division of Water Supply and Geoscience, “Physiographic Provinces of New Jersey” Digital Geodata Series

⁵ NJ Geographic Information Network (2010)

⁶ Approximation from Ocean County Parcel GIS data (2014)

⁷ David Roberts and Zachary Zeilman, Strategic Recovery Planning Report (2016), 2.

The topography of the Coastal Plain and Borough is generally flat to very gently undulating. The shallow water of the coastal plains, as shown in the bathymetric map⁸ in Figure 3, allows for a gentler, less turbulent relationship between the land and sea, resulting in the accumulation of sand along the shoreline which forms the beaches. The highest elevation in the Borough is the newly constructed dunes at 22' NAVD 88 and the lowest elevation is located at sea level or 0' NAVD 88.⁹

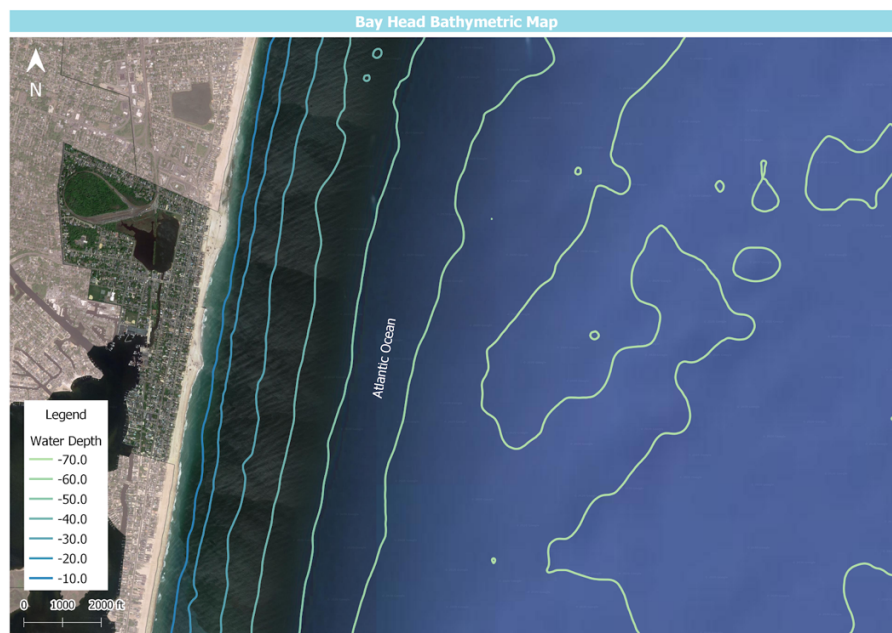


Figure 3. Bay Head Bathymetric Map.

2.3 Beaches

The beaches of Bay Head are a valued feature of the community that are enjoyed year-round by residents and non-residents. The Bay Head beaches are continually changing in part due a natural process called *longshore transport* in which sand and other sediment is moved or transported by repetitive wave action, potentially causing beach erosion in one location and/or beach buildup in another. As a result of these factors, the beach can shrink and grow several times per year.¹⁰ The Bay Head beaches are further affected by the impact that the community beach groins, or *jetties*, can have on the width of the beach adjacent to each groin.

In an effort to fortify the coast against storm events and surges, various preventive measures have been implemented.

A rock wall, or *revetment*, along some beach front homes in Bay Head was first installed in the 1890s and was further fortified in 1962 into a 16-foot-high engineered rock wall after a nor'easter. The wall remained largely buried beneath the sand until uncovered during Superstorm Sandy.

The revetment was further expanded to encompass the entire coastline of Bay Head following Sandy. The completed 1.8-mile revetment extends from Lyman Street in neighboring Mantoloking into Point Pleasant Beach. The revetment was paid for by beachfront property owners and private donations.¹¹



Figure 4. Exposed Rock Revetment following Superstorm Sandy.

⁸ NJDEP, Digital Geodata Series: DGS07-3 Bathymetric Digital Elevation Grids, (2020).

⁹ Bay Head Borough Elevation Certificates

¹⁰ Stockton College of New Jersey Coastal Research Center, New Jersey Beach Profile Network: Ocean County, (2010), 92.

¹¹ Jean Mikle, "Judge rules against Bay Head homeowners in dune case" (Asbury Park Press, 2017)

In 2019, the US Army Corps of Engineers (USACE) undertook a *Storm Damage Reduction Project* impacting the Bay Head beaches. This project was a part of a larger project by the USACE along the New Jersey coastline following Sandy. The project aimed to widen the beach and create 22-foot-high dunes. Dune grass was also planted to protect the area and to gather additional sand.¹²

The Bay Head beaches are for the most part private lots that extend to the mean highwater mark of the ocean. Some of the lots are owned by the *Bay Head Improvement Association* (BHIA), a private organization that is not affiliated with the Borough.¹³ During the summer months, the BHIA collects beach badge fees for beach access at the 11 public beach entrances (Figure 6) along East Avenue, maintains all the beaches, and provides lifeguards.

As of 2020, the price for a seasonal beach badge was \$90.¹⁴

For additional information on beach access, please refer to Section 4.8.



Figure 5. Bay Head Beach Replenishment - 2019.

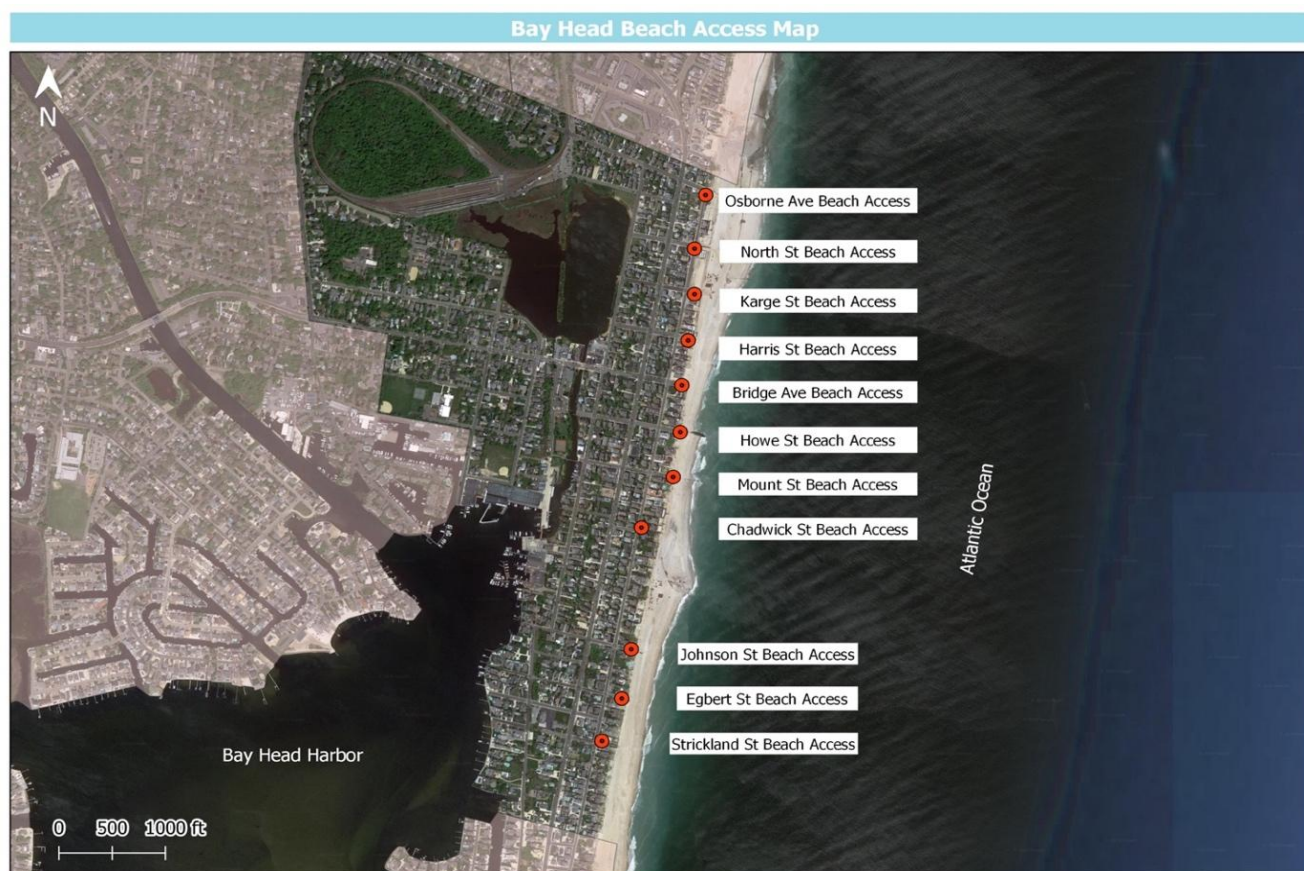


Figure 6. Bay Head Beach Access Map

¹² Ibid., (2017)

¹³ The Borough of Bay Head, *Public Access Plan*, (May 2020), pg. 6.

¹⁴ Bay Head Improvement Association

2.4 Bays and Estuaries

2.4.1 Barnegat Bay

The Borough of Bay Head is located at the northern head of Barnegat Bay and derives its name from this feature. Running from Bay Head on the north to Little Egg Harbor on the south, Barnegat Bay is 42 miles long and has an area of 64 square miles.¹⁵

The Barnegat Bay is comprised of three shallow bays that have varying tidal influence:

- Barnegat Bay
- Manahawkin Bay
- Little Egg Harbor

These bays are generally shallow, with relatively little freshwater flow from tributaries, and limited connection to the Atlantic Ocean. These factors create a lack of natural flushing and high residence time for harmful pollutants.

The natural physical shape of the bays and their hydraulics also contributes to *eutrophication*, or excess nutrient growth, which is exacerbated by human activities.

Barnegat Bay has many freshwater tributaries including: Metedeconk River, Kettle Creek, Toms River, Cedar Creek, Forked River, Oyster Creek, Double Creek, Mill Creek, Westecunk Creek, and Tuckerton Creek.¹⁶

Large sections of Barnegat Bay are classified as *Category 1* (C-1) waters as defined by the NJDEP's Water Quality Standards program.¹⁷ Because of the exceptional water quality significance in designated C-1 areas, new or changed development is restricted in these areas in order to protect water quality.

The Barnegat Bay has important economic value for the region.

According to the *2015 Economic Impact of Tourism Report*, Ocean County experienced \$4.58 billion in direct sales and \$636 million in recreational activities from tourism.¹⁸ A 2012 report on the *Economic Value of the Barnegat Bay* prepared for the Barnegat Bay Partnership by the University of Delaware determined that the economic value of the Barnegat Bay from water quality, water supply, fish/wildlife, recreation, agriculture, forests, and public parks benefits exceeds \$4 billion.¹⁹

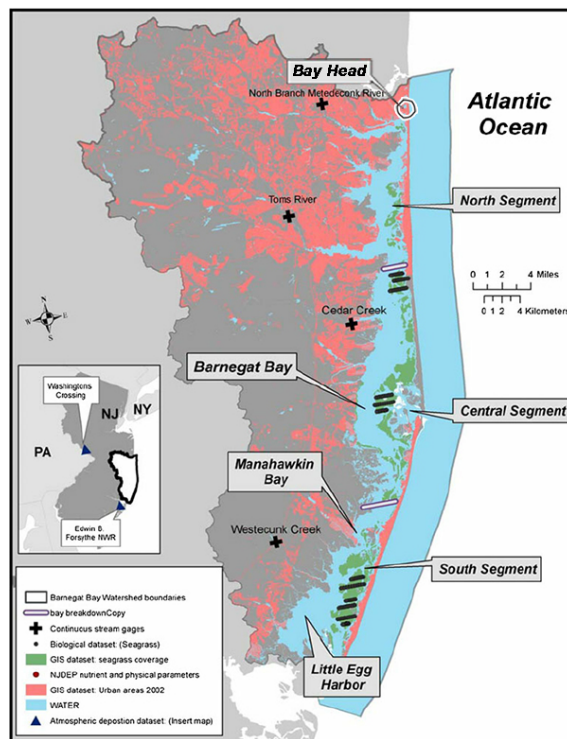


Figure 7. Map of Barnegat Bay, Manahawkin Bay, and Little Egg Harbor

¹⁵ Save Barnegat Bay Web Site (savebarnegatbay.org), The History of Save Barnegat Bay Page, (2020).

¹⁶ Barnegat Bay Estuary Program, The Scientific Characterization of the Barnegat Bay – Little Egg Harbor Estuary and Watershed

¹⁷ The Trust for Public Land, *Barnegat Bay 2020*, (July 2020), pg.11.

¹⁸ State of New Jersey, *Economic Impact of Tourism Report*, (2015)

¹⁹ Gerald J. Kauffman and Catherine Cruz-Ortiz, *Economic Value of the Barnegat Bay Watershed*, (2012)

2.4.2 Twilight Lake

Twilight Lake is a tidal, brackish-water lake connected to the Barnegat Bay on the south by Scow Ditch. The NJDEP maps classify the lake as a *dredged lagoon*.

Twilight Lake is approximately 27.0 acres with an average depth of 2.8 feet.



Figure 8. Aerial Photo. Twilight Lake & Barnegat Bay.

The lake is composed of two rectangular basins oriented north to south that are bisected by a peninsula on the north end and a small island, Kellogg Memorial Island, on the south. The two basins are connected by two narrow channels. The area to the northwest is considered to be a modified tidal marsh with several sinuous fingers extending into the marsh.²⁰

Pre-Sandy - 2012 Study

A study conducted by *Princeton Hydro* and published in June of 2012 analyzed Twilight Lake prior to Superstorm Sandy. The study concluded that the shallowness of the Lake was due in part to the original basin morphometry as well as sediment infilling with sands and highly organic silts. Both of the lake's shallow basins have planar bottoms and similar features.

The shallowness of the Lake causes several challenges for recreational and ecological use:

- It promotes the proliferation of aquatic plants and algae through increased nutrient loading in the sediments and decreased light.
- It impacts the fishery through the loss of site complexity and the physical loss of habitat space.
- It impacts fishing by creating overly shallow areas along the shore that are no longer fishable from shore.
- It limits boating accessibility and navigation.²¹



Figure 9. Twilight Lake, Scow Ditch, Barnegat Bay.

²⁰ Princeton Hydro LLC, Lake Characterization Memorandum for Twilight Lake, (June 2012), 3.

²¹ Ibid., 12.

The outer rims of the Lake are moderately sloped with the area adjacent to the island having steeper slopes. A large portion of the western basin is just over three feet in depth. The eastern basin is very similar, although there is a sizable area adjacent to the island where depths exceed four feet. Two small depressions have formed at the mouth of the northwestern channel and at the head of Scow Ditch through the discharge of water at these points. These are the deepest points in the respective basins.

In the western basin, the northern and southern areas are gently sloping towards the dominant basin depth and the fingers extending into the marsh are generally less than two feet deep. The northern third of the eastern basin is also gently sloping, but the southern shore of the eastern basin is relatively steep and is hardened to maintain these slopes. A shallow sandy flat is also evident along the eastern shoreline between North Street and Twilight Road near the pumped outfall.²²

The underwater depth or bathymetry of Twilight Lake as measured by the pre-Sandy 2012 Princeton Hydro study is summarized in Table 2 below and depicted in Figure 10 on the next page. In Figure 10, the contour lines correspond to water depth.

Figure 11 also on the next page shows the sediment thickness of Twilight Lake from the 2012 Princeton Hydro study. In this figure, the contour lines correspond to sediment thickness.

Map 3 in Figure 12 (page 14) provides a more recent bathymetric survey of Twilight Lake conducted in 2015 following the dredging of the lake as described later in this section.

Table 2. Twilight Lake Bathymetric Statistics – 2012.

Parameter	Data
Surveyed Area (acres)	27
Mean Water Depth (feet)	2.8
Maximum Water Depth (feet)	5.4
Water Volume (cubic yards)	121,384
Mean Sediment Thickness (feet)	2.1
Maximum Sediment Thickness (feet)	6.0+
Sediment Volume (cubic yards)	89,588

²² Ibid., 6.

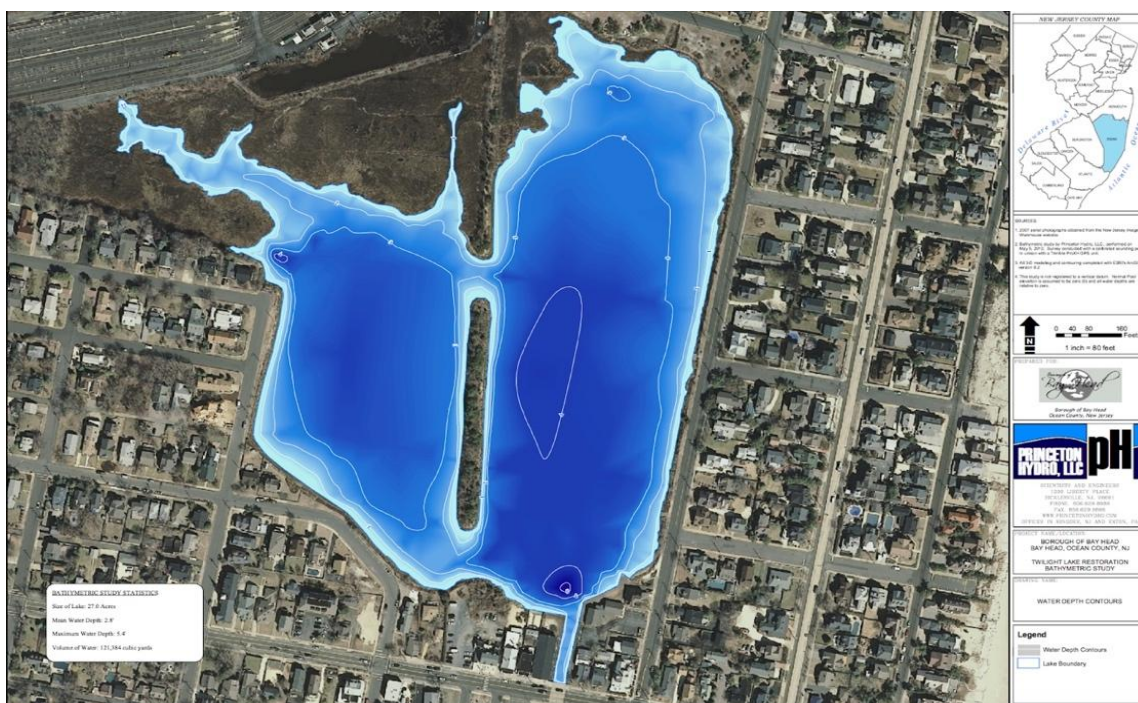


Figure 10. Twilight Lake Bathymetric Map – Pre-Sandy - 2012.

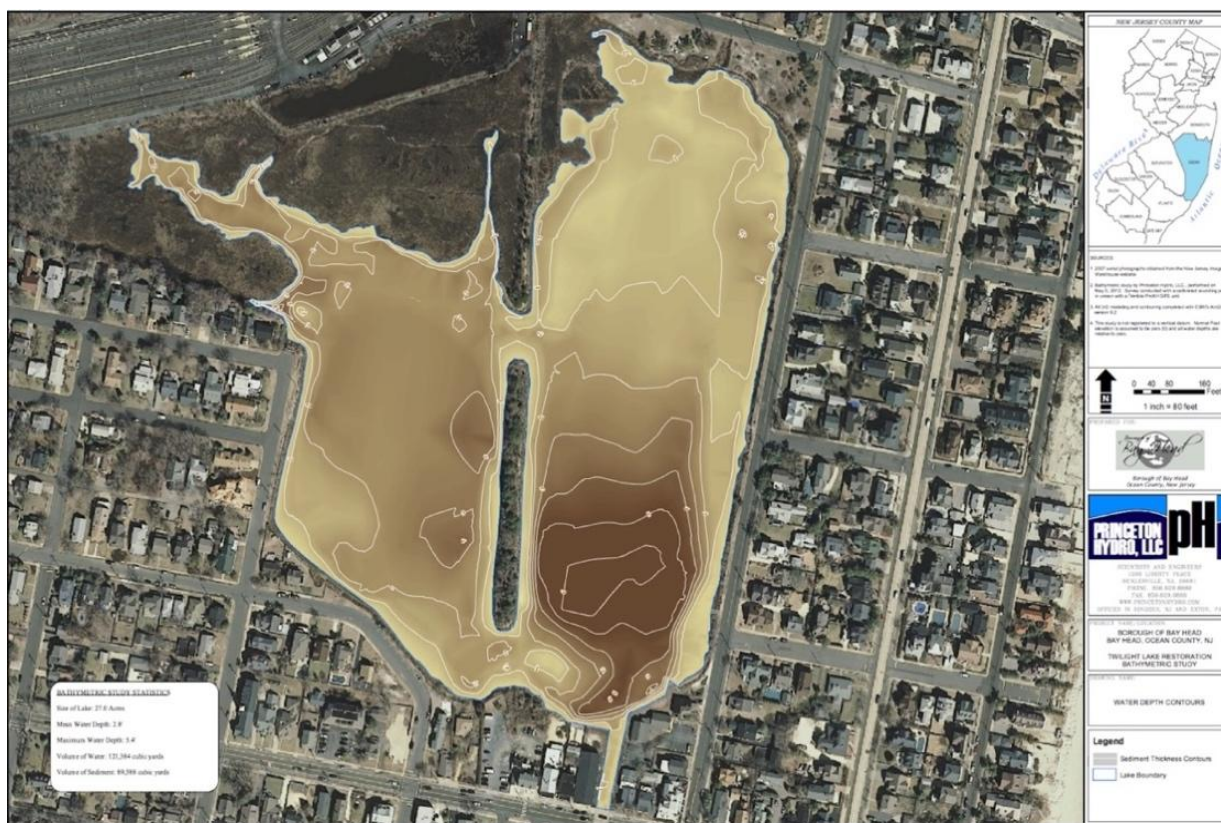


Figure 11. Twilight Lake Sediment Thickness Map - 2012.



Figure 12. Twilight Lake Bathymetric Map – Post Sandy - 2015.

The 2012 Princeton Hydro survey further analyzed the sediment composition of Twilight Lake. The analysis found that the western basin remains relatively uniform throughout much of the basin, with sediment thickness just over two feet in most of the basin. Sediment thickness is slightly shallower along the southwest shore, and thicker adjacent to the island. Sediment thickness is between two and four feet throughout the northwestern fingers and contains very high organic content including root biomass.

Sediment thickness in the eastern basin is distinct. The southern half of the eastern basin is characterized by very thick sediment accumulation. The upper portion of the southern half has sediment accumulations of approximately two feet quickly increasing in thickness moving south towards Scow Ditch to a maximum of over six feet and remaining as thick as five feet right up to the mouth of the ditch. The sediment composition in this area was a loose, dark, sandy organic muck which is typical of coastal lakes similar to Twilight Lake.

The very thick accumulations in this area demonstrate that at some point depths were greater and may have exceeded ten feet, perhaps a function of dredging at some earlier time.²³

²³ Ibid., 6-7.

2014 Lake Dredging

Twilight Lake was dredged in 2014 following Superstorm Sandy. The project included the removal of approximately 17,000 cubic yards from the northeast portion of the lake and 12,000 cubic yards from the southeast portion of the lake.²⁴

A survey of Twilight Lake was completed in 2015 following the dredging. The 2015 survey indicated that Twilight Lake had experienced shifts in sediment resulting in sediment loss along the outer shoreline of the lake and center island, and sediment accumulation in the middle of the body of water.

The bathymetric mapping from the 2015 study was provided earlier in Figure 12.

The results of 2015 sediment gain/loss analysis are shown in Figure 13.



Figure 13. Twilight Lake – Sediment Gain/Loss Analysis - 2015.

2020 Grant for Twilight Lake

In August 2020, the Borough of Bay Head was awarded an \$85,000 grant from the Department of Environmental Protection to develop a *Twilight Lake Protection and Watershed Management Plan*.²⁵ The plan will enable the Borough, working with Princeton Hydro, to properly identify, design, and implement future restoration activities for Twilight Lake, addressing existing and emerging threats to water quality, such as the proposed construction of a new substation by NJ Transit overlooking the lake. The resulting Lake Management Plan will include an updated baseline measurement of the bathymetric and water quality conditions highlighted in this section (and in Sections 2.10.2 and 4.6.6) plus will recommend actions for monitoring and improving these conditions so that any future change in water quality is quickly detected and appropriate mitigation steps are taken.

2.4.3 Scow Ditch

Scow Ditch connects Twilight Lake to Barnegat Bay and directly impacts the flow of intercoastal water into and out of Twilight Lake. Scow Ditch is little over two feet in depth. The ditch has gradually become narrower and shallower over the years, especially following Superstorm Sandy. As a result, the natural flushing effect from tidal water entering and exiting the lake from Barnegat Bay via the ditch has been lessened.

The possible dredging Scow Ditch to increase the tidal flushing of Twilight Lake is an ongoing consideration and will be further analyzed during the development of the Lake Management Plan mentioned above.

Sediment composition in Scow Ditch is also distinct. Scow Ditch has almost no sediment accumulation. A 2012 sediment analysis of Twilight Lake indicated that the cores taken from Scow Ditch were the coarsest and also

²⁴ Presentation Handouts, Twilight Lake Meeting, August 8, 2015.

²⁵ The Official Site of the State of New Jersey, "DEP Approves \$3.5 Million for Water Quality Improvement Projects, Including Efforts to Reduce Harmful Algal Blooms" (08/10/2020)

showed the presence of shell fragments.²⁶ Organic content comprises 5.5% of the sediment composition in Scow Ditch²⁷.

2.5 Wetlands

The majority of the wetlands in Bay Head are located to the north and west of Twilight Lake as shown in Figure 14. Most of the wetlands in Bay Head are classified as “Freshwater Forested” (green areas) along with the lighter-blue areas which are “Estuary and Marine Wetlands.”

Wetlands are located within the NJ Transit rail yard loop south of Osborne Ave.; on the northwest banks of Twilight Lake itself; along the abandoned railbed extending from the north onto the Twilight Lake Peninsula and then onto Kellogg Island; and within the Maintenance Garage area (home of Recycle Center and Evergreen Park) to the north of Park Avenue.

✓ **NOTE:** the wetlands depicted in Figure 14 are an approximation based upon arial photographic interpretation. A more accurate assessment of wetland boundaries would require a formal wetland *delineation* process as described at NJDEP webpage [Delineating Freshwater Wetlands](#).

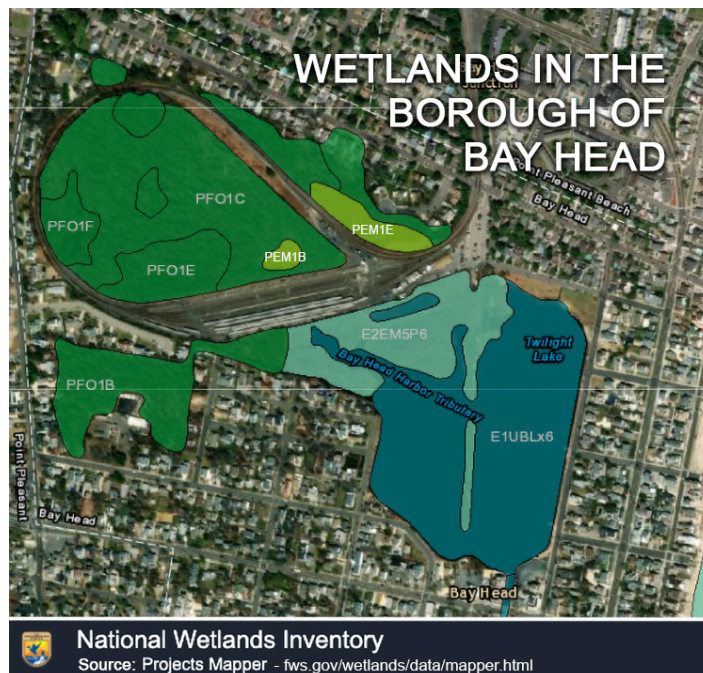


Figure 14. Wetlands in the Borough of Bay Head

Wetland Classification

The different types of wetlands are differentiated by a four-part *Classification Code*. For example, the major wetland area within the rail yard loop is categorized as “P FO 1 C” meaning:

P SYSTEM: Palustrine - The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.

FO CLASS: Forested - Characterized by woody vegetation that is 6 m tall or taller.

1 SUBCLASS: Broad-Leaved Deciduous - Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season - e.g., black ash (*Fraxinus nigra*).

C WATER REGIME: Seasonally Flooded - Surface water is present for extended periods especially early in the growing season but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.

Appendix H contains a description of the Classification Codes for the various wetlands found in Bay Head.

²⁶ Princeton Hydro LLC, Lake Characterization Memorandum for Twilight Lake, (2012), 7.

²⁷ Ibid., 8.

A preliminary field assessment conducted by the Borough of the abandoned rail track on the north end of Twilight Lake in 2015 included identification of wetlands using the three-parameter approach detailed in the 1989 *Interagency Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. The wetland boundaries were measured relative to the visible edge of the existing, informal path that exists on the abandoned rail bed where it is easily accessible on foot.²⁸

The wetlands contribute a significant amount of organic silts and herbaceous plant material into Twilight Lake. Marshes allow the accumulation of fine sediments and organic material produced within the marsh and the presence of vegetation is a major driver of sediment capture.

A 2012 sediment analysis study of Twilight Lake by Princeton Hydro indicated that organic content of the northeastern section of Twilight Lake was less than 1%, in contrast to 29% in the northwest of the lake adjacent to the marsh. The sediment extending from Scow Ditch to the northwestern region closest to the wetlands in the lake also has high water retention, with the percent moisture or water content varying between 81% and 339% in this area. This metric expresses the weight of water in the sample relative to the weight of solids.²⁹

2.6 Watershed Management Area

Bay Head is located in *NJDEP Watershed Management Area (WMA) 13 – Barnegat Bay*.³⁰ WMA 13 drains the central Atlantic section of New Jersey. The Barnegat Bay Watershed is a 660 square mile area encompassing all of the land and water in Ocean County, as well as parts of Monmouth County. WMA 13 is comprised of an assemblage of coastal sub-watersheds, which all ultimately drain to the Atlantic Ocean. These subwatershed include the Metedeconk River, Toms River, Forked River, and Cedar Creek subwatersheds.³¹

The Borough of Bay Head is a part of the Metedeconk River subwatershed. According to 1995 estimates from the New Jersey Department of Environmental Protection, the Metedeconk River subwatershed is 35 percent developed, with a total impervious surface of 17 percent. This number has increased since 1995, resulting in greater losses of forests and wetlands.³²

Table 3 below details the changes in land use in WMA 13 from 1995 to 2002. Figure 15 shows the land use/land cover in WMA 13 in 2007.

Land Use	1995	2002	Net Change
Agriculture	5,305	4,579	-727
Barren Land	9,206	8,938	-268
Forest	156,860	147,438	-9,423
Urban Land	87,846	99,394	11,548
Water	158,812	158,520	-292
Wetlands	90,218	89,380	-839

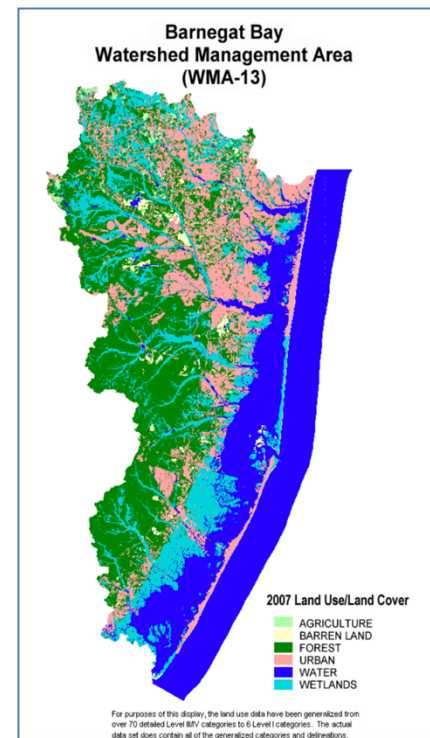


Figure 15. Barnegat Bay Watershed Management Area (2007 Land Use)

Table 3. Watershed Management Area 13: Barnegat Bay (in Acres).

²⁸ The Borough of Bay Head, Technical Memorandum: Next Steps to Advance a Path Across Twilight Lake Along the Alignment of a Former Rail Line, (2016), 1.

²⁹ Princeton Hydro LLC, Lake Characterization Memorandum for Twilight Lake, (2012), 8.

³⁰ NJDEP Division of Watershed Management, "New Jersey's Watersheds, Watershed Management Areas and Water Regions", (2007)

³¹ State of New Jersey, *Hazard Mitigation Plan*, (2014)

³² Barnegat Bay Partnership, "Metedeconk River Watershed"

2.7 Geology

While the New Jersey Coastal Plain (see also Section 2.1) on which Bay Head is located is characteristically very flat, erosion-resistant gravel or iron-cemented sediment underlie upland areas and isolated hills. Coastal Plain sediments have been mined in the past for bog iron, glass sand, foundry sand, ceramic and brick clay, the mineral glauconite for use in fertilizer and titanium from the mineral ilmenite, which is found in sand deposits.

Today the Coastal Plain sediments continue to supply glass sand and are extensively mined for sand and gravel construction material. The sediments consist of layers of sand, silt, and clay deposited alternatively in deltaic and marine environments as sea level fluctuated during the Cretaceous and Tertiary time. These layers of sediment outcrop in irregular bands that trend northeast-southwest. Wide areas of the Coastal Plain are covered by a thin veneer of Late Tertiary and Quaternary sand and gravel deposited by rivers.³³

2.8 Soils/Soils History³⁴

The United States Department of Agriculture's (USDA) Natural Resources Conservation Service classifies the soil of Bay Head into eight types, as shown in Figure 16 and listed in Table 4. Each of the soil types is further described later in this section.

Of the eight identified soil types, the major soil type in Bay Head is listed as *Psammaquents, sulfidic substratum*, with the symbol "PstAt" which predominates on the eastern side of the Borough.

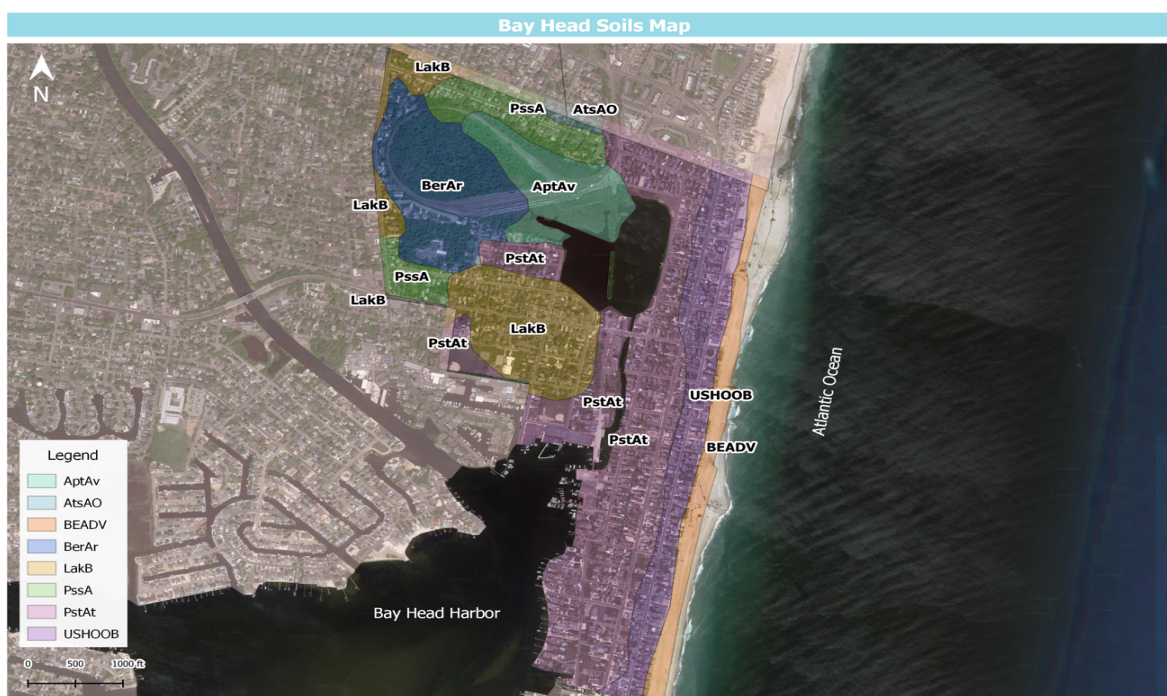


Figure 16. Bay Head Soils Map.

³³ NJDEP, New Jersey Geological and Water Survey, (2016)

³⁴ USDA, Ocean County Soil Survey, (1980)

Table 4. Soil Name and Characteristics.

Soil Symbol	Soil Name and Characteristics	Acres	Percentage of Map Area
AptAv	Appoquinimink-Transquaking-Mispillion complex, 0 to 1 percent slopes, very frequently flooded	32.7	6.70%
AtsAO	Atsion Sand, 0 to 2 percent slopes, Northern Tidewater Area	3.2	0.70%
BEADV	Beaches, 0 to 15 percent slopes, very frequently flooded	26.6	5.50%
BerAr	Berryland sand, 0 to 2 percent slopes, rarely flooded	52.5	10.80%
LakB	Lakehurst sand, 0 to 5 percent slopes	55.9	11.50%
PssA	Psamments, 0 to 2 percent slopes	29.3	6.00%
PstAt	Psammaquents, sulfidic substratum, 0 to 2 percent slopes, frequently flooded	145.3	29.80%
USHOOB	Urban land-Hooksan complex, 2 to 10 percent slopes	56.5	11.60%

Soil Type Characteristics

- Appoquinimink-Transquaking-Mispillion complex (*AptAv*) is a nearly flat, very poorly drained soil. This soil is frequently flooded with a moderately high to high ability of the most limiting layer to transmit water. The slope of this soil is 0 to 1 percent. This soil is strongly saline and is found in tidal marshes.
- Atsion Sand (*AtsAO*) is a sandy, siliceous, and mesic Aeric Haplaquod. It is a poorly drained soil formed in acid, sandy Coastal Plain sediments. Atsion sand is found in depressional areas and broad flats, with slopes less than 2 percent.
- Beaches (*BEADV*) is a poorly drained, sandy soil. This soil is frequently flooded with a high to very high ability of the most limiting layer to transmit water. The depth to the water table is 0 to 7 inches. The parent material of this soil type is beach sand. This soil is slightly saline to strongly saline. The slope of this soil is 0 to 15 percent
- Berryland sand (*BerAr*) is a sandy, siliceous, and mesic Typic Haplaquod. It is a poorly drained soil formed in acid, sandy Coastal Plain sediments. Berryland sand is found in wide, depressional areas and broad flats that are at the lowest elevation in the landscape, with slopes less than 2 percent. This soil type is subject to rare to frequent flooding.
- Lakehurst sand (*LakB*) is a mesic, coated Haplaquodic Quartzipsamment. This soil type is deep, moderately well drained or somewhat poorly drained soil formed in acid, sandy Coastal Plain sediments. This soil is found in depressional areas and on low divides, with slopes from 0 to 5 percent.
- Psamments (*PssA*) consists of moderately deep to deep, excessively drained to very poorly drained soils with no horizonation. This soil forms in stratified or smoothed sandy fill, with slopes from 0 to 5 percent. These soils are 20 to 60 inches deep or more to the original soil or waste fill. Psamments are extremely acidic.
- Psammaquents, sulfidic substratum (*PstAt*) is a nearly flat, very poorly drained soil. This soil is frequently flooded with a moderately high to very high ability of the most limiting layer to transmit water. This soil is very slightly saline to strongly saline. The slope of this soil is 0 to 2 percent.
- Urban land-Hooksan complex (*USHOOB*) consists of approximately 65% urban land soil and 20% Hooksan and similar soils, with 15% minor components. This soil can be found on dunes on barrier islands and

barrier beaches. The slope of this soil is 2 to 10 percent. This soil is not frequently flooded and is excessively drained, with a high to very high ability of the most limiting layer to transmit water. This soil is non-saline to very slightly saline.

2.9 Climate

New Jersey has five distinct climate regions which are influenced by geology, distance from the Atlantic Ocean, and varying atmospheric flow patterns. These five regions are:

- Northern
- Central
- Pine Barrens
- Southwest
- Coastal

The Borough of Bay Head is within the *Coastal Climate Zone* (dark-blue area in Figure 17).

The Coastal Climate Zone is greatly influenced by the relationship between the land and sea. The Atlantic Ocean has a high heat capacity compared to land which helps regulate the air temperature along the coast and results in more gradual temperature fluctuations year-round. In autumn and early winter, when the ocean is warmer than the land surface, the Coastal Zone will experience warmer temperatures than interior regions of the state.

Sea breezes play a major role in coastal climate. When the land is warmed by the sun, heated air rises, allowing cooler air at the ocean surface to spread inland. In the spring and summer months, ocean breezes keep temperatures along the coast cooler. These breezes can often penetrate five to ten miles inland.

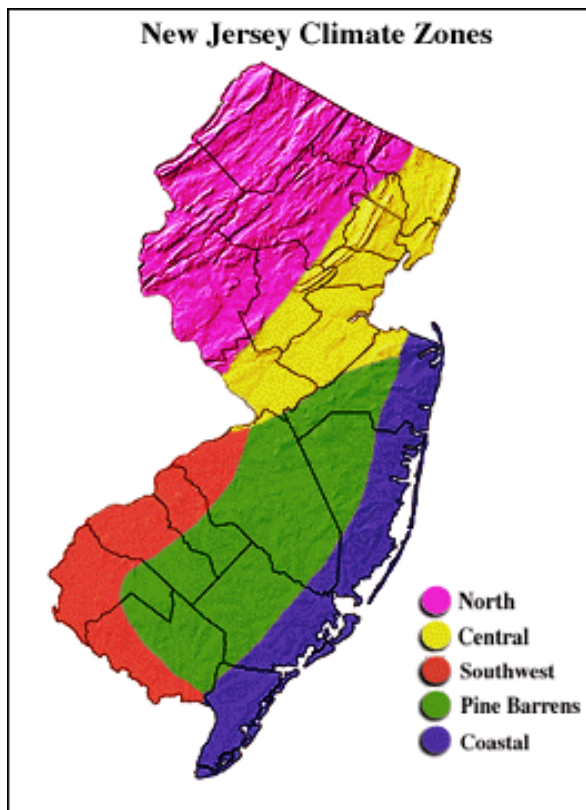


Figure 17. New Jersey Climate Zones.

Coastal storms, sometimes characterized as nor'easters, are most frequent between the months of October and April. These storms track over the coastal plain or up to several hundred miles offshore, bringing strong winds and heavy rains or snow. Tropical storms and hurricanes (see also - Section 1.3) are also a special concern along the coast. In some years, they contribute a significant amount to the precipitation totals of the region. Damage from tropical or coastal storms can be especially severe during times of high tide. New Jersey averages about 45 inches of rain a year.³⁵

Table 5. Climate data for Bay Head Beach - 1981-2010 Averages.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °F (°C)	40.1 (4.5)	42.7 (5.9)	49.4 (9.7)	58.9 (14.9)	68.5 (20.3)	77.9 (25.5)	83.2 (28.4)	82.0 (27.8)	75.9 (24.4)	65.4 (18.6)	55.3 (12.9)	45.1 (7.3)	62.1 (16.7)
Daily mean °F (°C)	32.5 (0.3)	34.6 (1.4)	40.9 (4.9)	50.3 (10.2)	59.9 (15.5)	69.4 (20.8)	74.9 (23.8)	73.8 (23.2)	67.2 (19.6)	56.2 (13.4)	47.0 (8.3)	37.3 (2.9)	53.8 (12.1)

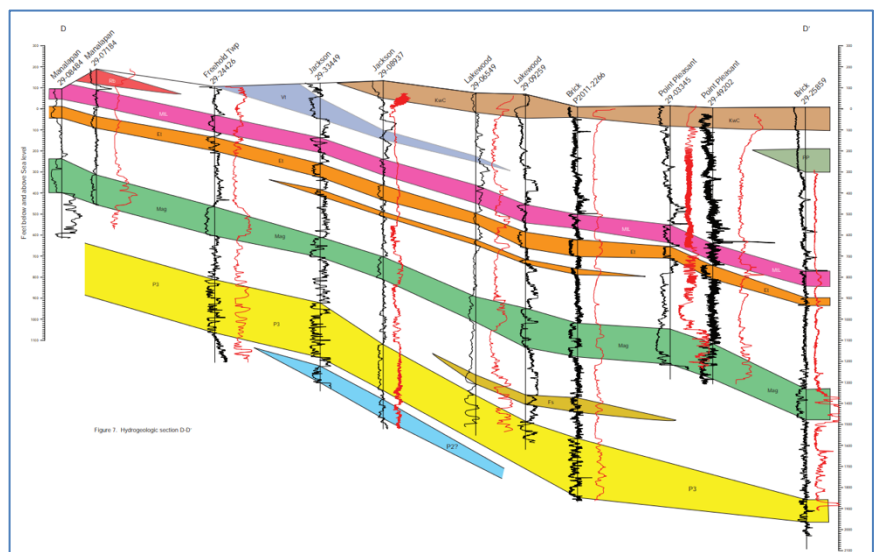
³⁵ The Office of the NJ State Climatologist, "The Climate of New Jersey"

Aquifer names

	Kirkwood-Cohansey aquifer system
	Rio Grande water bearing unit
	Atlantic City 800-foot sand
	Piney Point aquifer
	Vincentown aquifer
	Red Bank Sand
	Wenonah-Mount Laurel aquifer
	Englishtown aquifer system
	Magothy aquifer
	Farrington Sand
	Potomac 3 aquifer
	Potomac 2 aquifer
	Basement

Geophysical logs

	natural gamma
	single point resistance
	spontaneous potential



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2.10.2 Surface Water

While the Borough of Bay Head is not located within the sub watershed of any landward stream, it contributes stormwater runoff to the Barnegat Bay and freshwater inputs to wetlands.³⁸

One of the central sources of surface water in the town is Twilight Lake. The main hydraulic connection in Twilight Lake is Scow Ditch located at the southeast corner of the lake. The ditch is connected to Bay Head Harbor, which lies at the junction of the Metedeconk River and the head of Barnegat Bay. While Twilight Lake is tidally influenced, the system is also tidally restricted and therefore the tides normally range less than a foot.

Stormwater runoff is a key issue in the Borough. Nutrients such as phosphorus and nitrogen are very common in stormwater inputs, especially in urbanized watersheds dominated by impervious surface coverage.³⁹ As a result of stormwater runoff, Twilight Lake is reported to be vulnerable to periodic water quality impairments, primarily in the form of algae blooms and excessive growth of aquatic plants. Although these more severe conditions have not yet been observed in Twilight Lake, they may be expected of urbanized watersheds such as the Lake.⁴⁰

In a 2012 survey by Princeton Hydro (see Section 2.4.2), three species of phosphorus were sampled, and both of the soluble species were below detection limits (Table 6 – next page). Total phosphorus is generally considered the nutrient most responsible for controlling the growth of plants and algae in the lake. While total phosphorus concentration was found to be a moderate value of 0.03 mg/L, this level is still high enough to sustain low level algae blooms.

Nitrate was also found at a moderate concentration of 0.10 mg/L. The total suspended solids (TSS) can reflect either suspended inorganic solids, such as silts, or organic particles including algae. At the time of sampling the concentration was 13.0 mg/L which is a moderate value and not unexpected. Secchi depth clarity was estimated at around 1.5 meters, which is an acceptable value. Chlorophyll a, which is used as a proxy measure of algal biomass, was a fairly low value of 8.0 µg/L.

Overall, water quality at the time of sampling (2012) was acceptable and indicated no major impairments to the ecological functionality of the system.⁴¹

As discussed in Section 2.4.2, another water quality survey of Twilight Lake was completed following Hurricane Sandy in 2015. This survey found that total Nitrogen was a little high, which could be attributed to monitoring in the heat of summer after receiving rainfall. These measurements were compared to those taken from the Barnegat Bay to serve as a comparison as seen in Table 9 on the next page.⁴²

The 2012 sediment analysis of Twilight Lake (see also - Section 2.4.2) found that overall, the sediments were fairly free of contaminants. Levels of benzo(a)pyrene corresponding to 0.259 mg/kg (ppm) and 0.592 mg/kg at the northeast and Scow Ditch sampling sites exceeded both Residential Direct Contact Soil Remediation Standard (RDCSRS) and the Non-Residential Direct Contact Soil Remediation Standard (NRDCSRS). The results from this survey were congruent with levels commonly found in suburban lake sediments and are associated with roof and driveway sealants that are transported with stormwater runoff.⁴³ A sediment analysis project post Hurricane Sandy

³⁸ Barnegat Bay Estuary Program, The Scientific Characterization of the Barnegat Bay – Little Egg Harbor Estuary and Watershed

³⁹ Princeton Hydro LLC, Lake Characterization Memorandum for Twilight Lake, (2012), 11.

⁴⁰ Ibid., 5.

⁴¹ Ibid., 11.

⁴² Borough of Bay Head, *Twilight Lake Survey*, (2015)

⁴³ Princeton Hydro LLC, *Lake Characterization Memorandum for Twilight Lake*, (2012), 9.

also found that all parameters were within standard limits except for benzo(a)pyrene and benzo(b)fluoranthene in the eastern portion of the lake. This sediment was later removed from the eastern portion of the lake.⁴⁴

Please see Section 2.4.2 for additional information regarding future testing and monitoring of pollutants in Twilight Lake to be conducted as part of the Twilight Lake Protection Plan funded by the 2020 NJDEP grant.

In addition to Twilight Lake, Barnegat Bay is also highly susceptible to stormwater runoff. As of the NJDEP's 2010 303D List of Water Quality Limited Waters, the entire northern portion of the Barnegat Bay (north of the Route 37 Bridge) was identified as impaired by a variety of pollutants, all of which are either transported or affected by stormwater runoff. As per the NJDEP *2010 Integrated Water Quality Monitoring and Assessment Report*, excessive pathogen, sediment and, in particular, nutrient non-point source loading are recognized causes of the water quality problems of Barnegat Bay.⁴⁵

Table 6. In-situ Twilight Lake Water Quality Data.

Depth (meters)			Temperature	Specific Conductance	Practical Salinity	Dissolved Oxygen		pH
Total	Secchi	Sample	°C	mS/cm	PSU	mg/L	% Saturation	S.U.
1.05	~1.50	0	15.97	33.1	25.6	8.81	101.7	7.4
		1	15.08	39.6	31.9	8.01	93.2	7.54

Table 7. Discrete Twilight Lake Water Quality Data.

Parameter	Unit	Data
Total Phosphorus	mg/L	0.03
Soluble Reactive Phosphorus	mg/L	ND < 0.002
Dissolved Inorganic Phosphorus	mg/L	ND < 0.01
Nitrate	mg/L	0.1
Total Suspended Solids	mg/L	13
Chlorophyll a	µ/L	8

Table 8. Twilight Lake Sediment Composition.

Parameter		Northeast Corner	Northwest/Transit Yard	Scow Ditch
Grain Size	Percent Gravel	5.7	0.2	1.7
	Percent Sand	92.2	53.4	68.7
	Percent Silt	0.7	30.5	20.7
	Percent Clay	1.4	15.9	8.9
Other Metrics	Percent Moisture	27.00%	339.00%	81.00%
	Percent Organics	0.90%	29.00%	5.50%
	USDA/USCS Description	SP - Sand/Poorly graded sand	SM - Mucky sandy loam/Organic silty sand	SM - Sandy loam/Silty sand
Plasticity	Plasticity Index	Not Plastic	2	6

Table 9. Water Quality Survey (2015).

Nutrient Data	Twilight Range	Bay Range	Units
Total Phosphorus	81-183	30-280	µ/L
Total Nitrogen	865-1703	182.33-857.51	µ/L
Phosphate	35-67	1.41-642.7	µ/L
Nitrate	4-153	210-450	µ/L

⁴⁴ Borough of Bay Head, *Twilight Lake Survey*, (2015)

⁴⁵ Borough of Bay Head, "GO Bay Head Commitment Letter", (2014)

2.11 Flood Prone Areas

Bay Head has historically experienced temporary flooding in low-lying areas and more severe flooding caused by extreme weather events. The combination of gradually rising tidal waters and continuing unpredictable extreme weather events will gradually increase the risk of coastal flooding events in the Borough over time.

in 2019, a *Coastal Vulnerability Assessment Report* of the Borough was published.

(Link to the full report: <https://bit.ly/3j3tQ3e>)

As indicted in the report, approximately 17% of the Borough is water that is subject to sea level increase, storm surge, tidal flow, and wind-forced movement⁴⁶. This localized flooding is exacerbated when the groundwater table is high which occurs after a heavy rain or when a prolonged southern wind forces the waters of Barnegat Bay towards the northern end of the Bay and/or prevents the normal tide waters from flowing to the south.

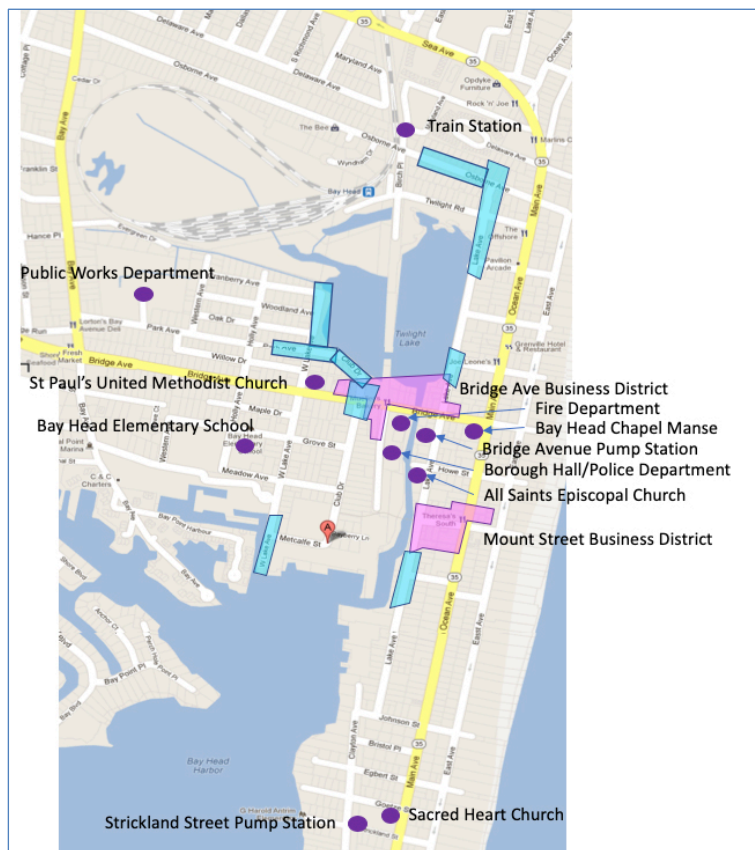


Figure 20. Flood Prone Areas in Bay Head.⁴⁷

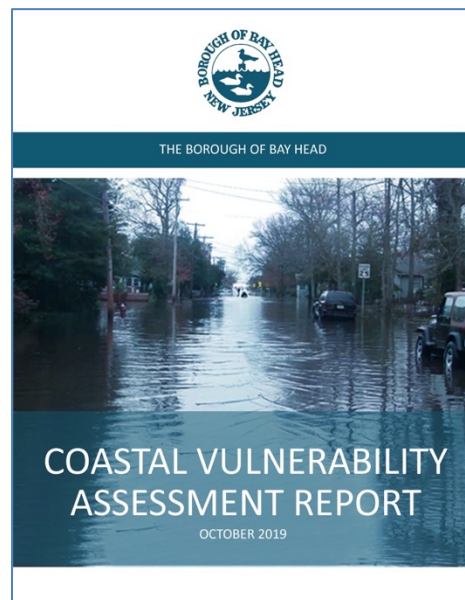


Figure 19. Coastal Vulnerability Assessment Report.

Additionally, the Atlantic Ocean, Barnegat Bay, and Twilight Lake are all subject to normal tidal fluctuations. The highest tides occur every two weeks around the periods of full moon and new moon when the moon and sun are in alignment. Once a year, Bay Head experiences a king tide which occurs when the Earth, Moon and Sun are aligned. The king tide is further enhanced when the Earth is closest to the Sun around January 2 of each year.⁴⁷

Figure 20 shows the areas of recent and recurring flooding (shown in turquoise) in relation to the critical infrastructure locations in Bay Head (purple dots) as well as the two business districts (pink areas) based upon information obtained from the Bay Head Public Works Department.

⁴⁶ The Borough of Bay Head, *Coastal Vulnerability Assessment Report*, (October 2019), pg. 7.

⁴⁷ Borough of Bay Head, *Coastal Vulnerability Assessment Report*, (2019).

Projections of flooding based on sea level rise in the Borough can be found through this virtual model based on NOAA elevation data: https://ss2.climatecentral.org/#12/40.0845/-74.0803?show=satellite&projections=0-DP16_RCP85-SLR&level=2&unit=feet&pois=hide.

2.12 Known Contaminated Sites

The *Known Contaminated Sites List for New Jersey* are sites and properties within the state where contamination of soil or groundwater has been confirmed at levels equal to or greater than applicable standards. Active sites are those sites having one or more active cases or remedial action permits where contamination has been confirmed. These sites may have any number of pending and/or closed cases.

The Borough of Bay Head has one active and known contaminated site at the NJ Transit station – Site ID 66037. The contaminated site, located at the rail yard adjacent to Twilight Lake on 1 Twilight Road⁴⁸, has been a recurring environmental concern to Bay Head residents and town officials.

As of the fall 2020, the contaminated site remains a visible public issue due to New Jersey Transit’s plans to build a new replacement substation on the NJ Transit-owned property overlooking Twilight Lake that will impact existing wetlands.⁴⁹

2.13 Air Quality

While air quality in New Jersey has improved in recent years, the State still ranks among the worst in the nation due to high concentrations of ground-level ozone according to a 2019 report by the American Lung Association.⁵⁰

The NJDEP stated that all of New Jersey’s 8 million residents are breathing unhealthy amounts of ozone pollution at some point during the summer.⁵¹ The American Lung Association gave Ocean County a failing air quality grade for ozone pollution in their 2017 report after indicating 16 days of unhealthy air quality.⁵² Much of the Jersey Shore and the South Jersey counties have received failing grades over the three-year period from 2014 until 2016. However, New Jersey has made notable progress in decreasing soot concentrations in the air, with Ocean County receiving a passing grade since 2012.⁵³

The NJDEP has identified six facilities in Bay Head with an air quality permit registered with the Division of Air Quality. These facilities are:

- The Bay Head Rail Yard
- Bay Head Public Works
- Borough Hall
- the NJ American Company Bay Head Station
- The Sanzari Marina
- The Ocean County Utilities Authority Lift Station (NPS-7)

These facilities are formally required to have a registered permit with the Department, and none appear to be a significant source of pollution or pose a risk, even though they are categorized as a “minor source of air pollution.”⁵⁴

The NJDEP has an Air Quality department and maintains a web site with local information and current air quality levels at: <https://www.nj.gov/dep/daq/>

⁴⁸ NJDEP, “Known Contaminated Sites in New Jersey Report”, (2017).

⁴⁹ The Ocean Star, “New Jersey Transit Defends Substation”, (Sept. 25, 2020), pg. 18.

⁵⁰ Len Melisurgo, “The 11 Counties with the worst air pollution in N.J.”, (NJ Advance Media for NJ.com, 2017)

⁵¹ NJDEP, *Getting to Know About Air Pollution*, (2004), 2.

⁵² Len Melisurgo, “The 11 Counties with the worst air pollution in N.J.”, (NJ Advance Media for NJ.com, 2017)

⁵³ Scott Fallon, “Air pollution in New Jersey is so bad it could be dangerous to your health to breathe”, (NorthJersey, 2018).

⁵⁴ NJDEP Division of Air Quality, “What’s in my Community” Mapping Application, (2020)

3 BIOLOGICAL RESOURCES

3.1 Hardiness Zone

The 2012 USDA Plant Hardiness Zone Map is the standard used to determine which plants are most likely to thrive at a location. The map is based on the average annual minimum winter temperature, divided into 10-degree F zones.

The Hardiness Zone for the Borough of Bay Head is 7a.

In this zone, the average annual extreme minimum temperatures range from 0 to 15 °F. Zone 7 has a medium length growing season, with a last frost date of April 15th and first frost date of November 15th.⁵⁵

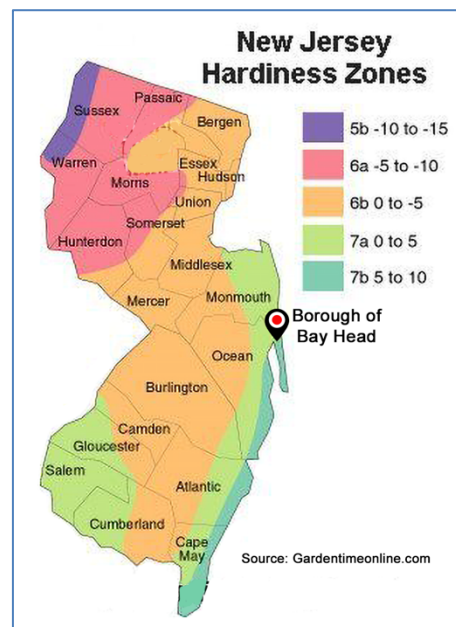


Figure 21. New Jersey Hardiness Zones.

3.2 Dunes

Coastal dunes provide a transitional zone between marine and continental environments and provide the seaward location of continental vegetation. Dunes serve as an ecological niche transitioning between the harsh, salty, and open marine environment and the milder, more protected environment inland.

Vegetation on coastal dunes provides a key natural function of sand storage, creating a strong natural barrier from storm surges. The roots of the vegetation anchor to the sandy substrate of the dune below the surface and stabilize the sediment on the surface providing a barrier to wind and waves. Without the presence of vegetation, the integrity of the dunes is more vulnerable to these forces.⁵⁶

Only certain types of plants can tolerate the high exposure, salinity, and low nutrient availability that the dunes offer. In order to protect dune vegetation from degradation and disease, it is important that biodiversity among vegetation is maintained.

At the dunes in Bay Head, a variety of species can be found. Primary vegetation found on the forefront of the dunes consists of species such as:

- American beachgrass (*Ammophila breviligulata*)
- Dusty miller (*Artemisia stelleriana*)
- Sea rocket (*Cakile edentula*)
- Seaside goldenrod (*Solidago sempervirens*)
- Wild carrot (*Daucus carota*)
- Beach pea (*Lathyrus japonicus*) and
- Seaside spurge (*Euphorbia polygonifolia*).

⁵⁵ USDA, "USDA Plant Hardiness Zone Map", (2012).

⁵⁶ Norbert P. Psuty and Erica Rohr, Coastal Dunes: A Primer for Dune Management with Models of Dune Response to Storm Frequencies, (Rutgers University Institute of Marine and Coastal Sciences, 2000), 1.

American beachgrass is the predominant dune vegetation planted on the forefront of the dune and was recently planted following the dune replenishment project. This species has roots that spread laterally as well as downward reaching depths of four feet.

Secondary dune vegetation can be found on the backside of the dunes, which offers more protection allowing plants to become taller and more established with time. This vegetation consists of woody plants adapted to coastal climates that add stability and biodiversity. These species include bayberry (*Myrica pensylvanica*), beach salt spray rose (*Rosa rugosa*), beach plum (*Prunus maritima*), eastern red cedar (*Juniperus virginiana*), winged sumac (*Rhus copallinum*), and shore juniper (*Juniperus conferta*) which normally grow on the slopes of dunes or behind them.⁵⁷

Appendix A provides additional information about the common dune vegetation found along the Bay Head dunes.

3.3 Marshes

The wetlands in the Borough (see Section 2.5) are home to unique and ecologically important vegetation. A 2015 study of Twilight Lake included a survey of the wetland vegetation in the northwestern section of the lake. The wetlands around this site are primarily emergent marsh, dominated by:

- Smooth Cordgrass (*Spartina alterniflora*)
- Common Reed (*Phragmites australis*)
- Goldenrods (*Solidago* spp.)
- Marsh Elder (*Iva frutescens*)⁵⁸

Common reed (*Phragmites australis*) is found in marsh systems worldwide. It is an erect perennial grass easily recognized by its plumes and that can grow from 6 to 15 feet tall. Research has demonstrated that the species has three separate lineages: in North America (endemic and widespread), from Europe (introduced and invasive), and a ‘Gulf Coast’ variety whose nativity remains unclear.

The introduced *Phragmites* grows aggressively and rapidly, consuming available space and outcompeting native plants. These plants can also alter wetland hydrology and reduce suitable wetland habitat due to its dense growth.

⁵⁹ Both the native and invasive varieties of this species are present in the Borough.

The marsh areas in Bay Head are tidally influenced and rely heavily on tides, currents, and rainstorms to provide nutrients for the plants and animals that inhabit them. The vegetation of the salt marsh is highly specialized to filter out nutrients such as nitrogen and phosphorus and therefore provides vital ecosystem services.⁶⁰

Appendix B provides additional information about the common marsh vegetation found along Twilight Lake.

3.4 Natural Vegetation

Native vegetation offers vital ecological and economic benefits. These species help naturally filter and conserve water, offer essential habitat that supports native wildlife, preserve soil health, and reduce the costs associated with fertilizers and pesticides. These plants can thrive with minimal care and the native species present along the New Jersey coastline are well-adapted to the environmental conditions surrounding them.⁶¹

The 2015 survey of Twilight Lake included documentation of the vegetation surrounding Twilight Lake. The survey reported that the thin upland community on either side of the abandoned rail path on the northwest end of

⁵⁷ Borough Council of Bay Head, “Code of the Borough of Bay Head, Part II: General Legislation, Chapter 75: Beaches”, (1996)

⁵⁸ The Borough of Bay Head, *Technical Memorandum: Next Steps to Advance a Path Across Twilight Lake Along the Alignment of a Former Rail Line*, (2016), 1.

⁵⁹ Corey L. Gucker, “*Phragmites australis*” (U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, 2008)

⁶⁰ Save Barnegat Bay, “Understanding the Bay and its Ecosystem”, (2019)

⁶¹ Jersey-Friendly Yards, “New Jersey Native Plants”

Twilight Lake is dominated by species commonly found in New Jersey, including short-leaf pine (*Pinus echinata*), American holly (*Ilex opaca*), eastern red cedar (*Juniperus virginiana*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), grey birch (*Betula populifolia*), and goldenrods (*Solidago spp.*). These species are commonly found throughout the Borough as well. Appendix C details some of the most commonly found native plants in the Borough.⁶² More comprehensive information regarding native plants can be found at:

http://npsnj.org/pages/nativeplants_Plant_Lists.html

While there are many species specifically native to and adapted to New Jersey, it is also important to note that many species native to other states and regions can be successfully grown in the Borough as long as they are within the same temperature range. Species such as crape myrtle (*Lagerstroemia indica*) which is commonly cultivated in Southern states, thrive in the Borough as a very popular choice in gardens. Additionally, hostas (*hosta spp.*) provide another example of a species that is not native to New Jersey but grows well in gardens in the Borough. These species are well adapted to the climate and can be grown successfully without becoming aggressive or invasive.⁶³

The natural vegetation of Barnegat Bay plays a significant role in supporting a complex ecosystem of species. The Bay's brackish water is a mix of saltwater from the ocean's natural inlets and fresh water from the mainland's rivers. Both converge into Barnegat Bay to form a body of water that is rich in nutrients for plants and an ecosystem that supports complex marine life.

Within the Bay near inlets, where the water has a high saline content, grows eelgrass (*Zostera marina*) which is a thin, ribbon-like plant that grows up to 2' high and 3/4" wide. Eelgrass grows to create dense beds in the eastern side of the Bay. These eelgrass beds are extremely important to the ecosystem because they provide hiding places as well as nesting habitat for small fish such as minnows and crabs.

The species Widgeon grass (*Ruppia maritima*) can be found growing in areas of the Bay where there is a higher concentration of freshwater. These underwater grasses are important in creating a safe haven for worms, clams, baitfish and small fish that provide prey for waterfowl.⁶⁴

Appendix C provides more information about the most common native vegetation in Bay Head.

3.5 Animal Communities

Twilight Lake offers valuable habitat to a variety of organisms. The high salinity of Twilight Lake greatly influences the biological community that resides there. As a result of this salinity, the fishery and aquatic plant community is an estuarine one dominated by organisms that are adapted to high and fluctuating salinity, as indicated by the presence of organisms such as Ribbed Mussels and barnacles.

A second implication of the influx of saline waters into Twilight Lake is *density-based stratification*, in which water is naturally distributed into layers corresponding to density. Because Twilight Lake is tidally restricted and only has a small tidal range, the exchange of water is modest, meaning that the Lake lacks tidally driven vertical mixing. If this resistance to mixing is sustained long enough, it may lead to depletion of oxygen near the bottom of the lake which in turn would negatively impact the usable fish habitat and increase the possibility of internal nutrient loading.⁶⁵

⁶² The Borough of Bay Head, *Technical Memorandum: Next Steps to Advance a Path Across Twilight Lake Along the Alignment of a Former Rail Line*, (2016), 1

⁶³ Conversation with Sharon Shaning (July 29, 2020)

⁶⁴ Save Barnegat Bay, "Understanding the Bay and it's Ecosystem", (2019)

⁶⁵ Princeton Hydro LLC, Lake Characterization Memorandum for Twilight Lake, (2012), 10-11.

Twilight Lake is connected to a large, emergent wetland complex that makes it an ideal stopover for birds migrating along the Atlantic Flyway. Appendix D provides information regarding bird species that were identified at Twilight Lake through citizen science efforts from 2010 until 2017.

The NJ Transit loop and property is the largest underdeveloped site in the Borough and is also home to a large proportion of the town's wildlife. Species such as osprey, eagles, deer, rabbits and small game such as raccoons, muskrats, and fox are known to inhabit this area. These species can also be commonly found migrating into residential areas and yards.

The Barnegat Bay hosts a complex food web and ecosystem, supporting clams, mussels, grass shrimp, baitfish, bluefish, striped bass, and wading birds, to name a few.⁶⁶ The ecological health of the Barnegat Bay is particularly at risk due to *eutrophication*. This process is the influx of excess nutrients in the Bay, which is caused predominantly by stormwater runoff entering the Bay carrying fertilizers and other forms of pollution such as dog waste.

In recent years, Barnegat Bay has experienced an increase in the abundance of stinging jellyfish, which is likely due to the loss of oxygen in the water which gives species such as jellyfish a competitive advantage over other species.⁶⁷

Bay Head has also seen a marked increase in the number of deer in the area. Once relatively uncommon, deer now are prevalent in many parts of town including residential areas. Deer can pose a danger to motorists who may not expect to encounter these creatures in a beach town. Further, most residents have not planned for deer when installing landscaping. As a result, whole yards may be prone to damage. Consideration of deer should be taken when planting flowers and, trees and shrubs.

The Borough aims to control the population of resident Canada Geese through a program of egg addling and deterring nesting. Geese can foul the grass areas of residential properties and our parks and their fecal matter can pollute the water to unsafe levels.

3.6 Threatened or Endangered Species

3.6.1 Plants

Seabeach amaranth (*Amaranthus pumilus*) has been federally listed as a threatened species since 1993. The species is native to the Atlantic Coast beaches and barrier islands.

During the summer of 2020, the *US Fish & Wildlife Service* found a tally of 101 seabeach amaranth plants on the southern part of the Borough's beaches. The plant had previously disappeared from NJ beaches in 1919 and did not reappear until 2000. No plants had been found in the Borough of Bay Head since 2011 prior to the 2020 reappearance.



Figure 22. Seabeach Amaranth.

⁶⁶ Save Barnegat Bay, "Understanding the Bay and it's Ecosystem", (2019)

⁶⁷ NJDEP, "Barnegat Bay Research Public Forum: Plan of Action", (2015)

The primary habitat of seabeach amaranth consists of overwash flats at accreting ends of islands, lower foredunes, and upper strands of non-eroding beaches. The species occasionally establish small temporary populations in other habitats, including sound-side beaches, blowouts in foredunes, interdunal areas, and on sand and shell material deposited for beach replenishment or as dredge spoil. Seabeach amaranth prefers to grow on a nearly pure sand substrate, occasionally containing shell fragments.⁶⁸

The reappearance of the species in Bay Head is likely due to disruption caused during the beach replenishment project. The Bay Head populations were likely established from the relatively large populations of the species in neighboring Mantoloking and Point Pleasant Beach.

The growing season of the species is from May 15 until November 30, and nearly all germination will be done by the end of July/early August, with the flowering and seed production continuing into the fall. The species is an annual, and spreads by seed dispersal facilitated by the wind and tide. Since these seeds can disperse across beaches, it is difficult to determine where populations will establish from year to year.

The ongoing management of the beaches can greatly influence the ability of the plant populations to survive. Bay Head has a more suitable habitat for the species as it is less heavily trafficked by visitors than neighboring towns such as Point Pleasant and is hand-raked, rather than by utilizing heavy mechanical equipment. If not protected from the mechanical beach grooming and crowds, it is very likely that the plants will be disturbed and endangered.⁶⁹

3.6.2 Birds

There are currently no endangered bird species on the Bay Head beaches. However, there are endangered species such as Piping Plovers in Point Pleasant and Mantoloking which provide the opportunity for species to establish on or migrate to Bay Head beaches in the future.⁷⁰ Areas of both Point Pleasant and Mantoloking are included as *Natural Heritage Priority Sites* for their presence of endangered bird species. These areas are designated critically important areas for conserving New Jersey's biological diversity.

3.7 Invasive or Exotic Species

Invasive species can grow aggressively and outcompete the native species present. When introduced into an environment that is absent of the natural diseases and insects that regulate their growth, these invasive species are given a competitive advantage. The competition for resources created by invasive species can disrupt valuable native ecosystems.

Appendix E outlines some common invasive species of vegetation and insects in the Borough.

⁶⁸ U.S Fish & Wildlife Service: New Jersey Field Office, "Seabeach amaranth (*Amaranthus pumilus*)", (2018)

⁶⁹ Conversation with Todd Pover, Field Biologist with U.S Fish & Wildlife Service (July 6, 2020)

⁷⁰ Ibid., (2020)

4 PHYSICAL RESOURCES

4.1 Population and Demographics

As of the 2010 United States Census, the Borough had a total population of 968 compared to a total population of 824 in 1960. In 2014, the American Community Survey (ACS) estimated Bay Head's population was 997.

Table 10. Bay Head Population - US Census (1950-2014).

POPULATION 1950 - 2014			
Year	Population	Change	% Change
1950	808	-	-
1960	824	16	2.0%
1970	1,083	259	31.4%
1980	1,340	257	23.7%
1990	1,226	(114)	(8.5%)
2000	1,238	12	1.0%
2010	968	(270)	(21.8%)
2014 (est.)	997	29	3.0%
Source: http://lwd.dol.state.nj.us/labor/lpa/dmograph/est/nj1790_2010.pdf ; DP-05 2014 ACS; http://www.njtpa.org/getattachment/Data-Maps/Demographics/Forecasts/Forecasts-for-RTP-rounded.pdf.aspx *(Parentheses) indicate a negative (-)			

Since the early 1950's, the total population of the Borough of Bay Head has fluctuated from 800 in the 1950's to over 1300 in the 1980's. Since 2010, however, the total population has remained relatively stable - averaging around 1,000 year-round residents. In addition, Bay Head's total population expands to 10,000 people or more during the summer months.

Since the Borough is almost entirely developed, any increase in Bay Head's full-time population would likely come from seasonal second homes becoming primary year-round residents, or families migrating from urban areas as virtual "work from home" alternatives become more feasible.

The medium age of the Bay Head population was 57.2 in the US 2010 Census and estimated at 54.8 by the 2014 ACS Report, indicating an older population.

The 2010 census data breakout of the residents by age shows that 16.3% were under the age of 20, 16.2% were between 20 and 44 years of age, and 67.3% were over the age of 44.

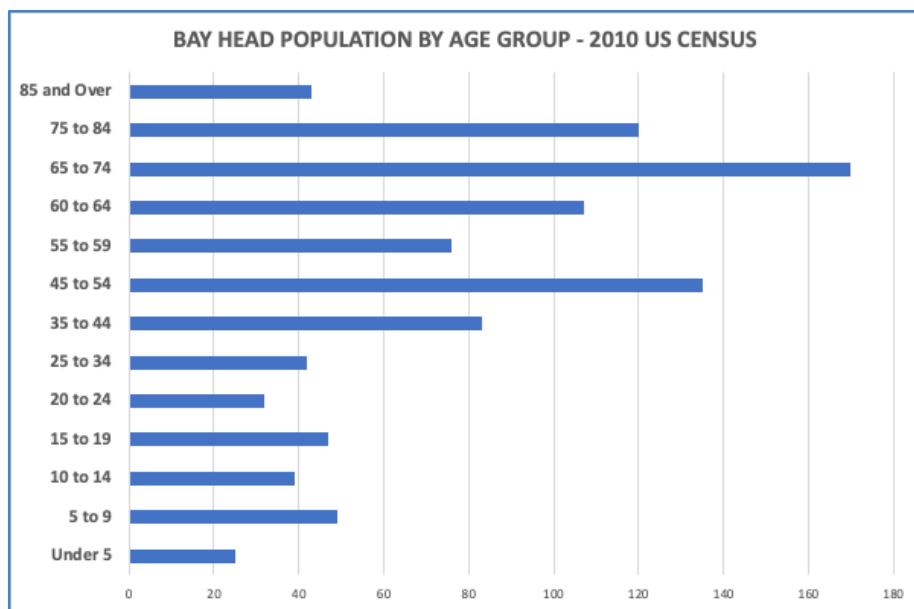


Figure 23. Bay Head Population by Age Group (2010 US Census)

There are 1023 residences, 459 households, four churches, and a K through 8th grade elementary school located within the Borough.⁷¹ Over 95% of Bay Head's population is English speaking.⁷²

The Borough of Bay Head maintains its own Police and Fire Departments, operates a Public Works Department, provides a public library (run by Ocean County), and operates a recycling center facility.

4.2 Land/Land Use

According to the 2010 United States Census Bureau, the Borough of Bay Head has a total area of 0.71 square miles (1.83 km⁷³ – approximately 454 acres), including 0.59 square miles (1.52 km⁷³ - 377 acres) of land and 0.12 square miles (0.32 km) of water (approximately 17%). Water frontage in the Borough is approximately 1.25 miles of Oceanfront along the eastern edge, 0.75 miles of Bayfront along parts of the western and southern edge, and 1.2 miles of Lake and Ditch frontage in the center of the Borough along Twilight Lake and Scow Ditch.



Figure 24. Oceanfront View.

⁷¹ The Borough of Bay Head, *Coastal Vulnerability Report*, (October 2019,) pg. 6.

⁷² Ibid., pg. 6.

⁷³ US Gazetteer files: 2010, 2000, and 1990, US Census Bureau.

Figure 25 provides two maps that further detail land and land usage in Bay Head.

The **Zoning Map** (Figure 25 – left side) shows the different zoning districts established within Bay Head by the Borough. Each different zone designates the functions (e.g., residential, commercial, etc.) that are permitted within the borders of that zone and further also defines any restrictions or regulations that must be met for development within that zone.

By contrast, the **Land Use Map** (right side of Figure 25) indicates how land has been actually utilized or used in the Borough and further differentiates between public and privately-owned land.

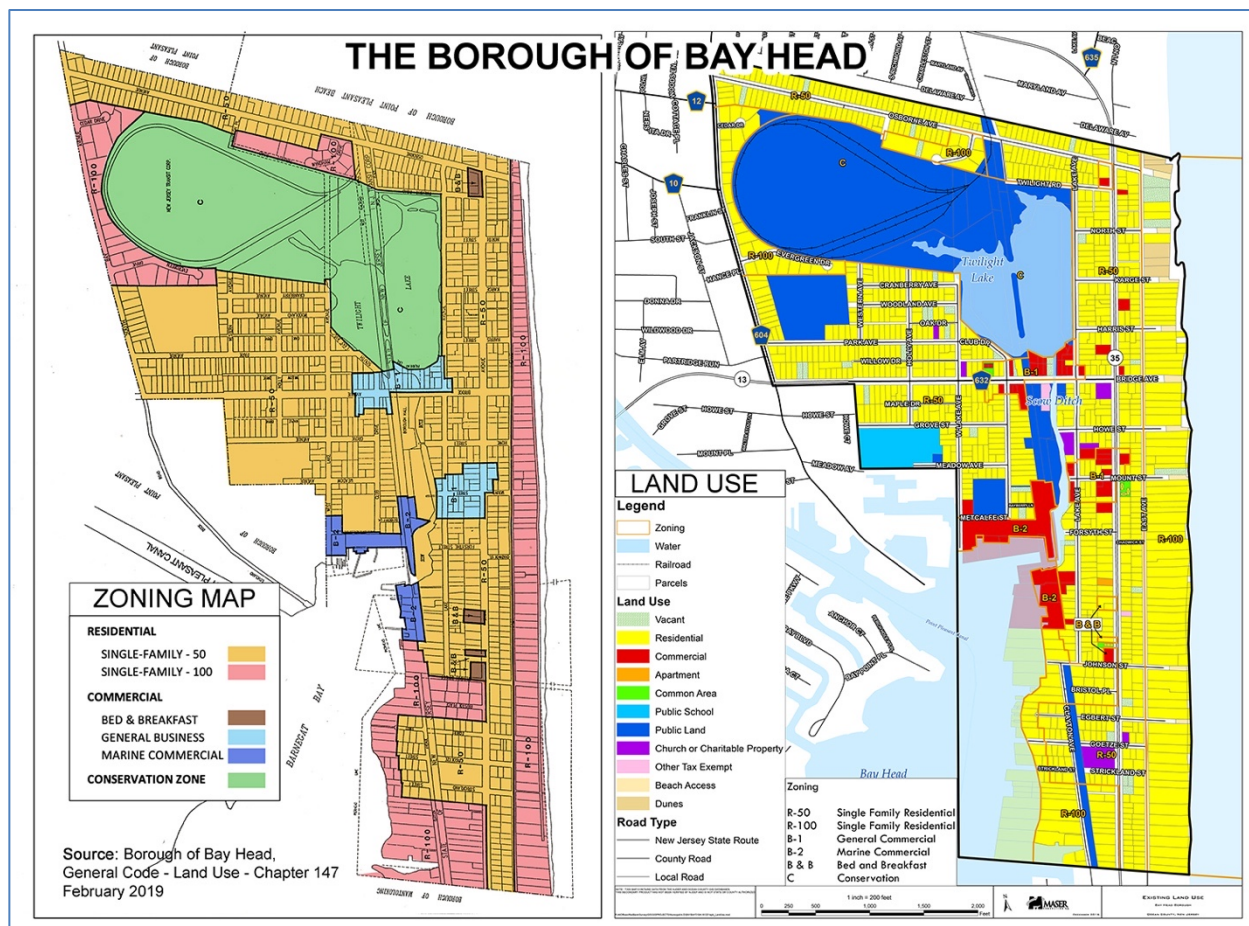


Figure 25. Zoning and Land Use in Bay Head

For a full-sized copy of either of these maps, please click the appropriate links or scan the QR code below:

Zoning Map - <https://bit.ly/3fNpBca>

Land Use Map - <https://bit.ly/36idiBw>



Zoning Districts

The Borough of Bay Head has six distinct zones:⁷⁴

- R-50 – Single Family Residential Zone (50 x 100 ft. lot)
- R-100 – Single Family Residential Zone (100 x 100 ft. lot)
- B-1 – General Business Zone
- B-2 – Marine Commercial Zone
- B&B – Bed & Breakfast Zone
- Conservation Zone

The primary zoned usage in Bay Head is “Residential” consisting of the R-50 (light orange) and R-100 (pink) zones. The residences are primarily of detached single-family structures, many dating to before the mid-1900’s. With over 550 historically significant structures, Bay Head is one of the largest historic districts in New Jersey (see also – *Section 4.3 – Historic Resources*).

The Conservation zone (light green) incorporates the railroad “Loop” including the marshy area and wetlands and Twilight Lake. Further development is prohibited in this zone, except as necessary to support existing public space and for transportation uses.⁷⁵

Bay Head has two zoned commercial business districts (light blue) - one in town center Bay Head and the second further to the south.

Marine-related commercial businesses, including the Bay Head Yacht Club and the Sanzari Mariana, are located along the Barnegat Bay waterfront on Bay Head’s south west border.

Each zone establishes the “permitted uses” in that particular area. In addition, multiple permitted uses are typically allowed in the same zone. For example, permitted uses in both Bay Head’s residential zones (R-50 and R-100) include single-family detached dwellings; public parks and recreational facilities; municipal buildings and other necessary municipal uses; and public and parochial schools. Likewise, all permitted uses in the residential zones are also allowed in the B1, B2, and B & B Commercial Zones. As a result, further insight regarding actual land usage (versus zoned allocation) can be obtained from the Land Use map.

Land Use

Land use in the Borough of Bay Head is depicted in the Land Use Map - right-hand side of Figure 25 on the prior page. The map was prepared by Maser Engineering in December 2016 during the reexamination of the Master Plan.

⁷⁴ The Borough of Bay Head, *Land Use Chapter 147*, (February 2019), pg. 147:13.

⁷⁵ The Borough of Bay Head, *Land Use - Chapter 147*, February 2019, pg. 147:23.

Table 11 further analyzes information from the Land Use Map and provides a summary of acreage estimated using the Google mapping tools.

The largest land usage in Bay Head is Residential which accounts for approximately 53% of the total land use, followed by Public Lands (approximately 22%). Commercial properties occupied approximately 15 acres or roughly 4% of the land total.

Public Ownership

Public property in Bay Head includes land, water, and roads owned by:

- The Borough of Bay Head
- The State of New Jersey and NJ DOT
- The Bay Head Board of Education
- New Jersey Transit
- Ocean County

Table 11. Bay Head Land Usage - December 2016.

LAND USEAGE	~ ACRES	%
Apartment	0.2	0.06%
Beach Access	1.6	0.43%
Church or Charitable	3.0	0.78%
Commercial	15.0	3.96%
Common Area	0.6	0.15%
Dunes	2.4	0.65%
Other Tx Exmpt	0.5	0.13%
Public Land	83.8	22.18%
Public School	7.2	1.92%
Residential	199.9	52.94%
Roads	60.0	15.90%
Vacant	3.4	0.90%
*Total Land	377.6	100.00%
Water	76.8	
*Total Land & Water	454.4	

SOURCE: Areas estimated using Google Maps.

Table 12. Publicly Owned Property in Bay Head

PUBLIC OWNER/PROPERTY	~ACRES	%
Bay Head Board of Education	7.2	6.21%
Bay Head Elementary School	7.2	6.21%
Borough of Bay Head	35.0	30.00%
Centennial Park - Muni Bldg	4.3	3.65%
Howe Park	2.4	2.07%
Maintenance Garage	8.6	7.36%
Scow Ditch Park	0.1	0.11%
Twilight Lake - NE Shore	6.4	5.51%
Wetlands-West Twilight	13.2	11.29%
NJ Transit	53.3	45.72%
Active Railroad - The Loop	53.0	45.44%
Rail Station	0.3	0.28%
State of New Jersey	21.1	18.07%
Clayton Ave - ROW	2.5	2.16%
Kellogg Memorial Island	0.9	0.73%
Twilight Lake - ROW	1.3	1.11%
Twilight Lake - West Basin (Water)	4.2	3.63%
Twilight Lake - East Basin (Water)	12.2	10.44%
**GRAND TOTAL	116.6	100.00%

SOURCE: Areas estimated using Google Maps.

New Jersey Transit is the largest public property holder in Bay Head owning over 50 acres; followed by the Borough of Bay Head (approx. 35 acres); and then the State of New Jersey (approx. 21 acres). The Bay Head Board of Education owns the Bay Head Elementary School.

In addition, public streets are owned by (1) the Borough of Bay Head - approximately 8.2 miles; (2) Ocean County - Osborne and Bridge Avenues – approximately 1.2 miles; and (3) New Jersey Department of Transportation – Route 35 – 1.34 miles.

Although not a public organization, the Bay Head Improvement Association (BHIA) owns approximately 2 acres of beach-front property along East Avenue that provides public access to the Bay Head Beaches (see Section 4.8 for information on beach access).

4.3 Historic Resources

The Bay Head Historic District was listed on the *National Register of Historic Places* in 2005. The Historic District serves as an example of a coastal summer resort dating from the last quarter of the nineteenth century to the beginning of World War II. Together, the Historic District offers a cohesive representation of the style of this particular time period, with characteristic architecture ranging from 1880 to 1940.

The dominant style among the Borough's historic buildings is the Shingle style. The overall presence of the Shingle style is unique and makes Bay Head one of the best collections of Shingle style homes in New Jersey.



Figure 26. Example of Shingle Style Home in Bay Head (17 Mount Street).

In addition to a unified style, many historic buildings share common materials. Buildings are overwhelmingly constructed using wood frames and clad with weathered shingles and wood trim. Some buildings utilize clapboard, and most roofs were originally wood-shingled but have since been replaced. The unified architectural style of Bay Head has largely persisted throughout time. Historically, builders and patrons made homage to the existing architecture and exhibited a degree of conservatism, continuing to use and preserve Bay Head's architectural features in their original form.

The Bay Head Loop was originally installed at the Bay Head Junction train station in 1918⁷⁶. Today, the tear-drop shaped loop, formed by the tracks surrounding the 33 acres of marsh and wetlands which make up the rail yards, serves a unique purpose by allowing trains to be turned without the use of a turntable or "wye" track. Because of the large amount of property needed to support a turning loop, few other loops were built in New Jersey and today the Bay Head site remains the only turning loop in New Jersey.

The New Jersey State Historic Preservation Office has previously determined that the Bay Head Loop is part of the eligible New York and Long Branch Railroad National Register Historic District.⁷⁷

Table 13 beginning on the next page details some of the Borough's most prominent historic buildings. Further information on the history of Bay Head can be found by visiting the *Bay Head Historical Society* (www.bayheadhistoricalsociety.com) which is open to the public seasonally from May to October.

⁷⁶ New Jersey DOP Historic Preservation Office, NJ Transit Bay Head Substation, (January 2014).

⁷⁷ Coastal Building Group, "Bay Head Historic District", (Living Places, 2013)

Table 13. Prominent Historic Buildings of Bay Head⁷⁸

Property	Date Established	Additional Information ⁷⁹
530 Main Avenue	1914	Originally Chafey's Drug.
18 Bridge Avenue	1883	Wheeler's Home Cottage
26 Bridge Avenue		Remodeled 2017, moved 1920's further away from the corner.
3 Bridge Avenue	1899	Howard Clark Cottage
58 Bridge Avenue	1882	Formally Dorcas of Bay Head and the Bay Head Land Company's Office.
334, 336, 338 East Avenue	1883 and 1900	334 East Ave. shows up on the 1883 Bay Head map. 338 and 336 East Ave. look like they could have been constructed by the same builder c. 1900.
344 East Avenue		
400 East Avenue	1900	
406 East Avenue	1900	
416 East Avenue	before 1883	
453 East Avenue	1900	
513 East Avenue		"The Centennial Cottage"
15 Harris Street	1900	
21 Harris Street	1882	Cornelia and Henry Buxbaum
40 Harris Street	1890	"The Norton Cottage"
41 Harris Street	1885	Built for the Priest family whose drug store still stands around the corner at 410 Main Ave.
50 Harris Street, 357 Lake Avenue	1882	Constructed for the other two sisters of D. H. Mount, Jr., Madeline and Maria.
22 Howe Street	1880	Hall-Studdiford Cottage
55 Howe Street	1910	
The Founders' Cottages		Three houses south of 1 Mount are known as "the Founders' Cottages" because they were built for David H. Mount, Sr., Edward Howe and William Harris, the three founders of the Bay Head Land Co.
30 Karge Street	1883	
444 Lake Avenue	1898	According to 1902 Sanborn map, this house was the borough hall and the post office with a single jail cell in a separate back building.

⁷⁸ United States Department of the Interior, "National Register of Historic Places Registration Form"⁷⁹ The Borough of Bay Head, "Bay Head Walking Tour" (June 2010)

Property	Date Established	Additional Information ⁷⁹
500 Lake Avenue	1889	All Saints Church; the oldest church in Bay Head. All Saints was a sour-bay meetinghouse with an entrance located on the north side. A transept with a square tower at the crossing was added at a later time. The belfry was built in 1905. Although the architect is unknown, local builder Wyckoff Applegate built the original building.
524 Lake Avenue	1910	Formally Applegate's Hardware which was founded by one of Bay Head's early builders, Wyckoff Applegate.
200 Main Avenue		E.F Cumming's Cottage
232 Main Avenue		
233 Main Avenue		
345 Main Avenue	1890	The Grenville Hotel
409 Main Avenue	1895	
410 Main Avenue	1880	Originally known as Priest's Drug Store.
421 Main Avenue		
440 Main Avenue		The Bay Head Chapel; was moved from its original site near Scow Ditch in 1910. The present structure was remodeled in 1950s.
500 Main Avenue, 37 Howe Street, 47 Howe Street	1882-1883	Three houses built by the Mount family for David H. Mount, Jr. M.D. (500 Main Ave.) and two of his four sisters, Flora and Anna (37 Howe St. and 45 Howe St.); remodeled 1905-1910.
525 Main Avenue		
540 Main Avenue		
575 Main Avenue		
534 Main Avenue	1875	Formally Curtis Market, Chadwick's/Fleming's grocery, Central Meat Market/Charlie Wing's Laundry.
1 Mount Street	before 1883	The Ver Planck/Cattus house
17 Mount Street	1905	Bought in 1913 by Oliver Hazard Perry and known as the Oliver Hazard Perry house.
42 Mount Street	1880	

4.4 Tax Maps

The tax maps of the Borough of Bay Head on the following pages were collected from records published in 1949 and 2006.

✓**NOTE:** The maps provided in this section do not serve as a comprehensive or most recently updated edition of the Borough's tax maps.

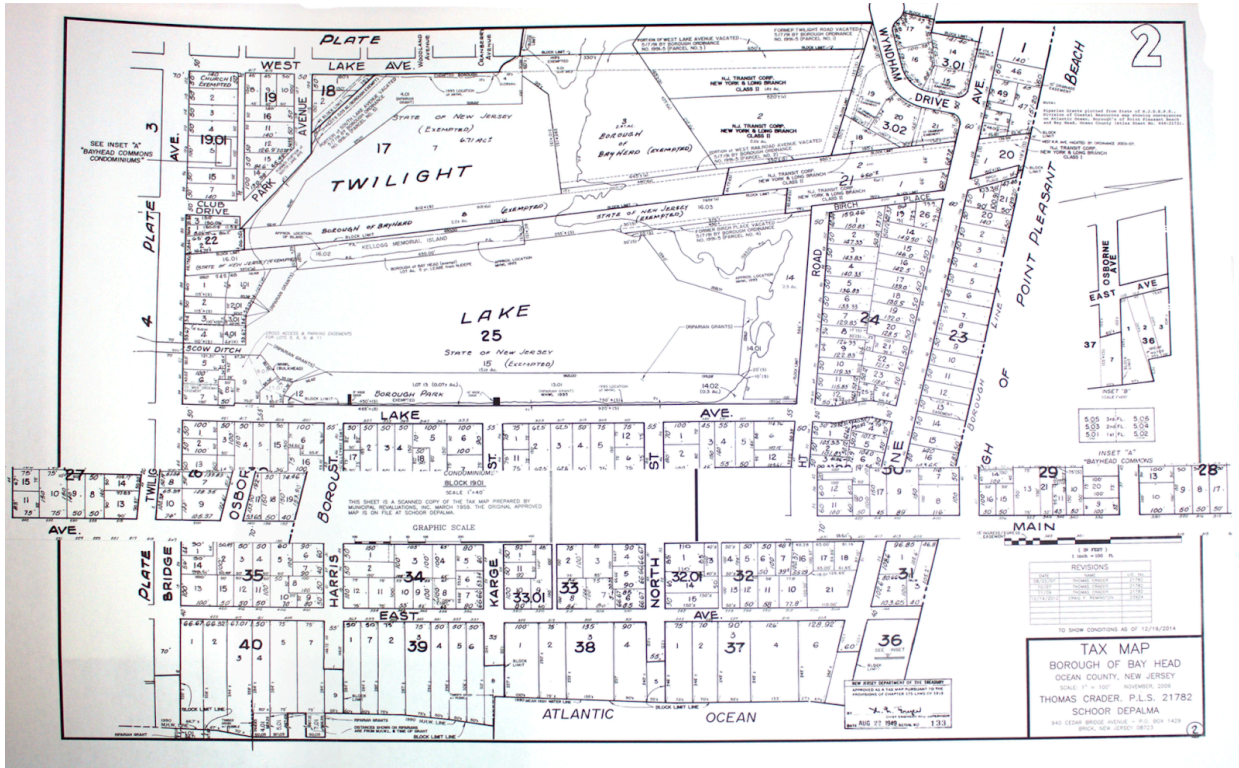


Figure 27. Tax Map 1 (2006)

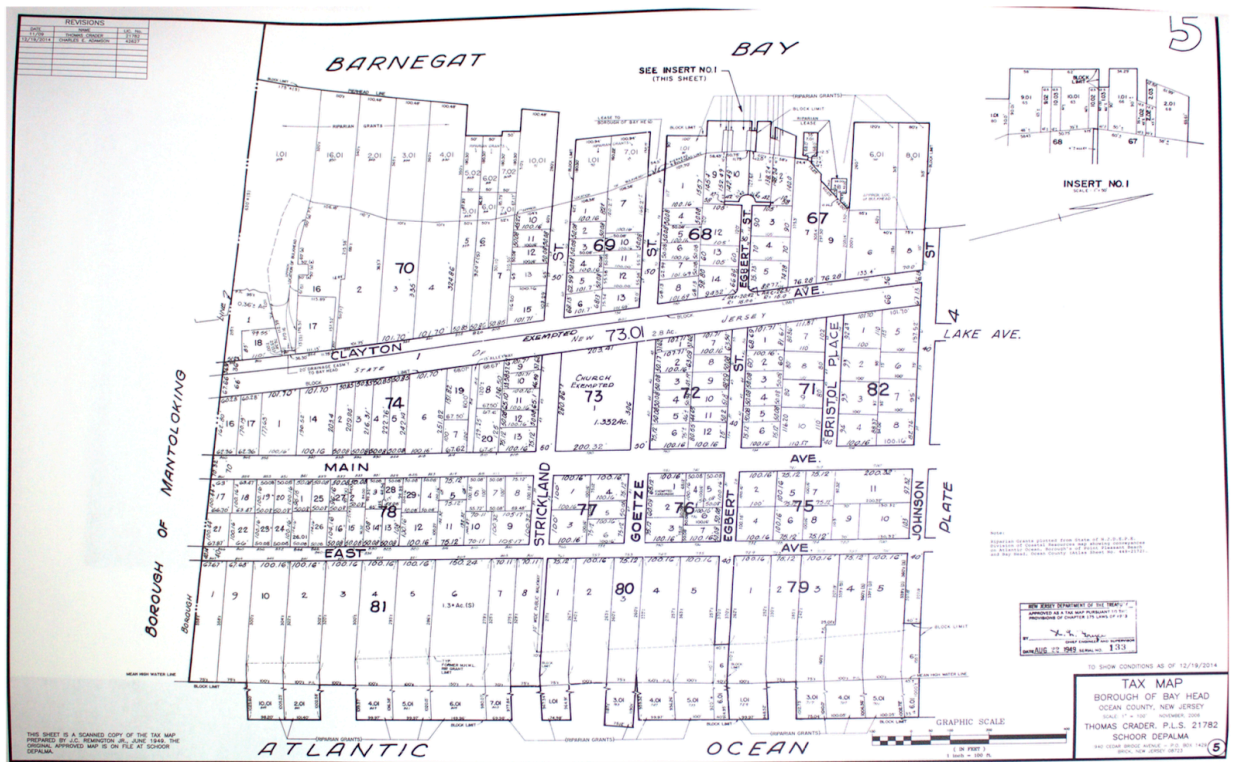


Figure 28. Tax Map 2 (2006)

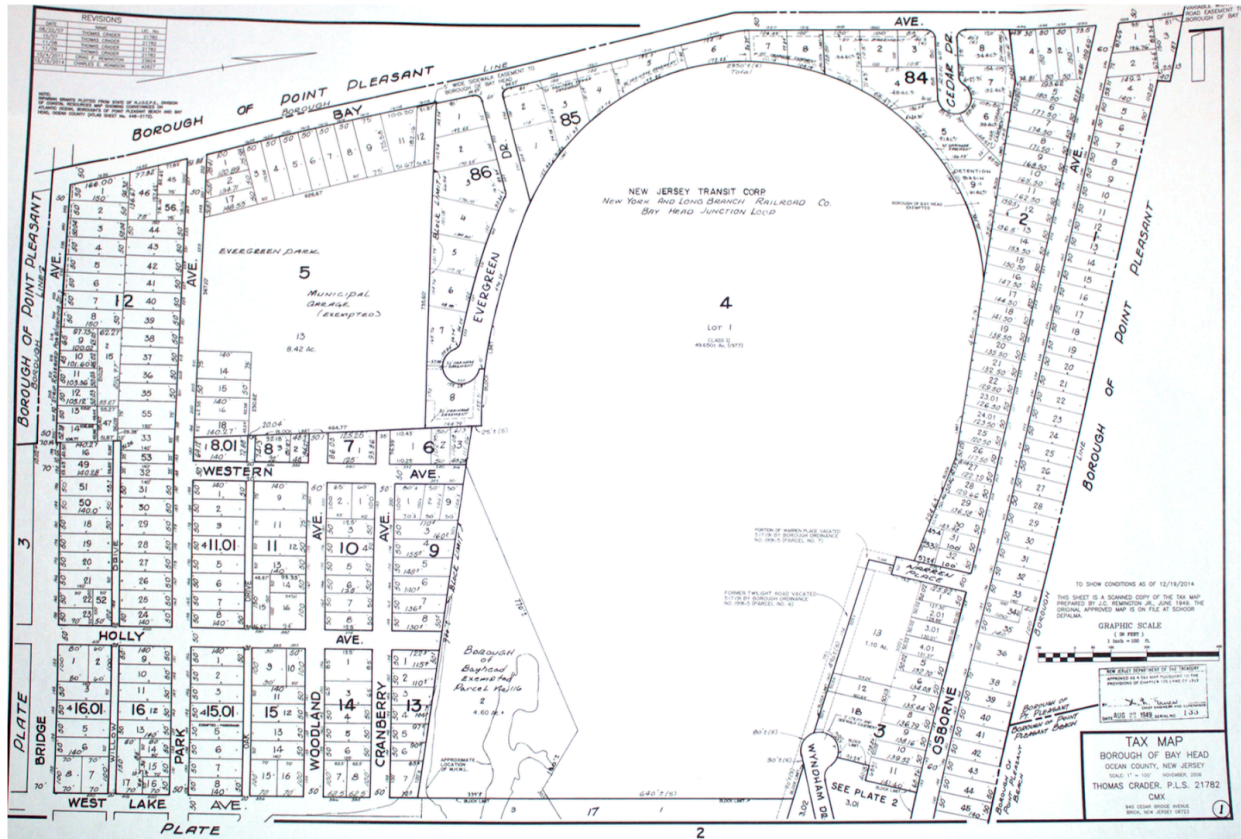


Figure 29. Tax Map 3 (2006)

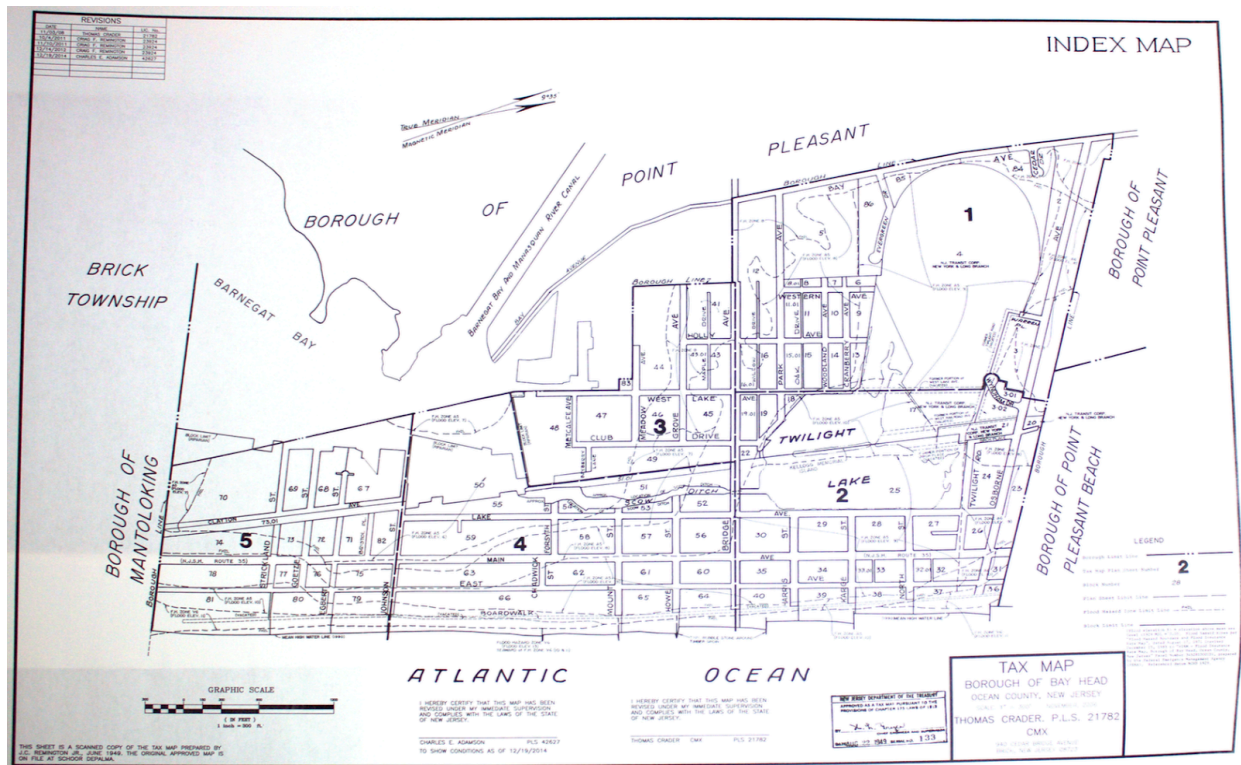


Figure 30. Tax Map 4 (2006)

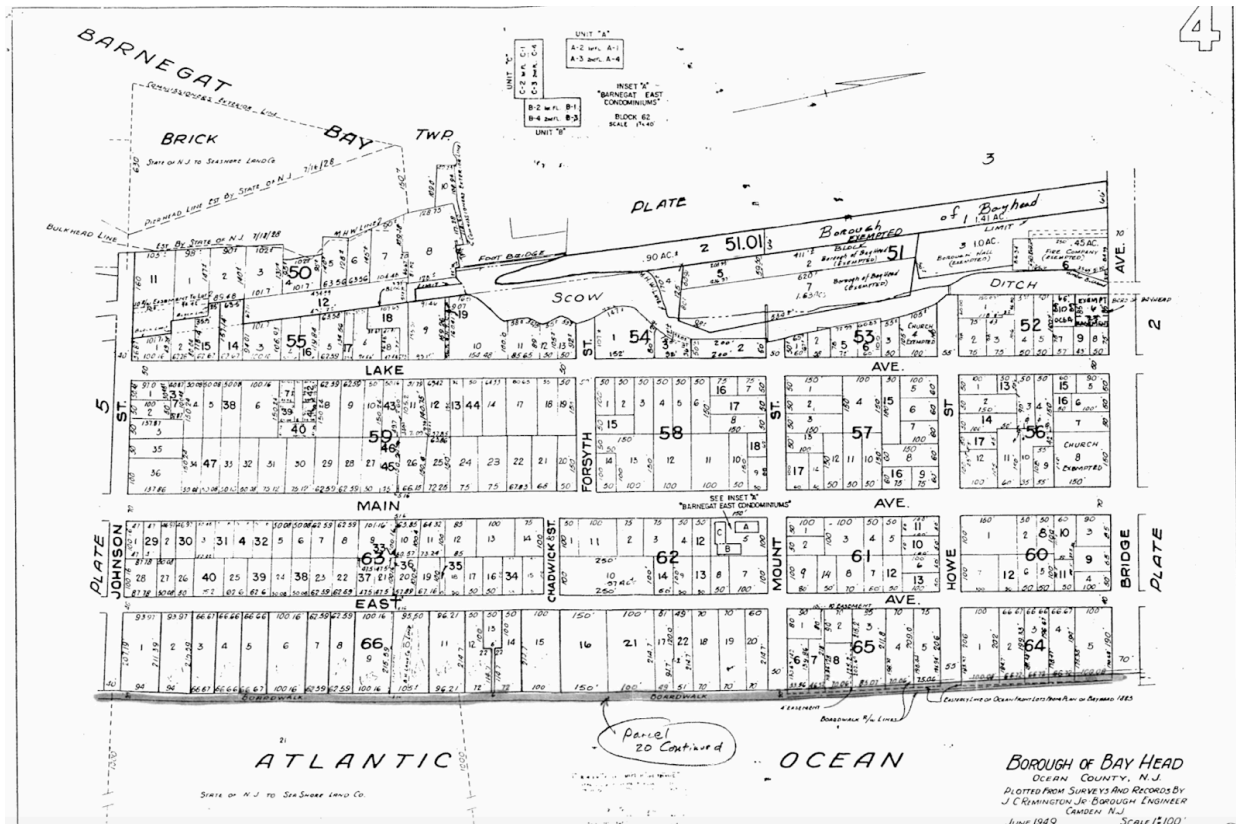


Figure 31. Tax Map 5 (1949)

4.5 Roads

As of May 2010, the Borough had a total of 10.74 miles (17.28 km) of roadways, of which 8.24 miles (13.26 km) were maintained by the municipality, 1.16 miles (1.87 km) by Ocean County and 1.34 miles (2.16 km) by the New Jersey Department of Transportation.⁸⁰

The Borough is bisected east and west by Main Street, also known as New Jersey Route 35, which begins at Bay Head's northern border with the Borough of Point Pleasant Beach and runs to the southern border with the Borough of Mantoloking. Route 35 is a critical artery for all vehicular traffic coming from the north to the Barrier Island.⁸¹

4.6 Utilities & Services

The Borough provides public utilities for all buildable parcels within Bay Head. All new structures, including residential and commercial, are required to connect to the sanitary sewer system. Potable water is supplied by a private utility company, New Jersey American Water Company (NAJAW). The utility purveyors for natural gas and electric are New Jersey Natural Gas (NJNG) and Jersey Central Power and Light (JCP&L), respectively.

4.6.1 Sanitary Sewer

Chapter 195 of *The Code of the Borough of Bay Head* requires that the owner of every residential, commercial or industrial building or structure within the Borough must connect the plumbing facilities of said structure with the sanitary sewerage system of the Borough. It is prohibited for sump pumps, downspouts, cellar drains, or swimming pools of any kind to be connected to the sanitary sewer system of the Borough.⁸² There are no septic systems in Bay Head.

The Borough of Bay Head is included in the *Ocean County Wastewater Management Plan* and is located entirely within the Northern Planning Area for Ocean County. Wastewater in Bay Head is collected through the Borough's lateral lines, which then connect to the Ocean County Utilities Authority (OCUA) system. An OCUA interceptor originates at the Bay Head Lift Station (NPS-7) just south of Twilight Lake. This interceptor flows west along Bridge Avenue, turns north on Holly Avenue, and turns west again along Park Avenue to the Borough boundary with Point Pleasant Borough. From there, wastewater is conveyed to the OCUA Northern Water Pollution Control Facility (NWPCF), which is located in Brick Township and was opened in 1976. The facility is designed to treat domestic sewage and some light industrial waste. Based on 2010 estimates from OCUA, the Bay Head Wastewater Flow (Millions of Gallons per Day) is approximately:

- Residential: 0.329 MGD
 - Commercial: 0.014 MGD
 - Industrial: 0.000 MGD
 - Inflow/Infiltration: 0.010 MGD
- Total Flow: 0.353 MGD**



Figure 32. Roads in Bay Head. Source: GOVMap

⁸⁰ New Jersey Department of Transportation, "Ocean Country Mileage by Municipality and Jurisdiction", (May 2010)

⁸¹ Borough of Bay Head, *Coastal Vulnerability Report*, pg. 6 (October 2019).

⁸² Borough Council of Bay Head, "Code of the Borough of Bay Head, Part II: General Legislation, Chapter 195:Sewers", (1996)

Figure 33 below shows the areas of the Borough served by existing wastewater facilities. “Sewered Areas” denotes that collection lines exist in the indicated areas and that these properties are either connected or have all regulatory approvals necessary to be connected.⁸³

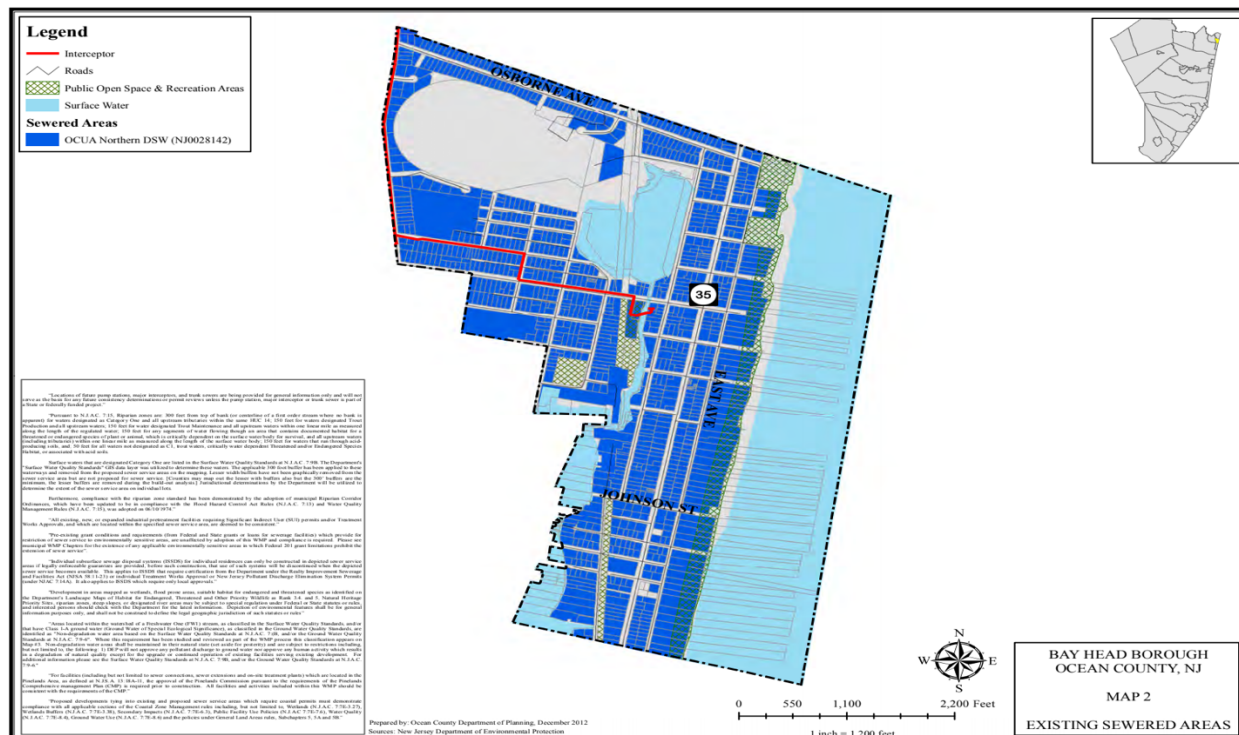


Figure 33. Existing Sewered Areas⁸⁴

4.6.2 Power

Power is supplied to Bay Head by *Jersey Central Power and Light* (JCP&L). There is one large 34.5 Kilovolt loop which provides power to the entire Barrier Island. Bay Head receives power from one substation. The electric infrastructure of the town includes two circuits, 393 utility poles, and nine miles of distribution lines.

JCP&L also has mobile sub-stations on the mainland that allows JCP&L to replace any sub-station within hours in case of power loss, providing reliability of more than 99%. In addition, JCP&L maintains portable Hesco devices ready to be deployed as an additional protective barrier in the event of flooding.

To report a power outage with JCP&L: call the Outage Reporting Line at 1-888- LIGHTSS (1-888-544-4877) or report at www.firstenergycorp.com.⁸⁵

4.6.3 Natural Gas

The Borough of Bay Head is currently supplied natural gas by *New Jersey Natural Gas Company* (NJNG) through a network of gas mains. These gas mains receive their supply from both the northern and southern ends of the island as well as from the mainland across Barnegat Bay in Brick Township. These multiple feeds ensure that continued service can be maintained to the Borough as well as to the remainder of the island.⁸⁶

⁸³ The Ocean County Department of Planning, *Ocean County Wastewater Management Plan*, (2015)

⁸⁴ *Ibid.*, (2015)

⁸⁵ The Borough of Mantoloking, *Mantoloking Environmental Resource Inventory* (2019)

⁸⁶ *Ibid.*, (2019)

4.6.4 Water Supply

Monmouth and Ocean Counties, with a combined population of approximately 1.2 million people, use approximately 6.5 billion gallons of water per year, of which 85 percent is for drinking water. Of the 6.5 billion gallons of water annually used, more than 50 percent is groundwater and the rest is surface water. In Ocean County specifically, groundwater supplies most drinking water needs.⁸⁷

The Borough of Bay Head draws its water supply from five wells and one surface water source. Wells are mostly used in the summertime to meet additional demand and the Jumping Brook Treatment Plant is the primary source. The majority of the Borough's water comes from a reservoir and supplemented from water in underground wells. The Jumping Brook Treatment Plant is located in Neptune and is fed by the Glendola reservoir in Neptune, NJ.

The Borough's drinking water supply is delivered by *New Jersey American Water*, and Bay Head's water system is part of what NJ American Water calls its "Coastal North System." The Coastal North System delivers water to many towns and obtains its water from many sources.

2016 Water Quality Report

In November 2016, the Bay Head Environmental Commission (BHEC) assessed the quality and safety of the Borough's drinking water supply in a public report at the request of the Mayor of Bay Head⁸⁸. Table 14 on the following page provides information on water quality levels in the Coastal North System from that report. While the ranges of the contaminants varied, in all cases compliance was achieved within the current standards.

The 2016 BHEC report concluded that the New Jersey American Water Company "has consistently provided safe drinking water to Bay Head in the past." The report also noted that water quality standards are changing and have become more stringent in recent years, especially with regard to the permissible levels of Chromium-6 in the water supply. The report further concluded that the BHEC would continue to monitor and comment upon the annual water quality reports published by the New Jersey American Water Company to help ensure that Bay Head's water supply remains safe and secure.⁸⁸

The annual New Jersey American Water Company water quality report is available on their website at <https://amwater.com/njaw/water-quality/water-quality-reports>.

⁸⁷ NJDEP Water Resources Management, "Aquifer Correlation Map of Monmouth and Ocean Counties, New Jersey", (2013)

⁸⁸ Bay Head Environmental Commission, *Water Quality Review* (2016)

Table 14. Annual Water Quality Report for the Coastal North System (2015)

Regulated Substances ¹

Contaminant	Units	MCL	MCLG	Range Detected	Highest Level Detected	Compliance Achieved	Typical Source
Inorganic Chemicals							
Fluoride ²	ppm	4	4	ND to 0.68	0.68	Yes	Erosion of natural deposits; Water additive which promotes strong teeth
Nitrate	ppm	10	10	ND to 1.16	1.16	Yes	Runoff from fertilizer use; Industrial or domestic wastewater discharges; Erosion of natural deposits
Chromium	ppb	100	100	ND to 0.2	0.2	Yes	Discharge from steel and pulp mills; Erosion of natural deposits
Treatment By-Products Stage-2							
Total Trihalomethanes [THMs]	ppb	80	NA	26.8 to 94.8	72.5 ³	Yes	By-product of drinking water disinfection
Total Haloacetic Acids [THAAs]	ppb	60	NA	6.8 to 61.2	24.3 ³	Yes	By-product of drinking water disinfection
Turbidity							
Turbidity ²²	ntu	TT	NA	0.05 to 0.27	0.27	Yes	Soil runoff
Treatment By-products Precursor Removal							
Total Organic Carbon	ppm	TT	NA	1.03 to 2.14	2.14	Yes	Naturally present in the environment
Disinfectants							
Chloramines	ppm	MRDL = 4	MRDLG = 4	0.02 to 2.9	1.32 ⁴	Yes	Water additive used to control microbes
Chlorite ⁵⁰	ppm	1	0.8	ND to 0.48	0.48	Yes	By-product of drinking water disinfection
Chlorine Dioxide ⁴⁴	ppb	MRDL = 800	MRDLG = 800	40 to 520	520	Yes	Water additive used to control microbes
Radiological Substances							
Alpha Emitters ⁹	pCi/L	15	0	ND to 9.2	9.2	Yes	Erosion of natural deposits
Combined Radium 226 and 228	pCi/L	5 ³	0	ND to 3.9	3.9	Yes	Erosion of natural deposits
Tap water samples were collected for lead and copper analysis from homes in the service area							
Contaminant	Units	Action Level	MCLG	Amount Detected (90 th %tile)	Homes Above Action Level	Compliance Achieved	Typical Source
Copper ¹³ 2014	ppm	1.3	1.3	0.234	none	Yes	Corrosion of household plumbing systems
Lead ¹³ 2014	ppb	15	0	3	1	Yes	Corrosion of household plumbing systems

The New Jersey American Water Company also purchases potable groundwater from outside sources. Figure 34 on the next page shows the Borough's current potable water conveyance system. The area covered by blue cross-hatching denotes that distribution lines exist and that these properties are either connected to the corresponding public water purveyor or have all regulatory approvals necessary to be connected with no further review.⁸⁹

⁸⁹ The Ocean County Department of Planning, "Ocean County Wastewater Management Plan", (2015)

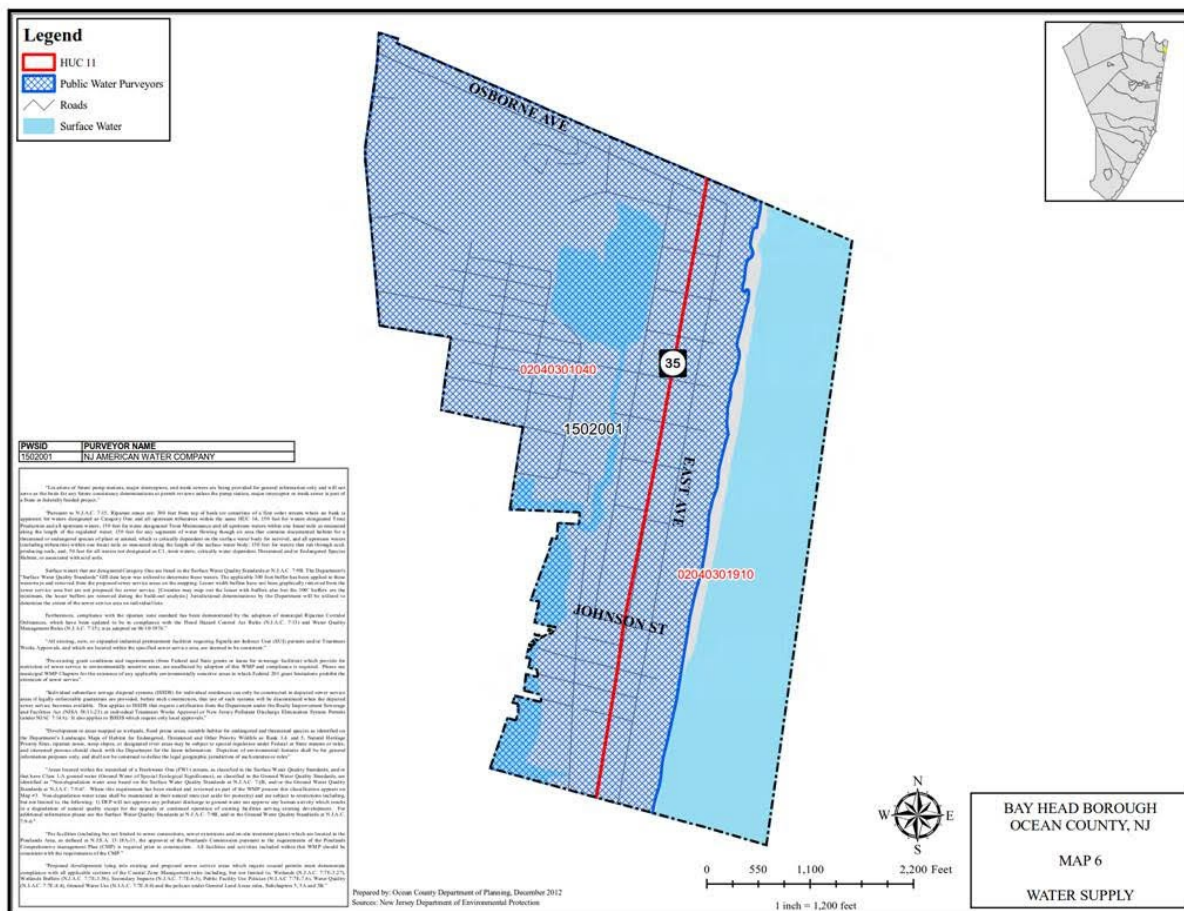


Figure 34. Bay Head Water Supply⁹⁰

4.6.5 Storm Sewer System

For information on stormwater infrastructure and outfall locations throughout the Borough, please refer to the detailed *Storm Infrastructure Maps* in Appendix F.

4.6.6 Storm Water Management

The Borough of Bay Head is prone to stormwater management concerns due to its proximity to the Atlantic Ocean and Barnegat Bay. Further, the water table levels around the Lake and Bay are very high, lessening the opportunity for natural ground water recharge. In addition, impermeable surfaces, used historically during Bay Head's development, directed stormwater runoff directly into the storm drains with little natural water table filtration.

In 2005, the Borough of Bay Head adopted a *Municipal Stormwater Management Plan*, in compliance with N.J.A.C. &14A-25 Municipal Stormwater Regulations and N.J.A.C. 7:8 Stormwater Management Rules. The 2005 Plan documented the strategy of the Borough in addressing stormwater-related inputs. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new major developments. These stormwater standards are intended to minimize the impact of stormwater runoff on water quality and quantity and the loss of groundwater recharge in receiving

⁹⁰ Ibid., (2015)

water bodies. The plan also discusses long-term operation and maintenance measures for Borough stormwater facilities.⁹¹

In 2005, the Borough further adopted a *Stormwater Pollution Prevention Plan* detailing municipal procedure for maintenance, cleaning, and inspection to prevent stormwater pollution. Such procedures include, but are not limited to, periodic sweeping of Borough streets and annual inspections and cleanings of catch basins and storm drain inlets.⁹²

In 2006, the Borough passed *Ordinance 2006-6* which further addressed concerns regarding flood control and stormwater runoff. The ordinance required that all major development projects in the Borough submit a stormwater management plan with their development application. A major development is defined “as any development that provides for ultimately disturbing one or more acres of land.”⁹³

The required stormwater plan, to be submitted for Planning Board review and approval, consists of a topographic base map; an environmental site analysis; a project description; and a maintenance and repair plan.

During construction, Borough inspectors will observe the construction of the project to ensure that stormwater management measures are constructed and function as designed.⁹⁴

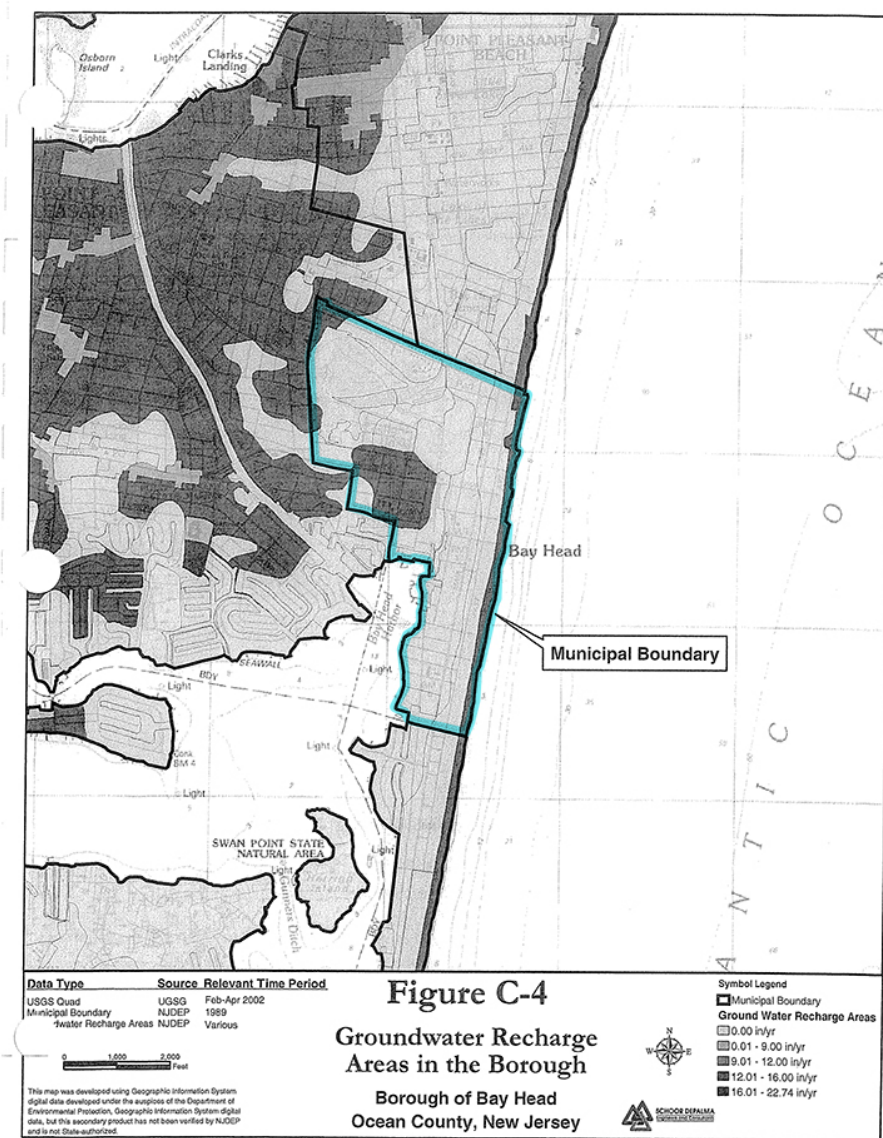


Figure 35. Groundwater Recharge Areas

⁹¹ Schoor DePalma, Inc., *Municipal Stormwater Management Plan for the Borough of Bay Head* (2007)

⁹² The Borough of Bay Head, *Stormwater Pollution Prevention Plan* (2005)

⁹³ Borough Council of Bay Head, “Code of the Borough of Bay Head, Part II: General Legislation, Chapter 207: Stormwater Management”, (2006)

⁹⁴ IBID.

4.7 Parks, Recreation, and Open Space

Parks and Recreation

The Borough of Bay Head owns and maintains approximately 8 acres of public parks in Bay Head. These parks, listed in Table 15 along with nearby public gardens and monuments, encourage appreciation of Bay Head's natural resources, promote outdoor recreational activity, and are utilized for approved organized events and activities that benefit the community.

Table 15. Parks, Gardens, and Monuments in Bay Head.

#	NAME	ACRES	USE
1	Centennial Park (behind Municipal Bldg)	1.6 acres	Courts, Playground, Walking Path
2	Howe Park (Club Drive and Metcalf)	2.4 acres	Sports Field, Recreation
3	Evergreen Park (near municipal garage)	1.0 acres	Passive Recreation
4	Bridge Avenue Park (near fire house)	0.2 acres	Passive Recreation
5	Twilight Lake park areas	2.7 acres	Paddle sports, Nature Watching, Conservation
**Total Municipal Recreation and Open Space		7.9 acres	
Source: The Borough of Bay Head Master Plan (1997)			

#	GARDENS AND MEMORIALS	LOCATION
1	Betty Kellogg Garden	North east end of Clayton Ave.
2	Blue Star Memorial	Fire Station – 81 Bridge Ave.
3	Butterfly House	Recycling Center – 214 Park Ave.
4	Clock Tower	Bay Head Town Center – Bridge Ave.
5	The Patch Garden	Recycling Center – 214 Park Ave
6	The Rail Garden	NJ Transit Station – off Osborne Ave
7	Tranquility Park	Bridge Ave. – behind Mueller's Bakery
8	Twilight Lake Garden	Lake Ave. – south east side Twilight Lake
9	Wini Applegate Memorial	Municipal Building – 83 Bridge Ave.
Source: Bay Head Town Map (2020)		

Centennial Park, located off Bridge Avenue behind the Municipal Building, is a popular site for both residents and visitors. The park contains a playground area for children, a walking path, and two public tennis courts. With majestic tall trees and well-kept landscaping and lawns, the park provides a shady haven in center of Bay Head for family outings, nature watching, or just relaxing. The park also hosts community events during the summer months, such as the annual *Art in the Park* festival.

At the south-east end of the park by the Mount Street walking bridge is a small, secluded area called **Holly Park**.

Gardens in and near Centennial Park are maintained by the local *Beautification Committee* with assistance from Bay Head Public Works.



Figure 36. Centennial Park Walking Path.

Howe Park (also called *Howe Field*) is another popular Bay Head park location at the corner of Metcalfe Street and Club Drive. The park is approximately 300 feet wide by 350 feet long, totaling 2.4 acres. The park was deeded to the Borough by the Howe family in 1919 and is known for its full-sized baseball field which has been used by the public since the early 1920's⁹⁵. The park is serviced by perpendicular street parking along the north side of Metcalfe Street.

As of September 2020, Howe Field is being refurbished by a major restoration project. The restoration project includes reseeding and re-soiling of the ball field as well as grading improvements to address drainage issues.



Figure 37. Howe Field - Aerial View.

Twilight Lake (see also Section 2.4.2) is perhaps Bay Head's most picturesque open space vista. The estuary Lake, connected to Barnegat Bay by Scow Ditch, is accessible by multiple public access points and docks (see Section 4.8) that facilitate paddle-based water activities such as canoeing and kayaking as well as providing vantage points for bird watching and leisure activities, such as crabbing or just enjoying the evening sunset.

Twilight Lake is further bordered by strips of open land along the eastern, northern, and western edges of the Lake.

On the east of the Lake along Lake Avenue, there is a small public dock and a sandy beach area that allows launching of small non-motorized watercraft and which is also the site of educational environmental classes during the summer.



Figure 38. Sunset Paddle on Twilight Lake.

The west side of Twilight Lake is also bordered by a narrow strip of Borough-owned land that is mostly vegetated with some benches to sit.⁹⁶

⁹⁵ Maser Consulting, *Bayfront Neighborhood Plan – Draft* (April 2017).

⁹⁶ The Borough of Bay Head, *Master Plan Reexamination Report & Update* (2017)

Open Space

The largest open space remaining in Bay Head is the approximately 34.8 acres of land owned by New Jersey Transit located at the north western end of Twilight Lake (yellow area in Figure 39). This area, known as the “Bay Head Loop”, is utilized by NJ Transit in the daily operation of train service as part of the North Jersey Coast Line. The area is not accessible to the public. The area contains protected wetlands and as such, is within Bay Head’s “C” Conservation Zone, in which no further development is permitted except for transportation purposes.⁹⁷

The Borough of Bay Head is also the home of a designated wildlife sanctuary. Located in the middle of Twilight Lake, the sanctuary is referred to as **Kellogg Memorial Island** and is described as an island within Twilight Lake in the Borough of Bay Head.⁹⁸ The island was dedicated on Memorial Day 1982 after a 5-year public effort to eliminate an abandoned railroad trestle and causeway that had previously crossed Twilight Lake and to replace the abandoned trestle bridge with the wildlife sanctuary which had been funded by private contributors.⁹⁹

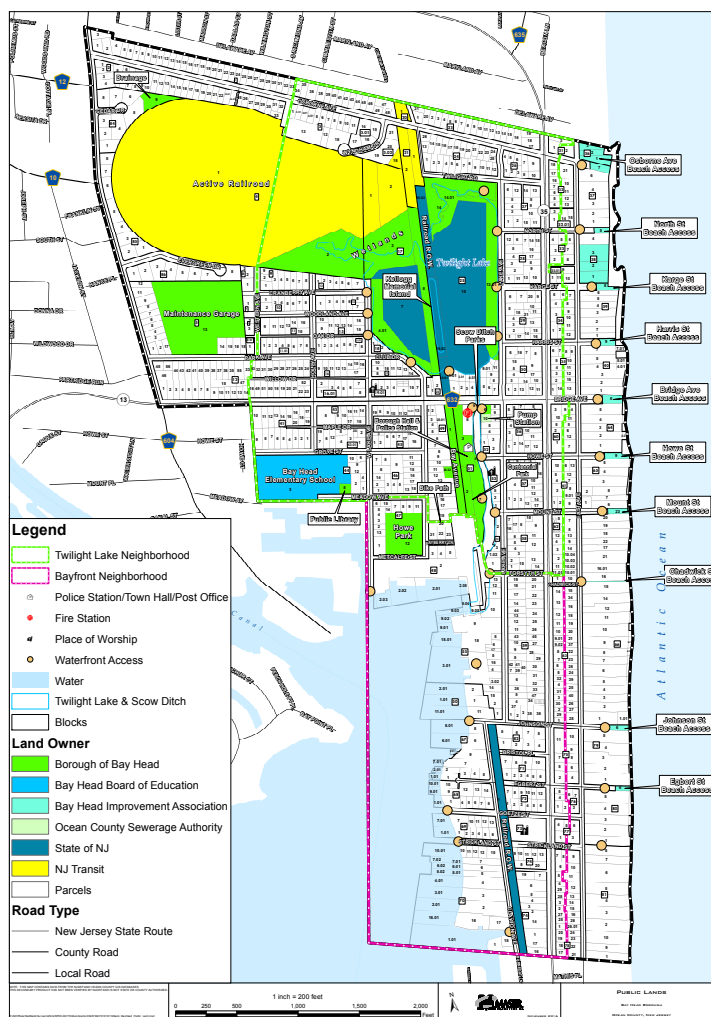


Figure 39. Open Space and Land Ownership.

Other open space in Bay Head includes:

- 6.09 acres of land (turquoise blue area in Figure 39) owned by the Bay Head Board of Education at the **Bay Head Elementary School** which contains tennis courts and public playgrounds in addition to the school building and related facilities.
- The **Maintenance Garage** area, 8.42 acres of land located off Park Avenue and owned by the Borough of Bay Head – the home of the Bay Head Recycling Center, Evergreen Park, the Patch Community garden, and the Recycling Library.
- A strip of land approximately 1/3 mile-long and 66-foot wide (blue) along the east side of Clayton Avenue owned by the State of New Jersey which was previously part of the Pennsylvania & Atlantic Railroad line, labeled as **Railroad Right of Way**.
- Various access points to the Bay Head Beaches and beach property along East Avenue totaling approximately 2 acres, managed by the Bay Head Improvement Association (BHIA - see also Section 4.8).

⁹⁷ Borough of Bay Head, *LAND USE – Chapter 147*, February 2019, Pg. 147:22.

⁹⁸ David G. Roberts and Zachary Zeilman, *Borough of Bay Head: Strategic Recovery Planning Report* (2016)

⁹⁹ The New York Times, *New Jersey Journal*, (May 16, 1982).

4.8 Ocean and Bay Access

The Borough of Bay Head provides public access to:

- Ocean beaches
- Barnegat Bay
- Twilight Lake and Scow Ditch

As summarized in the 2020 *Borough of Bay Head Municipal Public Access Plan*, “The Borough provides access to its oceanfront beaches, bayside waterways, and lakefront to the greatest extent possible. Public Access in Bay Head is provided by the municipality and managed by the *Bay Head Improvement Association (BHIA)* when pertaining to the ocean and consists of a variety of access points including beach walkways, and bayfront and lake access.”¹⁰⁰

Figure 40 identifies the numerous public access locations within Bay Head.¹⁰¹

Beach Access

Public access to the ocean beaches is provided by elevated beach entrances and beach walkways located at the eastern end of eleven Bay Head cross streets (tan-colored circles in Figure 40).

As mentioned above, beach access is managed by the BHIA, a private organization that collects badge fees for beach access and maintains the beaches during the summer months in addition to providing lifeguards.¹⁰²

Handicapped beach access is provided at North Avenue. Partial handicap access (visual access only) is further provided at the Osborne and Howe Street beach entrances.

Bay Access

Bay Head provides multiple street-ends along the Bay (green circles in Figure 40) that offer visual/viewing access to the Bay. There are no public beaches along the Bay.

Twilight Lake and Scow Ditch

Multiple physical access points (blue circles) are available around Twilight Lake and Scow Ditch. Twilight Lake also has docks and small beaches for physical access and water sport recreation, such as canoeing and kayaking.



Figure 40. Public Access Points in Bay Head.

¹⁰⁰ The Borough of Bay Head, *Municipal Public Access Plan* (2020), pg. 6.

¹⁰¹ Ibid, pg. 16.

¹⁰² The Borough of Bay Head, *Municipal Public Access Plan* (2020), pg.

5 ENVIRONMENTAL ISSUES

The Borough of Bay Head is blessed to have relatively few environmental concerns. However, the environmental challenges it does face tend to be closely related to its geographic location - namely Bay Head's proximity to both the ocean and Bay and its elevation.



As the lead coordinating agency and public voice on conservation matters throughout the Borough, the **Bay Head Environmental Commission** (BHEC) welcomes a discussion on all relevant matters that the public may bring before the Commission and notes the following current issues of concern within the community.

- **Known Contaminated Sites.** The only known and active contaminated site in the Borough is the NJ Transit Yard. Currently there is pending litigation between the Borough of Bay Head and NJ Transit in opposition to NJ Transit's plan to expand its footprint and certain operations into wetlands area.
- **Sea Level Rise/Flooding.** As discussed in this report, a portion of Bay Head is currently prone to flooding during heavy rains coupled with wind and tide events. Since the elevation of the majority of Bay Head is very near current sea level and assuming sea level rise continues, significant portion of the town will be prone to additional flooding including "sunny day" flooding events. The existing rock revetment and dune system provide added protection from the ocean and the revetment can be further fortified. However, the most significant threat in the future may be from the Bay since it is more difficult to elevate the Bay side in a continuous manner in order to mitigate the impact of sea level rise.
- **Water Quality.** The potential negative impact on water quality resulting from storm water runoff into Twilight Lake and Scow Ditch is documented in this report. Storm drainage results in increased sediments into the water, fertilizers, pesticides, oils and automotive fluids from the roadways, fecal matter from ducks and geese. Although Twilight Lake has been fortunate to have no serious water quality issues in the past, the potential exists for future problems, such as algae blooms or fish kills. To mitigate these concerns, the Borough recently secured an \$85,000 grant to institute a lake management plan for Twilight Lake to proactively monitor water quality and to take steps to prevent a worsening of water quality conditions.
- **Beach Erosion.** Although the Bay Head beaches and dunes were replenished in 2019 under the guidance of the Army Corps of Engineers, erosion of the Bay Head beaches is an ongoing and continuing concern. The beaches have a seasonal nature with loss of beach in the winter and the sands redeposited in the summer. While it will take several years of experience to determine the need for additional replenishment, it should be noted that the Bay Head beaches experienced significant beach loss in the fall of 2020 and early months of 2021 and that future replenishment by the Army Corps of Engineers is not guaranteed and subject to funding availability.
- **Air Quality.** As a beachfront town, the Borough of Bay Head enjoys sea breezes throughout the year which provide favorable air quality which is generally better than inland conditions. Within the borough, transportation accounts for the majority of air pollution with Rt. 35 running the length of the town. Also of concern is the aforementioned NJ Transit Rail Yard and the impact that idling trains can have on local air quality. It is hoped that improvements in the yard will respect the sensitive nature of the surrounding area and also allow for trains to be turned off when not in use.
- **Diverting Waste from the Landfill/Recycling.** In recent years, Bay Head has reduced the numbers of items accepted at the Bay Head Recycling Center (e.g., electronic equipment, shredded paper no longer accepted, etc.). This reduction in acceptable materials/items is because Bay Head is a participant in the Ocean County recycling program and Ocean County no longer accepts these items. To help mitigate this reduction, the

Environmental Commission will continue to identify alternative resources, both nearby and internet-based, that will accept those items rather than diverting them to the landfill.

- **Loss of Shade Trees.** As the Borough is today nearly all built out, shade trees have historically been removed to make way for new development. Many lots and yards are no longer conducive to provide growing space for larger trees. Where possible, the planning of appropriate shade trees should be encouraged, and larger existing trees should be saved during future development projects.
- **Sustainable Jersey.** The Borough of Bay Head remains committed to continuing its participation in the Sustainable Jersey (SJ) program. The program provides “best practices” tools and guidelines for communities in order to contribute to a sustainable future.
- **Open Space.** This report has focused on Bay Head’s natural resources and the community that has been built around them. It is the relationship between these elements – the natural, biological, and physical resource, that help to make Bay Head such a unique community. As stewards of this environment, the Environmental Commission is committed to protecting these resources and especially the areas of open space which so enrich our community.

It is our hope that this inventory will increase public awareness and create a better understanding of Bay Head’s natural resources as well as serving as a comprehensive reference source that will be amended and updated over time as new information is collected and circumstances change.

6 APPENDICES

6.1 APPENDIX A. COMMON DUNE VEGETATION

COMMON DUNE VEGETATION				
Classification	Common Name	Scientific Name	Native/Exotic	Description
Grasses	American Beachgrass	<i>Ammophila breviligulata</i>	Native	
	Sea Lyme Grass	<i>Leymus arenarius</i>	Native	
Flowers	Dust Miller	<i>Artemisia stelleriana</i>	Exotic	
	Sea Rocket	<i>Cakile edentula</i>	Native	

COMMON DUNE VEGETATION				
Classification	Common Name	Scientific Name	Native/Exotic	Description
	Seaside Goldenrod	<i>Solidago sempervirens</i>	Native	
	Seaside Spurge	<i>Euphorbia polygonifolia</i>	Native	
	Beach Pea	<i>Lathyrus japonicus</i>	Native	
	Wild Carrot	<i>Daucus carota</i>	Exotic	

COMMON DUNE VEGETATION				
Classification	Common Name	Scientific Name	Native/Exotic	Description
	Seabeach Amaranth	<i>Amaranthus pumilus</i>	Native	
Trees & Shrubs	Northern Bayberry	<i>Myrica pensylvanica</i>	Native	
	Beach Salt Spray Rose	<i>Rosa rugosa</i>	Exotic	
	Shore Juniper	<i>Juniperus conferta</i>	Exotic	

COMMON DUNE VEGETATION				
Classification	Common Name	Scientific Name	Native/Exotic	Description
	Beach Plum	<i>Prunus maritima</i>	Native	
	Eastern Red Cedar	<i>Juniperus virginiana</i>	Native	
	Winged Sumac	<i>Rhus copallinum</i>	Native	

6.2 APPENDIX B. COMMON WETLAND/MARSH VEGETATION

COMMON WETLAND VEGETATION				
Classification	Common Name	Scientific Name	Native/Exotic	Description
Grasses	Smooth Cordgrass	<i>Spartina alterniflora</i>	Native	
	Common Reed	<i>Phragmites australis</i>	Native and Exotic varieties	
Flowers	Goldenrod	<i>Solidago spp.</i>	Native	
Shrubs	Marsh Elder	<i>Iva frutescens</i>	Native	

6.3 APPENDIX C. COMMON NATIVE VEGETATION

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
Flowers	Canadian Wildginger	<i>Asarum canadense</i>	
	Butterfly Milkweed	<i>Asclepias tuberosa</i>	
	Blue Wild Indigo	<i>Baptisia australis</i>	
	New Jersey Tea	<i>Ceanothus americanus</i>	

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
	Green and Gold	<i>Chrysogonum virginianum</i>	
	Sweetfern	<i>Comptonia peregrina</i>	
	Common Boneset	<i>Eupatorium perfoliatum</i>	
	Sneezeweed	<i>Helenium autumnale</i>	
	Smooth Oxeye	<i>Heliopsis helianthoides</i>	

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
	Sandmyrtle	<i>Leiophyllum buxifolium</i>	
	Cardinal Flower	<i>Lobelia cardinalis</i>	
	Great Blue Lobelia	<i>Lobelia siphilitica</i>	
	Wild Bergamot	<i>Monarda fistulosa</i>	
	Common Evening Primrose	<i>Oenothera biennis</i>	

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
	Wild Quinine	<i>Parthenium integrifolium</i>	
	Foxglove Beardtongue	<i>Penstemon digitalis</i>	
	Fall Phlox	<i>Phlox paniculata</i>	
	Moss Phlox	<i>Phlox subulata</i>	
	Ninebark	<i>Physocarpus opulifolius</i>	

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
	Black Eyed Susan	<i>Rudibeckia hirta</i>	
	Brown Eyed Susan	<i>Rudibeckia triloba</i>	
	Seaside Goldenrod	<i>Soldiagio sempervirens</i>	
	New York Aster	<i>Symphyotrichum novi-belgii</i>	
	Coneflower	<i>Echinacea</i> spp.	

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
	American Speedwell	<i>Veronica americana</i>	
Trees & Shrubs	Short-leaf Pine	<i>Pinus echinata</i>	
	Lowbush Blueberry	<i>Vaccinium angustifolium</i>	
	Highbush Blueberry	<i>Vaccinium corymbosum</i>	
	American Holly	<i>Ilex opaca</i>	

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
	Eastern Red Cedar	<i>Juniperus virginiana</i>	
	Sweetgum	<i>Liquidambar styraciflua</i>	
	Red Maple	<i>Acer rubrum</i>	
	Grey Birch	<i>Betula populifolia</i>	
	Willow Oak	<i>Quercus phellos</i>	

COMMON NATIVE VEGETATION			
Classification	Common Name	Scientific Name	Description
	Black Cherry	Prunus serotina	
	Overcup Oak	Quercus lyrata	

6.4 APPENDIX D. TWILIGHT LAKE BIRD SIGHTINGS

TWILIGHT LAKE BIRD SIGHTINGS		
Classification	Common Name	Scientific Name
Shorebirds (waders)	Great Egret	<i>Ardea alba</i>
	Killdeer	<i>Charadrius vociferus</i>
	Spotted Sandpiper	<i>Actitis macularius</i>
	Great Blue Heron	<i>Ardea herodias</i>
	Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>
	Snowy Egret	<i>Egretta thula</i>
	Willet	<i>Tringa semipalmata</i>
	Green Heron	<i>Butorides virescens</i>
	Glossy Ibis	<i>Plegadis falcinellus</i>
	Greater Yellowlegs	<i>Tringa melanoleuca</i>
	Lesser Yellowlegs	<i>Tringa flavipes</i>
Songbirds	Song sparrow	<i>Melospiza melodia</i>
	American Crow	<i>Corvus brachyrhynchos</i>
	Mourning Dove	<i>Zenaida macroura</i>
	American Robin	<i>Turdus migratorius</i>
	Northern Mockingbird	<i>Mimus polyglottos</i>
	European Starling	<i>Sturnus vulgaris</i>
	Yellow Warbler	<i>Setophaga petechia</i>
	Red-winged Blackbird	<i>Agelaius phoeniceus</i>
	Common Grackle	<i>Quiscalus quiscula</i>
	House Sparrow	<i>Passer domesticus</i>
	Downy Woodpecker	<i>Dryobates pubescens</i>
	Tufted Titmouse	<i>Baeolophus bicolor</i>
	Cedar Waxwing	<i>Bombycilla cedrorum</i>
	Fish Crow	<i>Corvus ossifragus</i>
	Barn Swallow	<i>Hirundo rustica</i>
	Boat-tailed Grackle	<i>Quiscalus major</i>
	Rock Pigeon	<i>Columba livia</i>
	Northern Cardinal	<i>Cardinalis cardinalis</i>
	Blue Jay	<i>Cyanocitta cristata</i>
	Common Yellowthroat	<i>Geothlypis trichas</i>
	Carolina Wren	<i>Thryothorus ludovicianus</i>
	Yellow-rumped Warbler	<i>Setophaga coronata</i>
	House Finch	<i>Haemorhous mexicanus</i>
	Eastern Kingbird	<i>Tyrannus tyrannus</i>
	Purple Martin	<i>Progne subis</i>

TWILIGHT LAKE BIRD SIGHTINGS		
Classification	Common Name	Scientific Name
	American Goldfinch	<i>Spinus tristis</i>
Seabirds (marine birds)	Herring Gull	<i>Larus argentatus</i>
	Northern Gannet	<i>Morus bassanus</i>
	Ring-billed Gull	<i>Larus delawarensis</i>
	Great Black-backed Gull	<i>Larus marinus</i>
	Osprey	<i>Pandion haliaetus</i>
	Laughing Gull	<i>Leucophaeus atricilla</i>
	Bonaparte's Gull	<i>Chroicocephalus philadelphia</i>
	Least Tern	<i>Sternula antillarum</i>
Waterfowl	Brant	<i>Branta bernicla</i>
	Mallard	<i>Anas platyrhynchos</i>
	American Coot	<i>Fulica americana</i>
	Canada Goose	<i>Branta canadensis</i>
	Bufflehead	<i>Bucephala albeola</i>
	American Black Duck	<i>Anas rubripes</i>
	Ruddy Duck	<i>Oxyura jamaicensis</i>
	Gadwall	<i>Mareca strepera</i>
	Surf Scoter	<i>Melanitta perspicillata</i>
	Hooded Merganser	<i>Lophodytes cucullatus</i>
	Double-crested Cormorant	<i>Phalacrocorax auritus</i>
	Red-breasted Merganser	<i>Mergus serrator</i>
	Ring-necked Duck	<i>Aythya collaris</i>
	Common Loon	<i>Gavia immer</i>
	Mute Swan	<i>Cygnus olor</i>
	Red-necked Grebe	<i>Podiceps grisegena</i>
	Snow Goose	<i>Anser caerulescens</i>
	Lesser Scaup	<i>Aythya affinis</i>

6.5 APPENDIX E. COMMON INVASIVE SPECIES – PLANTS AND INSECTS

COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
Grasses	Common Reed	<i>Phragmites australis</i>	
	Japanese Stiltgrass	<i>Microstegium vimineum</i>	
	Maiden Silvergrass	<i>Miscanthus sinensis</i>	
	Golden Bamboo	<i>Phyllostachys aurea</i>	

COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
Vines	Field Bindweed	<i>Convolvulus arvensis</i>	
	English Ivy	<i>Hedera helix</i>	
	Japanese Honeysuckle	<i>Lonicera japonica</i>	
	Porcelainberry	<i>Ampelopsis brevipedunculata</i>	
	Wintercreeper	<i>Euonymus fortunei</i>	

COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
	Chinese Wisteria	<i>Wisteria sinensis</i>	
	Japanese Wisteria	<i>Wisteria floribunda</i>	
	Mile-a-minute	<i>Persicaria perfoliata</i>	
	Oriental bittersweet	<i>Celastrus orbiculatus</i>	
Flowers	Garlic Mustard	<i>Alliaria petiolata</i>	

COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
	Spotted Knapweed	<i>Centaurea maculosa</i>	
	Canadian Thistle	<i>Cirsium arvense</i>	
	Japanese Knotweed	<i>Reynoutria japonica</i>	
	Butterfly Bush	<i>Buddleia spp</i>	
	Japanese Meadowsweet	<i>Spiraea japonica</i>	

COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
	Multiflora Rose	<i>Rosa multiflora</i>	
	Purple Loosestrife	<i>Lythrum salicaria</i>	
	Wild Teasel	<i>Dipsacus fullonum</i>	
	Lesser Celadine	<i>Ranunculus ficaria</i>	
	Common Mugwort	<i>Artemisia vulgaris</i>	

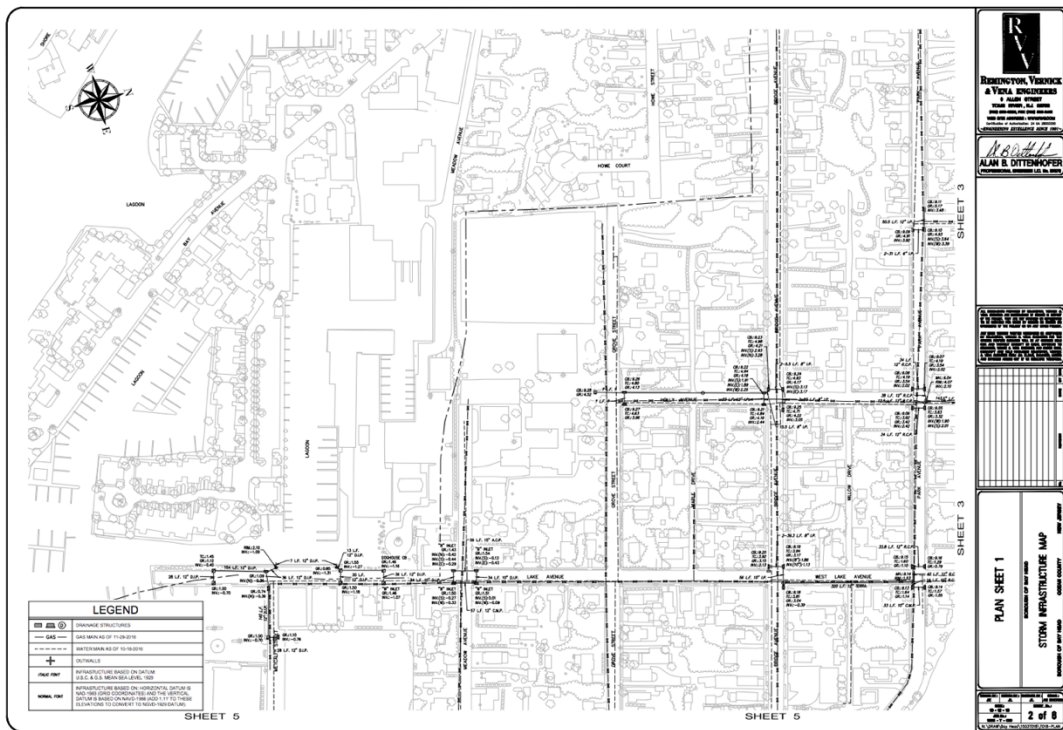
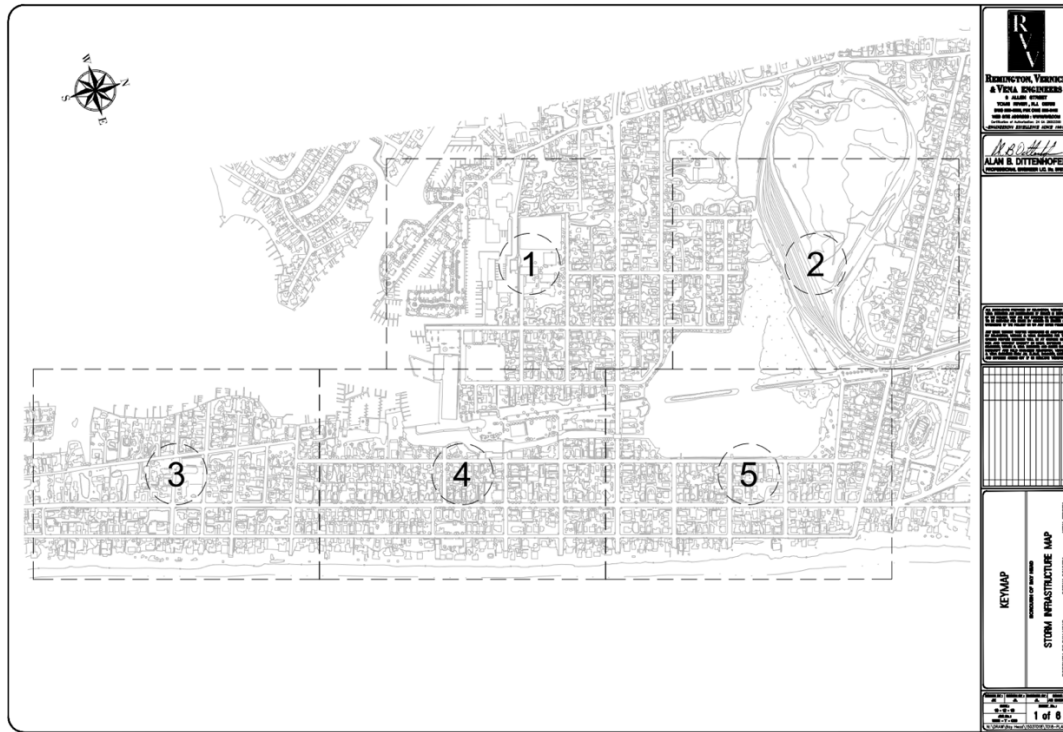
COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
	Eurasian Water-milfoil	<i>Myriophyllum spicatum</i>	
Trees & Shrubs	Japanese Barberry	<i>Berberis thunbergii</i>	
	Norway Maple	<i>Acer platanoides</i>	
	Bradford pear	<i>Pyrus calleryana</i>	
	Winged Burning Bush	<i>Euonymus alatus</i>	

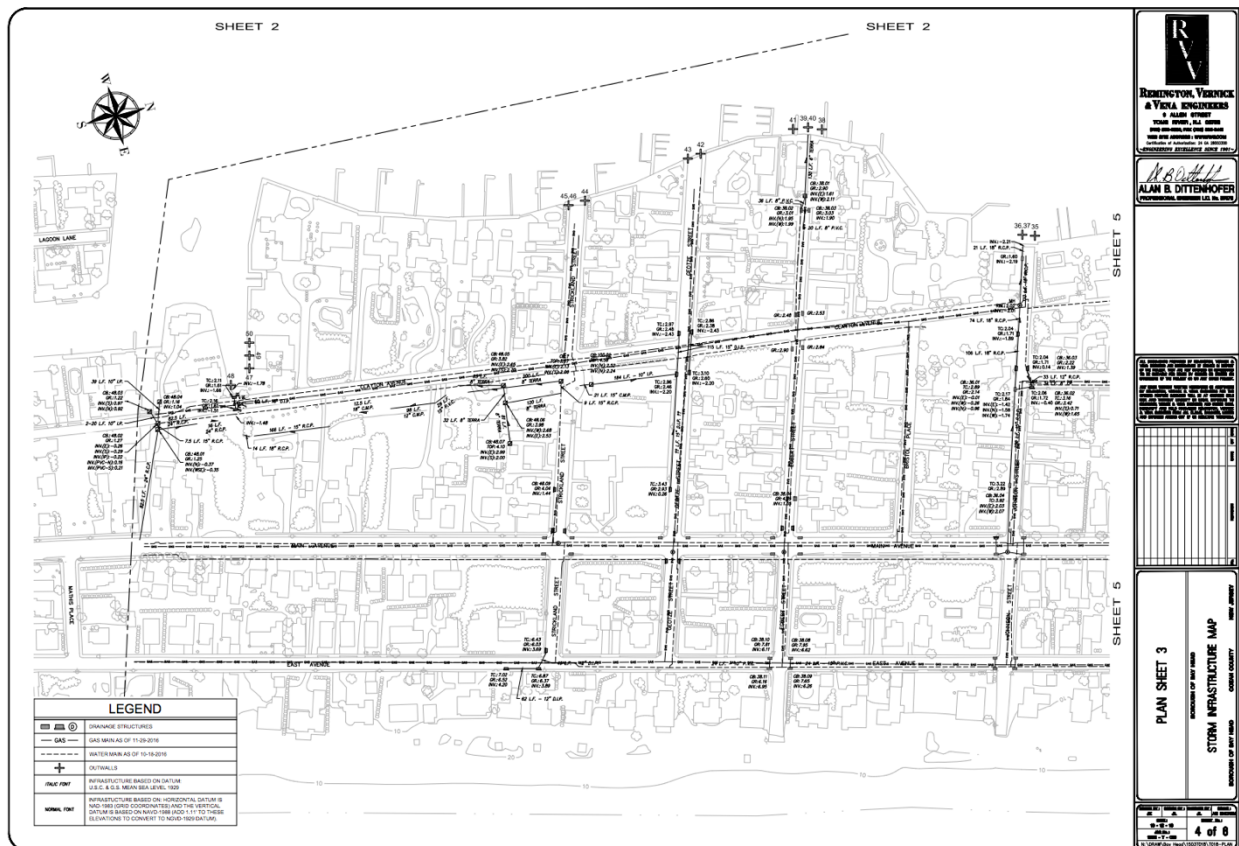
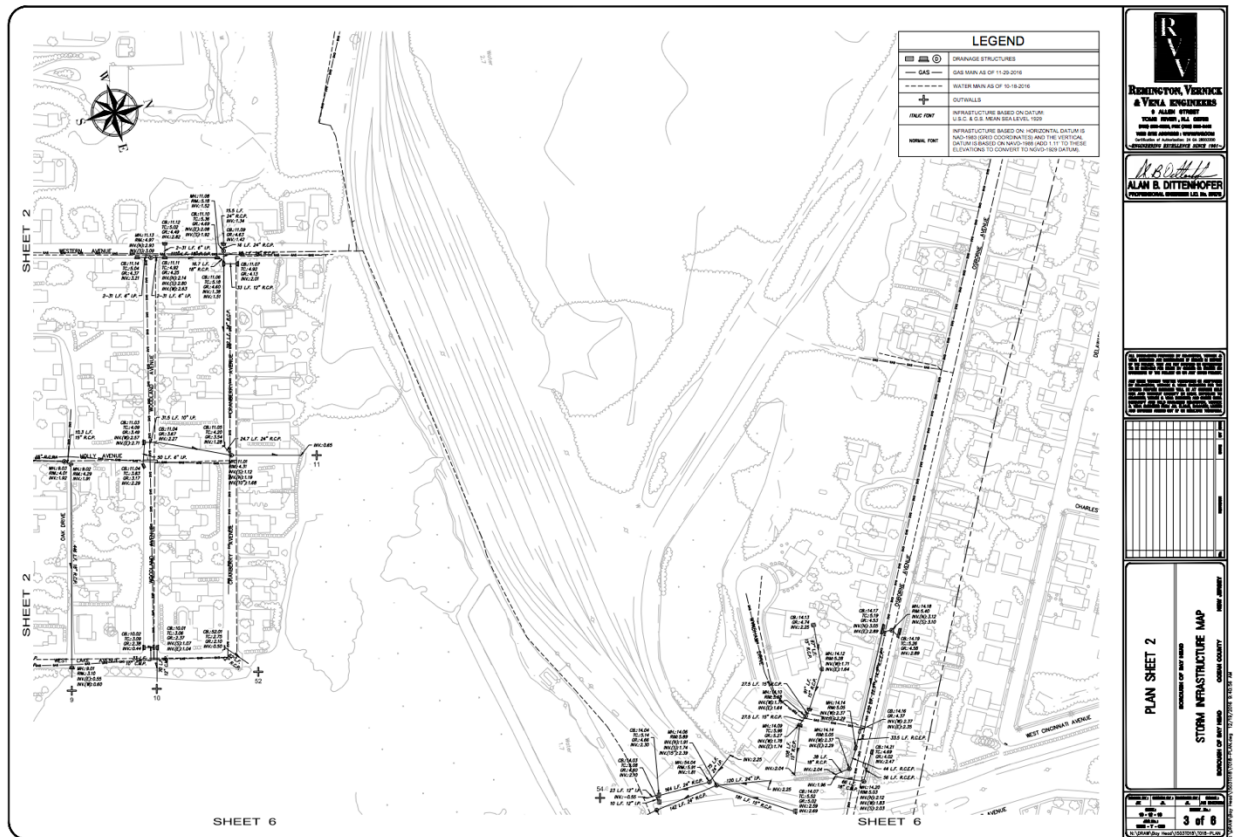
COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
	Linden Viburnum	<i>Viburnum dilatatum</i>	
	Tree of Heaven	<i>Ailanthus altissima</i>	
	Japanese Angelica Tree	<i>Aralia elata</i>	
	Japanese Silverberry	<i>Elaeagnus umbellata</i>	
	Amur honeysuckle	<i>Lonicera maackii</i>	

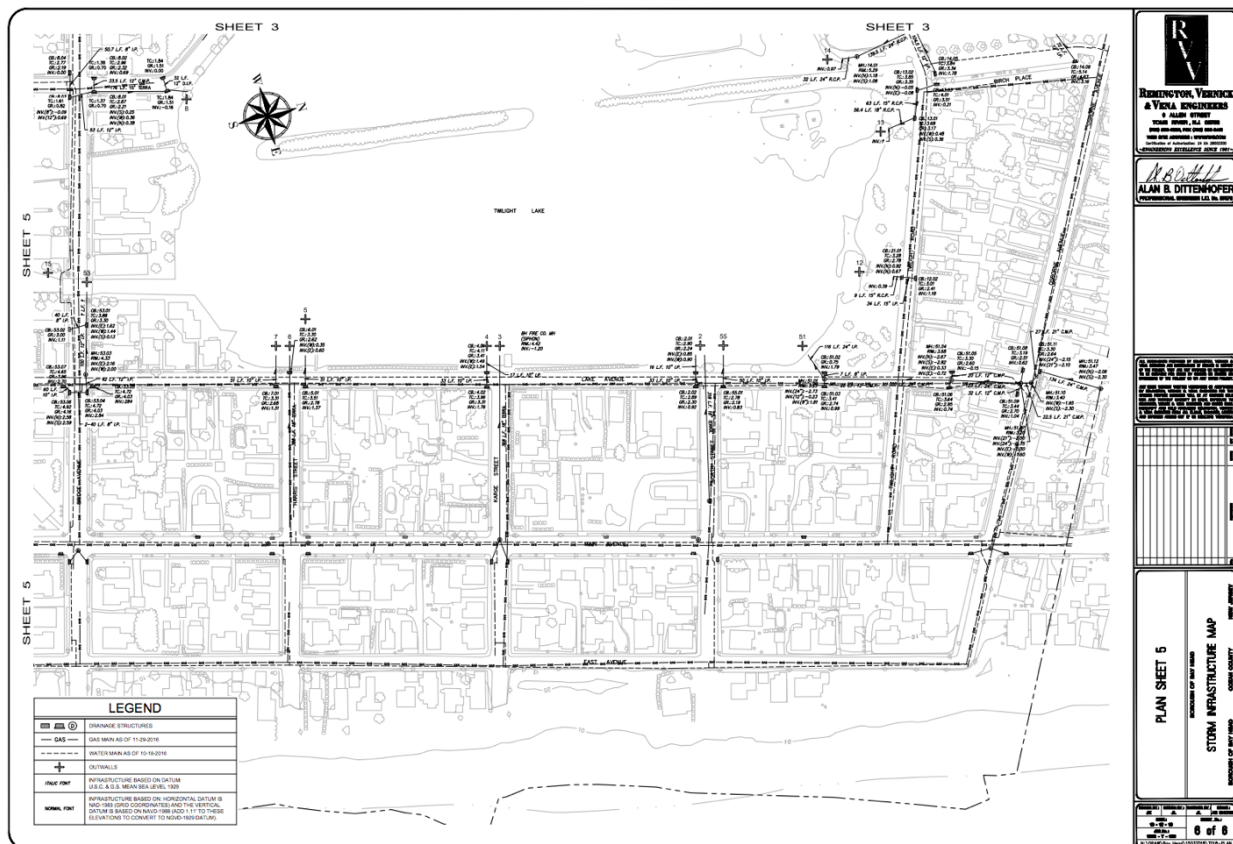
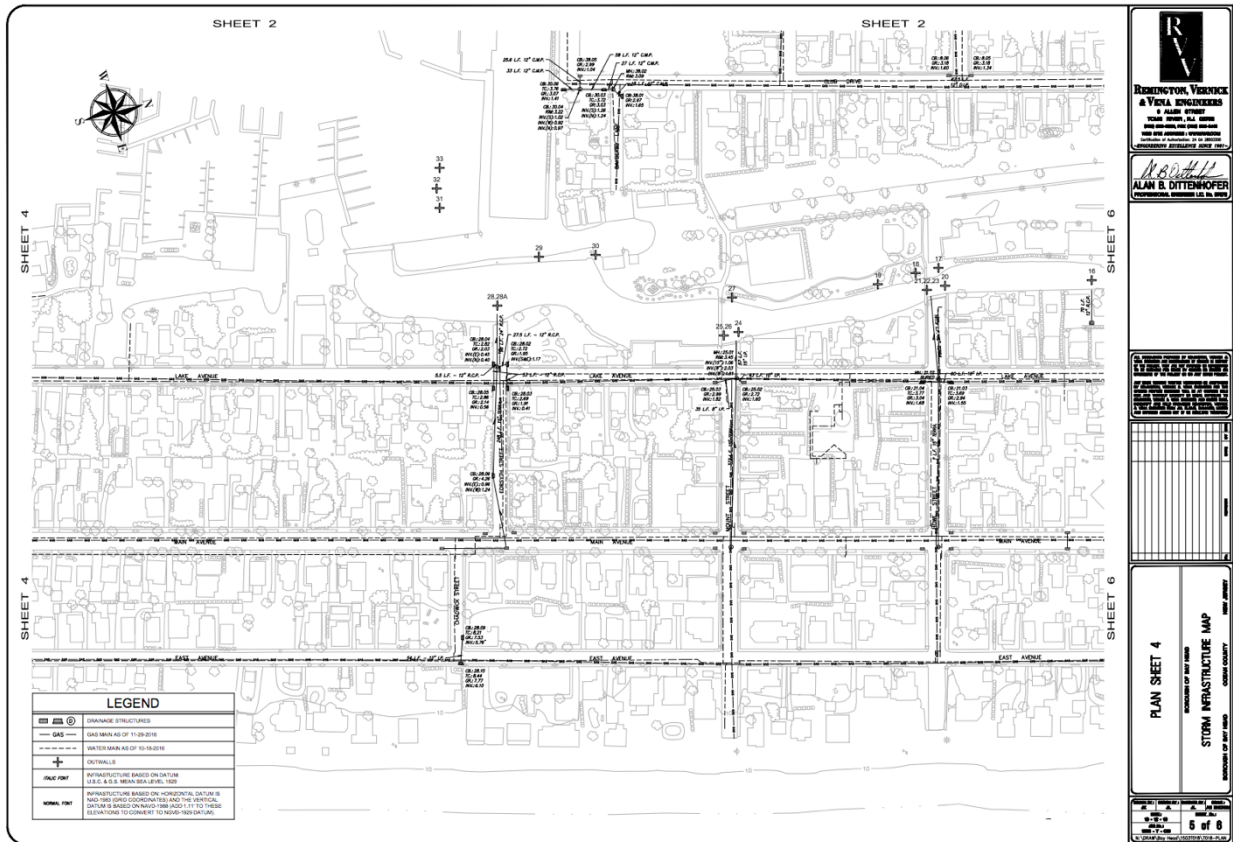
COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
	Buckthorn	<i>Rhamnus cathartica</i>	
	Black Locust	<i>Robinia pseudoacacia</i>	
	Japanese Wineberry	<i>Rubus phoenicolasius</i>	
Insects	Asian Longhorn Beetle	<i>Anoplophora glabripennis</i>	
	Asian Tiger Mosquito	<i>Aedes albopictus</i>	
	Gypsy Moth	<i>Lymantria dispar dispar</i>	

COMMON INVASIVE SPECIES			
Classification	Common Name	Scientific Name	Description
	Wolly Adelgid	<i>Adelges tsugae</i>	
	Japanese Beetle	<i>Popillia japonica</i>	
	Southern Pine Beetle	<i>Dendroctonus frontalis</i>	

6.6 APPENDIX F. STORM INFRASTRUCTURE MAPS







6.7 APPENDIX H. WETLAND CLASSIFICATION CODES IN BAY HEAD

Source: Wetlands Code Interpreter - wsprimary.wim.usgs.gov/decoders/wetlands.aspx

Description for code E1UBLx:

- E** System **ESTUARINE**: The Estuarine System consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (*Rhizophora mangle*) and eastern oysters (*Crassostrea virginica*), are also included in the Estuarine System.
- 1** Subsystem **SUBTIDAL**: The substrate in these habitats is continuously covered with tidal water (i.e., located below extreme low water).
- UB** Class **UNCONSOLIDATED BOTTOM**: Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%.
- L** Water Regime **Subtidal**: Tidal salt water continuously covers the substrate.

Other Modifier(s):

- x** SPECIAL MODIFIER **Excavated**: This Modifier is used to identify wetland basins or channels that were excavated by humans.

Description for code E1UBLx6:

- E** System **ESTUARINE**: The Estuarine System consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (*Rhizophora mangle*) and eastern oysters (*Crassostrea virginica*), are also included in the Estuarine System.
- 1** Subsystem **SUBTIDAL**: The substrate in these habitats is continuously covered with tidal water (i.e., located below extreme low water).
- UB** Class **UNCONSOLIDATED BOTTOM**: Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%.
- L** Water Regime **Subtidal**: Tidal salt water continuously covers the substrate.

Other Modifier(s):

- x** SPECIAL MODIFIER **Excavated**: This Modifier is used to identify wetland basins or channels that were excavated by humans.

6 WATER CHEMISTRY **Oligohaline**: 0.5-5 ppt

Description for code E2EM5P6:

- E** System **ESTUARINE**: The Estuarine System consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (*Rhizophora mangle*) and eastern oysters (*Crassostrea virginica*), are also included in the Estuarine System.
- 2** Subsystem **INTERTIDAL**: The substrate in these habitats is flooded and exposed by tides; includes the associated splash zone.
- EM** Class **EMERGENT**: Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.
- 5** Subclass **Phragmites australis**: Large perennial grass found in wetlands throughout temperate and tropical regions of the world. It is characterized by its towering height of up to four meters (about 14 feet) and its stiff wide leaves and hollow stem. Its feathery and drooping inflorescences (clusters of tiny flowers) are purplish when flowering and turn whitish, grayish or brownish in fruit.
- P** Water Regime **Irregularly Flooded**: Tides flood the substrate less often than daily.

Other Modifier(s):

6 WATER CHEMISTRY **Oligohaline**: 0.5-5 ppt

Description for code PEM1B:

- P** System **PALUSTRINE**: The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.
- EM** Class **EMERGENT**: Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.
- 1** Subclass **Persistent**: Dominated by species that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems.
- B** Water Regime **Seasonally Saturated**: The substrate is saturated at or near the surface for extended periods during the growing season, but unsaturated conditions prevail by the end of the season in most years. Surface water is typically absent, but may occur for a few days after heavy rain and upland runoff.

Description for code PEM1E:

- P** System **PALUSTRINE**: The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.
- EM** Class **EMERGENT**: Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.
- 1** Subclass **Persistent**: Dominated by species that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems.
- E** Water Regime **Seasonally Flooded/Saturated**: Surface water is present for extended periods (generally for more than a month) during the growing season, but is absent by the end of the season in most years. When surface water is absent, the substrate typically remains saturated at or near the surface.

Description for code PFO1B:

- P** System **PALUSTRINE**: The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.
- FO** Class **FORESTED**: Characterized by woody vegetation that is 6 m tall or taller.
- 1** Subclass **Broad-Leaved Deciduous**: Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (*Fraxinus nigra*).
- B** Water Regime **Seasonally Saturated**: The substrate is saturated at or near the surface for extended periods during the growing season, but unsaturated conditions prevail by the end of the season in most years. Surface water is typically absent, but may occur for a few days after heavy rain and upland runoff.

Other Modifier(s):

Description for code PFO1C:

- P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.
- FO Class FORESTED:** Characterized by woody vegetation that is 6 m tall or taller.
- 1 Subclass Broad-Leaved Deciduous:** Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (*Fraxinus nigra*).
- C Water Regime Seasonally Flooded:** Surface water is present for extended periods especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.

Description for code PFO1E:

- P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.
- FO Class FORESTED:** Characterized by woody vegetation that is 6 m tall or taller.
- 1 Subclass Broad-Leaved Deciduous:** Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (*Fraxinus nigra*).
- E Water Regime Seasonally Flooded/Saturated:** Surface water is present for extended periods (generally for more than a month) during the growing season, but is absent by the end of the season in most years. When surface water is absent, the substrate typically remains saturated at or near the surface.

Description for code PFO1F:

- P System PALUSTRINE:** The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.
- FO Class FORESTED:** Characterized by woody vegetation that is 6 m tall or taller.
- 1 Subclass Broad-Leaved Deciduous:** Woody angiosperms (trees or shrubs) with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (*Fraxinus nigra*).
- F Water Regime Semipermanently Flooded:** Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.

Description for code PFO4B:

- P** System **PALUSTRINE**: The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2.5 m (8.2 ft) at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.
- FO** Class **FORESTED**: Characterized by woody vegetation that is 6 m tall or taller.
- 4** Subclass **Needle-Leaved Evergreen**: The dominant species in Needle-leaved Evergreen wetlands are young or stunted trees such as black spruce or pond pine.
- B** Water Regime **Seasonally Saturated**: The substrate is saturated at or near the surface for extended periods during the growing season, but unsaturated conditions prevail by the end of the season in most years. Surface water is typically absent, but may occur for a few days after heavy rain and upland runoff.