Massachusetts Habitat Conservation Plan for Piping Plover

Request for Certificate of Inclusion

Prepared for submission to:

Massachusetts Division of Fisheries & Wildlife
Natural Heritage & Endangered Species Program
1 Rabbit Hill Road
Westborough, MA 01581

Prepared by:

Duxbury Beach Reservation, Inc.
P.O. Box 2593
Duxbury, MA 02331

March 2018

Contents

Introduction and Overview

The following is a request by Duxbury Beach Reservation, Inc. for a Certificate of Inclusion (COI) in the statewide Habitat Conservation Plan (HCP) for Piping Plover for the 2018 nesting season on Duxbury Beach. The request includes one covered activity: Use of Roads and Parking Lots in the Vicinity of Unfledged Piping Plover Chicks and Least Tern Chicks. Review of the past three years of Piping Plover nesting on Duxbury Beach has determined that 11 Piping Plover broods may be impacted. The area affected will be length of Gurnet Road from the north edge of the property (Lagerstedt Lot) to the Gurnet Guardhouse in the south covering 6.4 kilometers (4 miles) of improved gravel roadway.

The Reservation is proposing that mitigation will be in the form of self-funding to implement selective predator management on-site. In addition, the Reservation will maintain the extensive monitoring, management, law enforcement, and education programs currently in place as part of the Duxbury Beach Endangered Species Program.

1.0 Site Description

Duxbury Beach is a barrier beach that consists of a peninsula, 12 kilometers (7.5 miles) long, extending from the Town of Duxbury at the northern end to the communities of Gurnet and Saquish (hereafter referred to as "Gurnet-Saquish") at the southernmost end (Town of Plymouth). Duxbury Beach Reservation, Inc. (the Reservation), a 501 (c)(3) charitable corporation, owns 7.2 kilometers (4.5 miles) of Duxbury Beach, including the portion leased by the Town of Duxbury, Duxbury Beach Park II (hereafter referred to as "Duxbury Beach Park"), and the far northern section of the beach that the Reservation reserves for public access. The property is an average of 60 meters (67 yards) wide – ranging from 46 meters (50 yards) to 168 meters (183 yards) and covering approximately 550 acres. Duxbury and Kingston Bays, as well as the northerly part of Plymouth Bay, lie west of the beach. The beach is owned and managed by Duxbury Beach Reservation, with the exception of the extreme southerly end of the beach (Gurnet-Saquish), which contains approximately 250 homes, mostly occupied by summer residents.

Duxbury Beach Reservation consists of several parcels of property in both Duxbury and Plymouth. These parcels span from the northern end of Duxbury Beach Park in Duxbury to the Gurnet Guardhouse in Plymouth. Several partners manage portions of the beach and oversee aspects of the day to day operations, particularly in regard to human-use and enforcement. The Town of Duxbury leases the portion of Duxbury Beach from the northern end of the town parking lot (referred to as the resident parking lot) south to the Plymouth town line. Duxbury Beach Park, also known as "Blakeman's", "The Bathhouse", and "The Pavilion" interchangeably, is under contract with Dana Battista. Duxbury Beach Park is managed as a parking area, restaurant, and recreational beach.

1.1 Physical Description of the Property

Duxbury Beach is a barrier beach located in the towns of Duxbury and Plymouth, Massachusetts. It connects to the mainland at a kame (a small, circular hill of glacial drift) in Duxbury, approximately 1.6 kilometers (1 mile) south of Green Harbor, Marshfield, and extends southeast along Gurnet Road into Plymouth (Appendix 1, Maps 1-4). Duxbury Beach ends at the drumlin of Gurnet Point in Plymouth. Between these two glacially formed anchor points at the northern and southern ends is a third point, at a section of the beach referred to as High Pines, which is glacial till covered by sand dunes. Duxbury Beach was formed due to the erosion of glacial

landforms as sand and gravel began to accumulate, protruding from these three anchor points and eventually joining to create Duxbury Beach.

On its western side, Duxbury Beach protects tidal flats; salt marsh; and Duxbury, Kingston, and the northerly part of Plymouth bays. In addition, valuable shellfishing activity is conducted in these areas. Coastal dune and coastal beach span much of the length of Duxbury Beach. The beach is a combination of sand, pebble, and cobble substrate. Due to shoreline armoring efforts by the towns of Scituate and Marshfield, sediment reaching Duxbury Beach has greatly diminished, leaving cobble exposed on Duxbury Beach for longer portions of the year when sand would historically build up during the summer. In order to maintain the barrier beach, the Reservation has made extensive efforts to prevent breaches, including dune reconstruction, beach nourishment, berm creation, and vegetation management.

Extensive vegetation management by the Reservation, including beach grass and woody shrub plantings and annual fertilizer placement, have helped to maintain and recolonize vegetated areas in an effort to stabilize the barrier beach. Vegetation management occurs with consideration of maintaining shorebird nesting habitat and with approval from the Massachusetts Natural Heritage and Endangered Species Program (NHESP). Dunes and marsh are vegetated with American beach grass (*Ammophila breviligulata*), Eastern red cedar (*Juniperus virginiana*), beach plum (*Prunus maritima*), beach rose (*Rosa rugosa* and *Rosa virginiana*), bayberry (*Myrica pensylvanica*), goldenrod (*Solidago sempervirens*), poison ivy (*Rhus radicans*), common mullein (*Verbascum thapsus*), sea lavender (*Limonium carolinianum*), saltmarsh cordgrass (*Spartina alterniflora*), etc.

Although much of the length of the barrier is narrow with low lying coastal dunes, the anchor points mentioned above are areas of diverse coastal habitats. The northern part of the beach protects saltmarsh habitat which extends to the mainland. The glacial till at High Pines is covered with tall woody vegetation and protects a small area of saltmarsh. Extending north from Gurnet Point is Plum Hills, an area of higher coastal dunes and dense woody vegetation. Westward of Plum Hills is saltmarsh extending to Saquish, a barrier beach anchored at Gurnet Point and extending southwest. The entirety of Duxbury Beach is mapped by NHESP as Priority Habitats of Rare Species and Estimated Habitats of Rare Wildlife. Piping Plover (*Charadrius melodus*) and Least Tern (*Sternula antillarum*) nest on Duxbury Beach, on the eastern and western sides of the beach. A large number of other shorebirds use Duxbury Beach for staging and as a stopover during migration. During the winter, Snowy Owls (*Bubo scandiacus*), captured at Logan Airport are released on Duxbury Beach. While many of the Snowy Owls continue south, some remain on Duxbury Beach for several months.

Duxbury Beach is accessible to beachgoers via Marshfield to Duxbury along Gurnet Road at the northern end and the Powder Point Bridge, which extends from Powder Point on mainland Duxbury to Gurnet Road at the southern end of a series of parking lots. Gurnet Road continues the length of the beach in Duxbury, becoming King Arthur Road as it crosses the Plymouth town line before reaching Gurnet Point. The road is paved in small sections near the parking lots, but is primarily an improved gravel road (as defined by the HCP) composed primarily of processed gravel. The road provides court-protected access for residents and visitors to Gurnet-Saquish, access for Duxbury residents and non-residents with over-sand vehicle (OSV) permits to the beach, and commercial shellfishing access to tidal flats.

Shellfishing access points are located intermittently on the west side of the road for access to the bayside beach. Limited OSV permit holders access the oceanside beach designated via three vehicle crossovers. Crossovers 1 and 2 are located south of the town parking lots and north of High Pines, and Crossover 3 is located to the south of High Pines. Vehicle use on the oceanside beach is restricted by a series of posts running perpendicular to the beach to the north of Crossover 1 and to the south of Crossover 3.

Four areas provide parking options for non-OSV visitors to Duxbury Beach: the Lagerstedt Lot (east of Gurnet Road and north of Duxbury Beach Park), Duxbury Beach Park lots (east and west of Gurnet Road to the north and east of the road to the south, known as the "Caterers' lot"), and the Duxbury Beach town resident lots (east and west of Gurnet Road north of the Powder Point Bridge and west of the road to the south), and the West End Lot (west end of Powder Point Bridge, not on Reservation property). Eleven "pull-offs" exist south of the bridge on the east and west side of the road and are usable by those with over sand permits.

Pedestrians are able to access the oceanside and bayside beach via walkways at the parking lots, including handicap accessible ramps oceanside at the town resident parking lot and Duxbury Beach Park and bayside at the Harbormaster Guardhouse. A pedestrian-only path crosses the dunes to the oceanside beach from Gurnet Road just south of the town resident lots. In addition, OSV access points on oceanside and bayside (three crossovers and shellfishing access roads) provide paths for pedestrians between the beach and Gurnet Road.

Duxbury Beach offers two lifeguarded beaches from Memorial Day through Labor Day. One lifeguarded beach is located on the town-leased portion of the oceanside beach in front of the resident parking lot, consisting of an area 91 meters (100 yards) on either side of a stationary lifeguard chair. A second lifeguarded beach is located at Duxbury Beach Park.

Four buildings are located on Duxbury Beach, consisting of the following (north to south): McLaughlin Cottage, the Pavilion, Duxbury Harbormaster Guardhouse, and High Pines Cottage. The McLaughlin Cottage is owned by a private individual for personal use, but it sits on Reservation-owned land. The cottage is located between the Lagerstedt Lot and Duxbury Beach Park. The remaining three buildings are owned by Duxbury Beach Reservation. The Pavilion building consists of a restaurant, snack bar, and upstairs apartment operated by Duxbury Beach Park. The Harbormaster Guardhouse is located at the east end of the Powder Point Bridge. Town of Duxbury Harbormaster officers staff the guardhouse. High Pines Cottage is a garage structure with a second floor. It is located at High Pines, and the Reservation and Harbormaster personnel use it for storage, meetings, and monitor trainings.

1.2 Piping Plover Nesting

Piping Plover Nesting Habitat

Piping Plover nesting occurs on Duxbury Beach annually from March through August, primarily south of Duxbury Beach Park. Nesting, foraging, and chick-rearing take place both east and west of Gurnet Road. Proactive symbolic fencing is placed around the potential nesting habitat, which includes: oceanside beach from Duxbury Beach Park to the end of the driving beach south of Crossover 3, from the path at the Gurnet Guardhouse north to Plum Hills, and around the bayside replicated habitats (further discussion of symbolic fencing on page 20). The areas of oceanside habitat are fairly narrow with a sand-cobble substrate and sparse vegetation. Nests are typically located on the slope or toe of the dune or seaward as vegetation at the crest of the dune is fairly dense and dunes are steeply scarped along parts of the front beach.

Replicated habitat construction and maintenance has occurred on Duxbury Beach via several methods since 1999. Habitat areas are 400 to 1000 square meters (478 to 1196 square yards) in size and are level with the surrounding beach, typically 0.3 meters (1 foot) above the extreme high tide. All former and current areas are located on the west side (bayside) of Duxbury Beach between High Pines and Plum Hill. These areas were chosen as they reduced the likelihood of broods crossing the road. In addition, these areas provide easy access

to the bayside foraging habitat. Nests laid in the replicated habitats have been some of the earliest laid on Duxbury Beach, suggesting these sites are favored by pairs and/or attract experienced nesting birds.

Piping Plover Abundance and Productivity

Historically, less than 20 Piping Plover pairs have nested on Duxbury Beach. However, beginning in 2014, the number of nesting pairs has ranged from 23 to 28. Similarly, the number of chicks fledged has increased, apart from 2017. The Reservation strives to maintain a fledge rate above 1.24 chicks fledged/pair, and has been successful during 51 percent of nesting seasons since 1989. In recent years, productivity has peaked at 1.94 chicks fledged/pair in 2013 and 1.83 chicks fledged/pair in 2016.

Abundance and productivity of the Piping Plover population on Duxbury Beach for the years 2010 through 2017 are as follows.

Table 1-1. Piping Plover abundance and productivity 2010 through 2017.

Year	Pairs	Chicks fledged	Productivity (chicks fledged/pair)
2010	11	16	1.45
2011	12	19	1.58
2012	14	13	0.93
2013	17	33	1.94
2014	26.5	24	0.91
2015	25	30	1.20
2016	23	42	1.83
2017	28	11	0.39

Piping Plover Egg Loss

The primary causes of egg loss on Duxbury Beach are predation and overwash. Major predators on the site are Eastern Coyote, American Crow, and Red Fox. In 2016, 50 percent of nest losses (5 of 10) were attributed to predation, and in 2017, 62 percent of nest losses (24 of 39) were suspected or likely due to predation.

Table 1-2. Piping Plover egg loss due to predation 2011 through 2017.

Year	Nests laid	Nests lost to predation (of total nests lost)	Percentage Loss
2011	23	8 (of 14)	57%
2012	22	3 (of 11)	27%
2013	19	2 (of 2)	100%
2014	30	5 (of 8)	62%
2015	28	3 (of 6)	50%
2016	29	5 (of 10)	50%
2017	46	24 (of 39)	62%

The Reservation instituted a lethal predator management program in 2010, carried out by the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service Wildlife Services (APHIS WS). Predator presence and impact has been variable since predator management was first instituted on Duxbury Beach. Crow predation has been low since crow removal began, with the exception of 2012, at zero to one instances of Piping Plover nest loss to crow predation each season (Table 1-3).

The inclusion of Eastern Coyote in the predator management program beginning in 2011 was based on the increase of suspected and known coyote predation on both plover and tern nesting, as well as the increase in tracks and sightings. Following this change to predator management in 2011, out of the 83 plover eggs laid by 12 pairs, 19 chicks fledged, resulting in a fledge rate of 1.58. This number is higher than the previous year's rate of 1.45 and well over the rate of 1.24 required to sustain the species. Coyote impact on nesting birds has remained high on Duxbury Beach since 2014 (Table 1.3).

While Red Fox impact on nesting birds was low from 2011 to 2016, there was a drastic increase in nest loss for both plovers and terns due to fox depredation in 2017 (Table 1-3). At the recommendation of APHIS WS, the Reservation voted to commence fox management in June of 2017. The Reservation plans to continue fox management efforts based on the high levels of loss in 2017.

From 2011 to 2017, there have been two instances of known predation events not caused by the three listed above. Common Grackle was deemed responsible for one nest failure in 2015, and in 2017 one nest was lost to skunk depredation. These two events account for two of the 34 nest losses attributed to known predators from 2011 to 2017.

Table 1-3. Total Piping Plover nests lost (% of total lost to known causes) to American Crow, Eastern Coyote, and Red Fox, 2011-2017.

Year	Total Piping Plover nests lost (% of total lost to known causes) to American Crow	Total Piping Plover nests lost (% of total lost to known causes) to Eastern Coyote	Total Piping Plover nests lost (% of total lost to known causes) to Red Fox
2011	5 (33%)	2 (13%)	2 (13%)
2012	0	1 (10%)	1 (10%)
2013	1 (50%)	1? (50%)*	1? (50%)*
2014	0	4 (57%)	0
2015	1 (20%)	0	0
2016	0	5 (56%)	0
2017	2 (5.8%)	9 (26%)	12 (35%)

*Unknown if predation was due to fox or coyote – track indeterminate

Due to the narrow nesting habitat on the oceanside beach, overwash during storms and monthly high tides does occur. During 2017, Duxbury Beach experienced extremely high monthly tides, particularly during the incubation period in late May and June. In May, monthly high tides occurred concurrently with a mild storm with east winds. The high surf during this event served to overwash seven nests. Of these seven, three had been incubated for at least 24 days. Additional overwash events occurred during mid-May and early June for a total of 10 overwashed nests in 2017.

1.3 Other State-Listed Species

In addition to Piping Plover, state-listed Least Tern (*Sternula antillarum*) nest on Duxbury Beach from May to August each year. Least Tern typically nest on the oceanside of the site in distinct sub-colonies. Since 2010, Least Tern have nested in a maximum of five areas of Duxbury Beach. Typically, the four areas used in 2017 have been active: the pedestrian boardwalk to the south end of the pedestrian beach; between Crossovers 1 and 2; between High Pines and Crossover 3; and south of Plum Hills to the Gurnet Guardhouse. In addition to these four areas, in 2014 terns nested north of the Pavilion, and in 2016 a colony was set up between the Pedestrian Boardwalk in the Town of Duxbury resident parking lot and Crossover 1.

Ideal Least Tern habitat location is similar to that of the Piping Plover nesting habitat on Duxbury Beach: (1) oceanside beach from Duxbury Beach Park to the end of the driving beach south of the Crossover 3, and (2) south of Plum Hills to the Gurnet Guardhouse. In 2017, at least one Piping Plover pair nested within each Least Tern colony. The areas of oceanside habitat are fairly narrow with a sand-cobble substrate and sparse vegetation. The colonies are typically located below the crest of the dune due to the dense vegetation. Least Tern have not typically established colonies on the bayside of the site; however, it is believed that the artificial habitats for Piping Plovers may also create suitable nesting habitat for a small Least Tern colony.

Table 1-4 Least Tern abundance and productivity 2010 through 2017.

Year	Pairs	Chicks fledged	Productivity Estimate
2010	107	-	Poor to Fair/Good
2011	53	0	None
2012	217	0	None
2013	133	-	Poor to Excellent
2014	57	-	Poor
2015	205	-	Fair
2016	151	31	Poor to Fair/Good
2017	196	0	None

Threats to Least Tern eggs and chicks are similar to that of nesting Piping Plovers on Duxbury Beach. According to the Mass Audubon 2017 Beach Nesting Summary Report, the largest causes of egg and chick loss for Least Tern in 2017 on Duxbury Beach were fox predation and overwash. Coyote and fox tracks were observed in the colony areas throughout the season, including tracks around recently lost nests and egg shells apparently depredated by crows. It is likely that the Least Tern nesting on Duxbury Beach have also benefited from the predator management program instituted in 2010.

2.0 Responsible Staff

Duxbury Beach is a unique beach in many ways from its ownership to its management. As owner of Duxbury Beach, the Duxbury Beach Reservation has overall responsibility to ensure that the Endangered Species Program is a sound and well executed program. The Reservation works with two essential partners to implement the program: the Town of Duxbury Harbormasters Department and the Mass Audubon Coastal Waterbird Program. The roles and qualifications of each group are outlined below.

1. Duxbury Beach Reservation

    a. Executive Director, Cris Luttazi

    Ms. Luttazi holds a BS in Marine and Freshwater Biology, as well as, a BS in Finance from Kingston University, London, England and Bridgewater State College, respectively. Ms. Luttazi is the Reservation's first appointed Executive Director and has held the position since June 2017. Prior to her current appointment, Ms. Luttazi was employed with Mass Audubon Coastal Waterbird Program for six years and the Woods Hole Oceanographic Institution. Ms. Luttazi is the chief operating officer and controller of the corporation and reports to the Reservation's President and the Board of Directors. Included in the duties and responsibilities of the Executive Director are leadership and management of the Reservation, inclusive of the Endangered Species Program.

    b. Reservation Coordinator, Brynna McGlathery

    Ms. McGlathery holds a BS in Biology and Environmental Science from Tufts University. Prior to working with the Reservation, Brynna worked as the Field Coordinator for the Mass Audubon Coastal Waterbird Program, as a shorebird technician for the Massachusetts Trustees of Reservations, and with the Rachel Carson National Wildlife Refuge in Wells, Maine, focusing on Piping Plover and Least Tern protection. Ms. McGlathery is responsible for the oversight of all facets of the Endangered Species Program on Duxbury Beach, coordinating the efforts of the Mass Audubon Coastal Waterbird Program and the Town of Duxbury Endangered Species Program. Ms. McGlathery is responsible for reporting to the Duxbury Conservation Commission as it relates to beach operations under Order SE 18-1198.

    c. Co-Chairman of the Duxbury Beach Reservation Technical Committee, Alan Vautrinot

    Mr. Vautrinot is the co-chairman of the Duxbury Beach Reservation Technical Committee and has supported the Reservation by managing regulations related to shorebird management since 1991. Mr. Vautrinot holds a Massachusetts surveyors license and is partner of Vautrinot Land Surveying, Inc.

2. Town of Duxbury Harbormasters Department

    The Endangered Species Program has full-time and seasonal staff that are responsible for supporting and upholding the rules and regulations of the Duxbury Beach Endangered Species Program.

    a. Harbormaster, Jake Emerson

    Mr. Emerson is the Harbormaster for the Town of Duxbury. He has been with the department since 2000. He was hired as the town's first full-time endangered species officer in 2003. He is

the only person to have held every position within the department. He graduated from the University of Richmond in 2002 and the Plymouth Police Reserve Academy in 2003.

b. Executive Officer, Michael Pforr

Mr. Pforr is the Executive Officer for the Town of Duxbury Harbormaster Department. He has been with the department since 2004. He was promoted to full-time Endangered Species Officer in 2005 and later promoted in 2016 to Executive Officer. He graduated from Bridgewater State College in 2007 and the Plymouth Police Reserve Academy in 2005.

c. Endangered Species Officers (ESO), Morgan Billings and Mario Thompson

The Town of Duxbury employs two full-time Endangered Species Officers (ESO) who are responsible for enforcing Duxbury Beach rules and regulations, as well as the federal and state Endangered Species Acts as outlined in the State and Federal Guidelines (Guidelines). The ESOs regularly patrol Duxbury Beach 12 months a year. The ESOs are responsible, alongside the Mass Audubon biologists, for locating Piping Plover broods prior to the beach being opened to OSVs and for assisting in vehicle management when road crossings occur.

ESOs report directly to the Town of Duxbury Harbormaster and are required to communicate routinely with the Duxbury Beach Reservation Executive Director and Reservation Coordinator. The ESOs are responsible for the Duxbury Beach Endangered Species Program, including overseeing the Coastal Natural Resource Monitors and Monitor Supervisor, the Deputy ESOs, and the work of the Mass Audubon biologists.

Mr. Billings is one of two full-time Endangered Species Officers for the Town of Duxbury Harbormaster Department. He has been with the department since 2014. In 2016 he was hired full-time as an Endangered Species Officer. He graduated from Nichols College in 2014 and graduated from the Plymouth Police Reserve Academy in 2016.

Mr. Thompson is the second full-time Endangered Species Officer for the Town of Duxbury Harbormaster Department. He has been with the department since 2015 and was promoted to full-time Endangered Species Officer in 2017. He graduated from Bridgewater State University in 2017 and the Plymouth Police Reserve Academy in 2016.

a. Deputy Endangered Species Officers (20 positions with five dedicated to Duxbury Beach)

From April through September, 20 Deputy ESOs are employed by the Harbormasters Department with up to five at a time stationed on Duxbury Beach. Alongside the ESOs, the Deputy ESOs are responsible for patrolling the beach from 06:00 to 21:00 from April through September and enforcing Duxbury Beach rules and regulations, as well as the federal and state Endangered Species Acts. The Deputy ESOs assist in vehicle management through the counting of vehicles on the beach, opening and closing crossovers, and directing overflow vehicles to the proper locations.

The Deputy ESOs report directly to the ESO and are required to communicate routinely with the Mass Audubon Coastal Waterbird biologist and the Reservation Coordinator.

b. Monitor Supervisor (2 positions)

The Town of Duxbury employs a Monitor Supervisor from March through August to perform supervisory and administrative work in the management of the Endangered Species Program. The Monitor Supervisor assists the ESOs and Mass Audubon biologist in initial and continued training of Coastal Natural Resource Monitors. In addition, the Monitor Supervisor works with the ESOs to schedule and place monitors for protection of Piping Plover chicks. The Monitor Supervisor assists as needed in locating clutches and chicks prior to opening the beach. As necessary, the Monitor Supervisor communicates with ESOs and the general public regarding motor vehicle, pedestrian, or dog closure areas on Duxbury Beach. A second Monitor Supervisor is hired to work later in the season, prior to the start date of the monitors, to act as an additional resource for Coastal Natural Resource Monitors when questions or issues arise. The second Monitor Supervisor works opposite shifts to the first Monitor Supervisor to provide full coverage.

The Supervisor reports directly to the ESOs and is required to communicate routinely with the Mass Audubon Coastal Waterbird biologist and the Reservation Coordinator.

c. Coastal Natural Resource Monitors

Approximately 50-60 Coastal Natural Resource Monitors are employed from May through August by the Town of Duxbury to assist in the protection of the listed shorebird species nesting on Duxbury Beach, including Piping Plover and Least Tern. Monitors are responsible for collecting behavioral data on chicks and broods, including location and movement of listed shorebird species. Monitors are also responsible for observing and recording environmental data, predator presence, avian community composition, and vegetation survey data. Monitors interact with the public to provide information about beach rules and regulations and to answer questions as necessary in a polite and professional manner. Coastal Natural Resource Monitors report directly to the Endangered Species Officer. Monitors are required to communicate routinely with the Mass Audubon biologists and the Reservation Coordinator. Monitors are required to attend a training held jointly by the Reservation, Mass Audubon biologists, and the Harbormasters Department at the commencement of the monitoring season. This training includes plover and tern nesting biology, chick monitoring protocols, data collection, beach rules and regulations, public interaction protocols, focal species and predator tracking, and special projects. In addition, the monitors receive ongoing in-field training to ensure classroom instruction is carried out correctly. Throughout the summer, monitors receive additional classroom training as needed as well as informal support while on the beach.

3. Mass Audubon

a. Coastal Waterbird biologists

Two full-time field assistants and one intern are employed by the Mass Audubon South Shore Sanctuaries to implement monitoring, data collection, and reporting for nesting protected coastal waterbirds, including Piping Plover and Least Tern, on Duxbury Beach. Mass Audubon biologists are overseen by Sue MacCallum, Director of the South Shore Sanctuaries. Staff take part in the Mass Audubon training program focused on protected coastal waterbird biology and protection, which takes place throughout the season. Mass Audubon biologists are responsible for locating and identifying protected species nesting and foraging areas; collecting nesting data, including spatial data; monitoring pair, clutch, and brood status; communicating changes in location or behavior of protected species as necessary to ESO, Coastal Natural Resource

Monitors/Monitor Supervisor, and Duxbury Beach Reservation; working with ESO to ensure that fencing and signage provide adequate protection for nests and chicks; assisting in the training of Coastal Natural Resource Monitors; locating clutches and chicks prior to the opening of the beach to non-essential vehicles; interacting with the public to provide education about the protected species nesting on Duxbury Beach; and submitting nesting summary data to NHESP.

b. South Shore Sanctuaries Director, Sue MacCallum

Ms. MacCallum has worked with Mass Audubon as the Director of the South Shore Sanctuaries in Marshfield for 12 years and previously worked with Mass Audubon as an Education Manager for 19 years. Ms. MacCallum oversees the seasonal Mass Audubon biologists working on Duxbury Beach and provides continuity and extensive knowledge of the beach and Endangered Species Program. Ms. MacCallum offers year-round consultation on beach management related to the Endangered Species Program through participation in meetings with the Reservation and other partners.

3.0 Beach Management Plan

Duxbury Beach offers a variety of activities related to conservation and recreation, and beach goers have at times disparate expectations that require oversight from multiple organizations, including Duxbury Beach Reservation, Town of Duxbury Harbormasters Department, and Mass Audubon. In addition, the variety of uses means that visitors are spread throughout the site, and thus intensive and well-founded management is critical.

3.1 Recreational Activities

Over Sand Vehicles (OSV)

Over-sand vehicle use is permitted on Duxbury Beach year-round with the purchase of an over-sand driving permit from the Town of Duxbury. Driving on the beach is restricted to certain areas and to particular times of day and year, depending on protected species nesting and other factors, such as maximum number of vehicles allowed or unusually high tides. The over-sand permit use hours are from 08:00 to 23:00 (Seasonal May through September). Further restrictions may be required for access management or public safety. During May through September, Crossovers 2 and 3 are closed at 20:00 (if open prior). From October through April, only Crossover 1 is open 08:00 to 16:00, weather and tide dependent.

When OSVs became popular on the beach, the Reservation mapped out an area of the beach that could have supported over 1000 vehicles. The length of the beach deemed suitable for OSV use extends for approximately 3,322 meters (3,633 yards), starting near the first pedestrian crossover south of the Powder Point Bridge and extending to a location approximately 76 meters (83 yards) south of Crossover 3. However, in order to protect existing shorebird nesting habitat and the barrier beach system, the Reservation chose to restrict the maximum number of vehicles allowed on the beach to 500. The Reservation further decreed that half this number, or 250 spaces, would be reserved for non-resident OSVs. The number of OSVs allowed decreases equally for residents and non-residents as Restricted Areas for nesting birds increase.

No non-emergency vehicles are permitted within Restricted Areas (front beach and bayside), which are placed 100 meters north and south of brood ranges and tern nursery areas (for further discussion of Restricted Areas

see page 20). Non-emergency essential vehicles may pass through Restricted Areas (front beach and Bayside) with an escort.

Swimming

There are two lifeguarded beaches on Duxbury Beach – one located on the oceanside of Duxbury Beach Park and the second on the oceanside beach east of the Powder Point Bridge. Swimming outside of these areas is without lifeguard supervision.

Horseback Riding

Horseback riding in permitted on Duxbury Beach with a permit purchased from the Town of Duxbury. From October through April, riding is permitted daily from sunrise to sunset. During May through September, riding is permitted sunrise to 09:00 and 18:00 to sunset, weekdays only. Horseback riding is not allowed in Closed and Restricted Areas used by nesting Piping Plover adults and broods or as Least Tern nurseries. Coastal Natural Resource Monitors ensure enforcement as they are positioned at each end of Restricted Areas.

Horseback riders must respect vehicle speed limit restrictions, including those put in place for protected species crossings, and they must stop as directed by ESOs and Coastal Natural Resource Monitors if a crossing occurs.

Shellfishing

Shellfishing access is allowed on Duxbury Beach with a permit purchased from the Town of Duxbury. Motor vehicle access for this purpose must comply with all beach motor vehicle regulations. Shellfish access points are located along the bayside of Duxbury Beach and are accessible to permit holders at all times of day outside of the shorebird season. Bayside access is completely closed to all vehicles two days prior to the estimated first hatching date and remains closed until all plover and tern chicks have fledged. The Duxbury Harbormaster Department is responsible for restricting shellfish access via Duxbury Beach during this time.

Bike Riding

Bike riding is permitted on Gurnet Road without a beach permit year-round. Bicyclists must respect speed limit restrictions, including those put in place for protected species crossings, and they must stop as directed by ESOs and Coastal Natural Resource Monitors if a crossing occurs. In order to cross a Restricted Area on the beach, bicyclists must dismount and walk bikes through the area below the fencing extending perpendicular to the shoreline and be guided around foraging broods if necessary by monitors. Coastal Natural Resource Monitors ensure enforcement as they are positioned at each end of Restricted Areas.

Beach Walking

Beach walking is encouraged on Duxbury Beach and is permitted year-round. Walkers must stay out of all dune, vegetated, marsh grass, posted bird or wildlife, and fenced areas. Walkers are not permitted inside symbolically fenced Closed Areas that are located around ideal habitat and plover pair and tern colony nesting territories. Walkers are allowed to cross through oceanside and bayside Restricted Areas below the perpendicular fencing and may be escorted around broods by Coastal Natural Resource Monitors. Monitors are positioned at each end of Restricted Areas to make sure walkers do not cut above perpendicular fencing designating a Restricted Area. When accessing the oceanside or bayside beach, walkers must use designated crossovers and pathways.

Kiteboarding

Kiteboarding is permitted off of Duxbury Beach on the bayside but outside of Restricted Areas and not within 200 meters (219 yards) of nesting Piping Plover adults or unfledged chicks. Kiteboarders use vehicle pull-offs to park and access the water and must have an over-sand driving permit. The primary access point is at High Pines. Pull-offs within Restricted Areas established due to chick locations are closed to all vehicles, including kiteboarders. Landing is not permitted within Restricted Areas or within 200 meters (219 yards) of any nesting activity.

Boating

Boating is not permitted within 46 meters (50 yards) of the oceanside beach except in designated vessel access areas. The designated area on the oceanside beach is located at the far southern end of the OSV parking area near Crossover 3. However, this area is closed to all vessels in the event of chick activity within 100 meters (109 yards). Coastal Natural Resource Monitors are present during closures to notify boaters and are supported by ESOs. On the bayside, boating is not permitted within 46 meters (50 yards) north or south of the Powder Point Bridge or within any Restricted Areas. Vessels in designated areas may anchor and access is at steerage speed only. Vessels include motorboats, sailboats, sailboards, kayaks, jet skis, etc.

3.2 Parking and Roads

Parking Lots

Several parking lots are located on Duxbury Beach or adjacent to the beach and are available year-round or seasonally. Below is an overview of parking lots, north to south.

I. Lagerstedt Lot: The Lagerstedt Lot is located on the east side of Gurnet Road at the northernmost end of Duxbury Beach. This gravel lot is kept gated when not in use for event parking or as overflow parking for non-resident OSV permit holders unable to access the front beach due to vehicle number restrictions. Overflow parking is managed by Town of Duxbury ESOs.

II. Duxbury Beach Park: Three parking lots are located at Duxbury Beach Park. A gravel parking lot is located on the west side of Gurnet Road to the north of the Pavilion building. Across the road from this lot is a paved parking area. A second gravel parking lot is located on the east side of the road south of the Pavilion, referred to as the "Caterers' Lot." These three parking lots are gated and locked from Columbus Day through Memorial Day, except for events. From Memorial Day through Labor Day, the operators of the Pavilion, manage the parking areas based on daily fees set by the Reservation for visitors without seasonal parking permits.

III. Town Parking Lot: Town resident parking lots are located immediately north of the east end of Powder Point Bridge. The western lot is gravel and the eastern lot is paved. These parking lots are open year-round, dependent on weather and construction work. Parking in these lots is restricted to vehicles with a resident parking permit. Parking lots are managed by the Town of Duxbury ESOs. Lots are open 08:00 to sunset from May through August (once Pavilion dinner service starts the lot is open until service completion) and 09:00 to sunset from September through April.

IV. South Resident Lot: A small paved parking lot is located immediately south of the Harbormaster Guardhouse on the west side of Gurnet Road. The South Lot is open 06:00 to 23:30 May through August

and 06:00 to sunset September through April. This lot operates under the same rules as the larger town lots on the north side of the bridge.

V. West End Lot: A town parking lot is located on the west side of Powder Point Bridge. This lot is open year-round to all visitors. No restrictions apply.

Vehicle Pull-offs

Eleven vehicle pull-offs are located south of the Powder Point Bridge along Gurnet Road on the east and west side. The pull-offs provide space for vehicles to turn around and provide parking for 35 vehicles with over-sand parking permits year-round. If a pull-off falls within a Restricted Area, the pull-off is closed off with symbolic fencing, cones, and signs.

Roads

Gurnet Road runs from mainland Duxbury (immediately south of Marshfield) the length of the peninsula in Duxbury, becoming King Arthur Road in Plymouth before reaching Gurnet Point. The improved gravel road is paved in small sections near the Town of Duxbury resident parking lots but is primarily gravel. The road provides access for residents and visitors to Gurnet-Saquish, access for Duxbury residents and non-residents with OSV permits to the beach, and shellfishing access to tidal flats. Those without OSV or shellfish permits or those who are not on a homeowner or visitor list for access to Gurnet-Saquish are not allowed south of the Harbormaster Guardhouse at the east end of the Powder Point Bridge.

3.3 Beach Cleaning and Refuse Management

The Reservation strives to present a clean, well run beach. To ensure public safety, avoid attracting predators, and minimize damage that large debris can cause to fencing, a thorough refuse management plan is utilized. As Duxbury Beach has several operators throughout the year responsible for distinctive areas, there is a multifaceted approach to refuse management on site. The Reservation oversees all aspects of the Beach refuse program with the support of the Facilities and Maintenance Committee.

Regular refuse management on Duxbury Beach includes parking lots, roadways, and oceanside and bayside beaches. With respect to the town parking lot at the west end of the Powder Point Bridge and the intensively used town resident beach parking lots at the east end of the bridge, trash removal during the week is the responsibility of the Duxbury Department of Public Works (DPW). These areas are equipped with large trash barrels that are serviced daily during the summer and as needed at other times. Signs direct that all trash be placed in the barrels.

Removal of small land and marine debris in the area of the Lagerstedt Lot and Crossovers 1, 2, and 3, including Gurnet Road, is performed by Town of Duxbury Coastal Natural Resource Monitors, the Monitor Supervisor, ESOs, and Reservation employees on a daily or weekly basis from April through Labor Day and monthly during the rest of the year. Trash removal occurs outside of Closed and Restricted Areas.

The parking lots and food concession at Duxbury Beach Park are open to the general public. This area is also equipped with trash barrels and the operators remove all trash from both the concession area and the adjacent

beach on a daily basis. They also remove trash in the vicinity of the town resident parking lots on the weekends when the DPW is not on duty.

In addition to daily and weekly refuse management protocols, the Reservation participates in two site-wide, volunteer-based clean-ups: the Duxbury Beach Coastal Sweep takes place during a weekend in September, post nesting season, each year and is managed by a Reservation volunteer. Prior to the nesting season, a Duxbury Beach "Spring Fling" includes a site-wide clean-up run by a volunteer with support from the Reservation. The timing of the clean-up takes into account the arrival of nesting shorebirds and the possibility of spring storms that may bring in additional debris. Typically, the clean-up takes place during the second half of March. Volunteers are instructed on disturbance avoidance measures if plovers are on site.

The Reservation employs a private Maintenance Team that works throughout the year. The Maintenance Team is responsible for a number of projects, including removal of large debris accumulated due to storms or degradation of equipment on the site (broken posts, fencing, etc.). Removal of large debris is dependent on location and time of year, taking into account shorebird nesting activity. Large debris that requires the use of a vehicle or is located within 100 meters (109 yards) of plover or tern activity (March 15 to September 15) is reported to the Reservation Coordinator, who then seeks approval to remove from the NHESP.

Beach raking does not occur on Duxbury Beach regardless of season and location. Limited removal of wrack by hand may occur on the Resident Parking Beach and Duxbury Beach Park. In the event of excessive wrack public health officials may deem it necessary to clear wrack from the beach for public safety reasons. Paved parking lots are swept to decrease dust annually.

3.4 Rules and Regulations

The Duxbury Beach Rules and Regulations vary by section of the beach as well as time of year due to the presence of protected shorebird species and increased human use.

<u>General</u>

1. All beach users must comply with all federal/state and local laws, terms, conditions, policies and the request or instructions of the patrolling Harbormaster Department personnel, Endangered Species personnel or police officers, or other authorized agencies or departments.

2. When endangered species are present on Duxbury beach, no person, their animal, or their vehicle shall disturb or attempt to disturb the endangered species in any way and/or fail to adhere to the direction and instruction of the Harbormaster Department personnel, Endangered Species personnel or police officers, or other authorized agencies or departments.

3. Drinking of alcoholic beverages is prohibited.

4. Dogs must be leashed and under the immediate and effective control of their handler at all times (see also Dog Regulations below).

5. No sand, stone, vegetation, or other material may be removed from Duxbury Beach, except for salt marsh hay or seaweed. Erosion control fencing or signs shall not be damaged or removed.

6. Trash must be stored and discarded properly, especially food scraps. All beach refuse must be removed by the beach user. Littering and dumping of household trash are prohibited. Glass containers are not allowed.

7. Bonfires and campfires are prohibited. Only small cooking fires in a metal container are permitted. No materials may be added to a fire after 22:00. All fires must be extinguished with water by 22:30, and all fire remnants must be removed from the beach area by the beach user.

8. Overnight camping is prohibited. Unauthorized vehicles access is prohibited.

9. Fireworks are prohibited.

10. Loitering in the beach parking lots is prohibited.

11. Beach functions of approximately 20 or more persons, or any other special event or research, require a special permit from the Harbormaster Department and notification given to the Duxbury Beach Reservation. Applications for permits shall be received at least one week prior to the proposed function.

<u>Motor Vehicle Regulations</u>

1. All vehicles must carry a copy of the Duxbury Beach Rules and Regulations pamphlet.

2. All vehicles parked on Duxbury Beach property must purchase and visibly display a current Duxbury Beach permit. Vehicles parked in any paved parking area at the east end of the Powder Point Bridge must visibly display a resident or rental resident beach lot permit from Memorial Day to Labor Day. All vehicles driving or parked in over-sand areas or parked in roadside pull-offs south of the Powder Point Bridge must visibly display a current resident or nonresident over-sand permit on a year-round basis. Parking permits shall be affixed to the windshield, below the mirror, and never in a tinted area. Unauthorized parking in all roadways, fire lanes, or vehicle crossovers is prohibited at all times. There are five types of Duxbury Beach permits;

    a. Resident Beach Lot Permit for use of paved parking lots (valid April through March)

    b. Resident Over-sand Permit for four-wheel drive (4WD) vehicles in paved parking lots, over-sand areas, and roadside pull-offs, (valid April through March)

    c. Resident Off-Season Over-sand Permit for 4WD vehicles in over-sand areas and roadside parking areas, (valid October through April)

d. Non-Resident Over-sand Permit 4WD vehicles in over-sand areas and roadside parking areas, (valid April through March)

e. Non-Resident Off-Season Over-sand Permit for 4WD vehicles in over-sand areas and roadside parking areas, (valid October through April)

3. Permits are valid only for the vehicle for which they were purchased. The permit registration number must match the vehicle registration. Permits are nontransferable. (Original permit must be returned in order to receive a replacement due to sale of vehicle, windshield replacement, etc.)

4. All other vehicles are prohibited, including motorcycles, minibikes, minicars, snowmobiles, paraglides, ATVs and ATCs (except when necessary for official use). No airplanes or helicopters are permitted to land on Duxbury Beach except in an emergency.

5. All parking is on a first come, first served basis. When parking capacities are reached, vehicle access restrictions will be imposed. Further restrictions may be imposed on the number of vehicles permitted on the beach properties at one time for public safety and access management.

6. All OSVs must be properly equipped before they are permitted on the beach. Vehicles may be inspected for the following equipment at any time (lack of any or all of these items may result in fines for each item missing):

    a. Shovel

    b. Tow rope, tow strap, or chain

    c. Spare tire, jack, and 18 inches square plywood support pad

    d. Tires that are properly pressurized for beach conditions

7. Resident Parking Area hours (weather permitting) are:

    - North Lot: 09:00 to Sunset (Seasonal) September through April 09:00 to Sunset (Off-Season)

    - South Lot: 06:00 to 23:30 September through April 06:00 to Sunset (Off-Season)

8. The over-sand permit use hours are from 08:00 to 23:00 (Seasonal May through September). Further restrictions may be required for access management or public safety. During May through September, Crossovers 2 and 3 are closed at 20:00 (if open prior). From October through April, Crossover 1 is open 08:00 to 16:00, weather and tide dependent.

9. Driving must be confined to designated routes and never in the water and never on or over dunes, vegetated areas, marsh grass, posted areas, or fenced areas. Vehicles shall travel in established tracks. Vehicles shall park in an organized fashion in a manner that will not interfere with the established track or traffic flow. Parked vehicles must move if

instructed by Harbormaster Department personnel at any time. Vehicles driving off the beach shall have the right of way. Vehicles are not allowed in pedestrian, mud-flat/shellfish, or wildlife areas. No vehicle shall travel or park within 3 meters (10 feet) of a sand fence or symbolic string fence on the ocean side of the beach.

10. All vehicles must be operated for the safety and regard of the operator, vehicle occupants, pedestrians, and beach resources. Maximum speed on the Powder Point Bridge, vehicle turn-arounds, paved parking areas, vehicle crossovers, and in designated over-sand areas is 10 mph, conditions permitting; on Gurnet Road, the maximum speed is 15 mph, conditions permitting. In any protected species area, the maximum speed shall be reduced to 5 mph, and traffic may be further restricted or stopped by the Harbormasters Department personnel for listed species protection and management.

11. All persons must ride within the confines of any motor vehicle and must be seated. Riding on fenders, tailgate, or roof, or standing in the vehicle is prohibited.

12. The roadway over the leased portion of the beach (Gurnet Road) to Gurnet Gate is for use by OSVs only. All Gurnet-Saquish traffic must use the roadway.

<u>Dog Regulations</u>

From September 15 through April 1, dogs are permitted as listed under the Town of Duxbury dog regulations. Dog walking is not permitted in vegetated areas or fenced areas year-round.

The following rules shall be in effect on Duxbury Beach properties from April 1 to September 15.

1. Dogs and their handlers are prohibited from all dune, vegetated, marsh grass, posted bird or wildlife areas, and all fenced areas.

2. All dogs are prohibited from the front beach, known as the Resident Beach, south to the poles delineating the start of the over-sand beach, April 1 to September 15.

3. All dogs are prohibited from the bayside beach north of the Powder Point Bridge adjacent to the Resident Parking Lot from April 1 to September 15.

4. Dogs and their handlers are prohibited from disturbing any endangered species or wildlife on Duxbury Beach.

5. A dog on Duxbury Beach properties shall be at all times leashed and under immediate and effective control of its handler. NOTE: “Immediate and effective control” is determined by Harbormaster Department personnel.

6. Any person wishing to take a dog onto Duxbury Beach properties shall register with the Town of Duxbury and obtain a permit. Registration and permits will be available at the Duxbury Town Hall. The permit must be carried by the handler of that dog at all times while the dog is on Duxbury Beach properties.

7. If in accordance with all rules and regulations, dogs are allowed on the Duxbury Beach properties between the hours of 08:00 and sunset, unless these hours are amended by action of the Duxbury Harbormaster Department. During all special events, dogs are prohibited on Duxbury Beach properties between the hours of sunset and 08:00.

8. Unless specifically amended by these rules or, if applicable, by action of the Duxbury Harbormaster Department, all other Duxbury, state or federal Dog Control Regulations shall continue to apply. These include regulations under the "Special Dog Regulations Contained within the General Beach and Motor Vehicle Regulations" pamphlet, Section 7.1 of the General By-laws of the Town of Duxbury, and Article 37 of the 2002 Duxbury Annual Town Meeting.

9. Dog handlers are required at all times of the year to remove droppings from the Powder Point Bridge, beach parking lots, and all beach areas.

10. Any violation of these Rules and Regulations or Duxbury General By-Laws or other federal/state laws may result in non-criminal and/or criminal process or provisions found in the Duxbury General By-Laws involving the revocation of the dog permit for the remainder of the season. If a dog permit is revoked, such revocation shall be recorded at the Duxbury Town Hall, and the owner's immediate family will not be eligible to re-apply for another permit until the following year.

Duxbury Beach Park

The following are not permitted on Duxbury Beach Park:

1. Drinking of alcoholic beverages is prohibited.

2. Fires of any type are prohibited.

3. Horses are not permitted.

4. Dogs are not permitted from Memorial Day through Labor Day.

5. Vehicles are not permitted off of the parking lot or roadway.

3.5 Law Enforcement

The Town of Duxbury employs two full-time Endangered Species Officers (ESOs) who are responsible for enforcing Duxbury Beach rules and regulations, as well as the federal and state Endangered Species Acts. The ESOs are responsible for enforcing traffic regulations on site, including parking, speed limits, OSV beach use and access, and traffic restrictions during brood crossings. The ESOs patrol Duxbury Beach 12 months a year. From April 1 through September 1, 20 Deputy ESOs support the two ESOs. On weekends a maximum of seven enforcement staff are present on the beach, and on weekdays a minimum of four are present.

Harbormaster enforcement staff patrols on Duxbury Beach are as follows throughout the year:

- May through September 06:00-23:00

- October
    - Monday through Thursday 07:00-19:00
    - Friday through Sunday 07:00-23:00
- November through January 07:00-17:00
- February 07:00-18:00
- March 07:00-19:00
- April 07:00-20:00

The team of four to seven officers are responsible for patrolling the beach from 06:00 to 21:00 with the beach open to the public from 08:00 to 23:00 from April through September. During the season, Crossover 1 is open until 23:00 and Crossover 2 closes at 20:00. Officers are responsible for ensuring that OSV operators are accessible to Crossover 1 (that is, they do not have to cross a Restricted Area) beginning at 20:00 when Crossovers 2 and 3 are closed. A deputy ESO is stationed at Crossover 1 from 20:00 to 23:00 to stop non-essential traffic traveling south. From October through April, two ESOs are responsible for patrolling the beach and opening and closing the gates to the front beach. Weather and tide dependent, the beach is open to vehicles daily from 08:00 to 16:00 via Crossover 1.

Due to the unique geographical location of Saquish and Gurnet Point, the Plymouth Police Department often seeks mutual aid from the Duxbury Police Department when responding to calls for service there. Essential vehicles have the right to access Gurnet-Saquish properties and include vehicles carrying property owners, their guests and invitees, service and repair personnel, fire, police, and other emergency vehicles. Duxbury Police Units will respond under mutual aid to Gurnet-Saquish upon the lawful request of Plymouth police officers only in cases of substantial crimes in progress. Duxbury Police Units and/or Duxbury Police Harbormaster Department Units respond to Gurnet-Saquish in cases of reported life-threatening medical emergencies upon the request of Plymouth emergency personnel when it is clear that the Duxbury Police or Harbormaster Units would provide the quickest arrival time of available first responders.

3.6 Other Operations

Beach functions of approximately 20 or more persons, or any other special event or research, require a special permit from the Harbormaster's office. After receiving the permit application, the town is responsible for submitting event information to Duxbury Beach Reservation for approval by the Executive Director. Applications for permits shall be received at least one week prior to the proposed function. Those attending a function must follow the rules and regulations of the beach, including vehicle rules. They must also respect all protected species signage and closed and Restricted Area fencing. Any groups or individuals holding an event must work with the Town of Duxbury and Duxbury Beach Reservation staff to ensure event details are in compliance with all federal/state and local law, terms, conditions, policies and the request or instructions of the patrolling Harbormaster/Coastal Natural Resources personnel, Endangered Species personnel or police officers, or other authorized agencies or departments. Fireworks are not permitted on Duxbury Beach and do not take place on the beach year-round. A Town of Duxbury sponsored bonfire celebration may take place on the oceanside beach at a point between the resident parking lot and north to Duxbury Beach Park after the close of the

shorebird season. In addition, in May and June educational programming, typically for schools, takes place on the ocean and bayside beaches near the resident parking lot. Camp programs also visit the site occasionally during the summer season.

3.7 Listed Species Monitoring and Management

Fencing and signage

Fencing on Duxbury Beach is extensive and varied depending on purpose and audience (vehicle versus pedestrian). Protection efforts are flexible and responsive to ensure that as nesting locations shift and brood range moves or expands, protection adapts accordingly. Signage notifying beachgoers of protected areas and certain beach rules (such as dogs and speed limits) are plentiful and enforced by the presence of enforcement and monitoring staff.

Permanent "symbolic fencing" is in place on the beach year-round, consisting of wooden posts placed every 15 meters (16 yards) parallel to the dune to protect the dune and vegetation from vehicles and as a visual deterrent to people. Snow fencing exists along much of the beach to limit pedestrian and vehicle incursion on dunes. Sturdy drift fence serves a similar purpose. Although both are possible to climb over, they serve as a visual deterrent to entering the dunes, and in some cases, shorebird nesting habitat. Snow fencing is also used along vehicle and pedestrian crossovers over the dune and restricts movement of vehicles and pedestrians into vegetation and nesting habitat. Post and cable fence, snow fence, split rail fence, and boulders are placed along roadways and parking lots to prevent pedestrians and vehicles from walking or driving over dunes, thus protecting the dunes, vegetation, and nesting. This fencing serves to physically prevent vehicles from driving over shorebird habitat and sensitive dune areas.

Seasonal symbolic fencing, consisting of rebar posts and orange twine, is erected the last week of March each season to proactively protect potential habitat. Proactively fenced areas are located along the oceanside beach from Duxbury Beach Park to the end of the driving beach south of Crossover 3, from the path at Gurnet Guardhouse north to Plum Hills, and around the bayside artificial habitats. As Mass Audubon biologists identify new plover or tern nesting areas, the ESOs erect new areas of symbolic or extend existing fencing. Fencing is also extended when nests are laid close to the fence line to provide a larger buffer from disturbance. This wider buffer extends 50 meters (54 yards) north and south of the nest. Closed Area signs are placed on every other post, and speed limit signs are placed every 15 meters (16 yards). These symbolically fenced areas are referred to as "Closed Areas." Closed Areas may also be erected in areas of high recreational use in case of brood use and for dune protection. Closed Areas are expanded if deemed necessary due to evidence of adult plover disturbance, or the need for additional cover or foraging opportunities for plover chicks.

In addition to Closed Areas that provide protection for nests and incubating adults, signage is put in place to prevent parking within 50 meters (55 yards) north and south as well as seaward of active nests. "Restricted Area" fencing is erected two days prior to the estimated hatch date to expand the protected areas for chicks. Restricted Areas extend 100 meters (109 yards) north and south of the brood range and include the entire side east to west (oceanside to bayside beach), provided that vegetation or topography of the beach makes habitat east to west accessible. If a brood is adjacent to an OSV area, the Restricted Area is set at 200 meters north and south of the brood range for the first week after hatching as brood activity has not been established. Restricted Areas on oceanside and bayside are delineated with symbolic fencing running perpendicular to the beach – extending from the Closed Area fencing to somewhere between the high tide mark and low water mark (dependent on depth and surf to ensure fencing is not destroyed). Perpendicular fencing on the bayside

generally does not extend past the high tide mark so as to ensure that boats moving through the channel do not hit the rebar posts. Initially, the perpendicular fence lines are placed 100 meters (109 yards) on either side of plover nests, providing 200 meters (218 yards) of protected beach. Restricted Area fencing is placed 100 meters (109 yards) to either side of the outermost Least Tern nest in the colony two days before the projected hatch date. Restricted Areas are adjusted as broods move throughout the site or tern chick nurseries shift to provide a 100 meter (109 yard) buffer from vehicles.

Pedestrians are able to walk through Restricted Areas below the end of the perpendicular fencing. This path may be through the water depending on the tide. Bikes must be walked through the area, and dogs, horses, and non-essential vehicles are not permitted. Signs informing visitors of the restrictions are located on the perpendicular fences with arrows indicating that pedestrians must walk around the fencing rather than ducking under. If there are established vehicle paths approaching a Restricted Area, sawhorses with "no vehicle access" signs are placed in front of the perpendicular fencing to provide additional visual deterrents for OSV operators.

In places where vehicle pull-offs fall within the Restricted Area, these pull-offs are closed to all vehicles (not including enforcement and monitoring staff). Pull-offs are closed with temporary symbolic fencing, "area closed" signage, and orange cones. Sections of roadway within a Restricted Area are delineated with orange barrels and reduced speed limit signs (speed drops to 5 mph) are placed in the center of the road. These signs also serve as the limits of vehicle use when a brood crossing is in progress. Visitors to the beach are informed of reduced speed limit areas by the attendants at the Harbormaster Guardhouse.

Pamphlets containing beach rules and regulations are available at the Harbormaster Guardhouse, and additional signage is in place at the beach entrance and parking lots regarding vehicle access, speed limits, and dog rules. Beach rules and regulations are also available to visitors on-line through the town and Reservation websites.

Other management

Predator Management: In 2009, the Reservation met with the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) to discuss recommendations and procedures for a possible predator management plan. In 2010, the Reservation's Board of Directors adopted a predator management plan and contracted with APHIS WS during the shorebird season to remove predators as appropriate and according to the approved plan. The plan's original focus was to manage American Crow (*Cosvus brachyrhynchos*). American crow management was done through DRC-1339 COR treated brown chicken eggs placed in mock exclosures to target crows exhibiting nest predating behavior.

In 2011, the decision was made to expand the predator management program to include Eastern Coyote (*Canis latrans var.*). This policy enhancement was based on the increase of suspected and known coyote predation on both plover and tern nesting, as well as the increase in tracks and sightings. In 2011, out of the 83 plover eggs laid by 12 pairs, 19 chicks fledged, resulting in a fledge rate of 1.58 chicks fledged/pair. This number was higher than the previous year's rate of 1.45 and well over the rate of 1.24 required to sustain the species.

Predator management efforts remained consistent from 2011 through 2016, with the exception of 2014, when the Reservation suspended predator management efforts for mammalian predators and instead engaged Dr. Chris Bloch of Bridgewater State University to provide a study of the effectiveness of predator management on Duxbury Beach and other beaches. Piping Plover productivity decreased to 0.92 chicks fledged/pair that season, compared to 1.94 in 2013. Dr. Bloch concluded that crow and coyote management had significantly improved Piping Plover productivity, and to a lesser extent Least Tern productivity. He also concluded that coyote removal on Duxbury Beach has had a negligible effect on the overall coyote population.

Animal and Plant Health Inspection Service Wildlife Services reported Red Fox (*Vulpes vulpes*) presence on Duxbury Beach in early May 2017. In June 2017, the Reservation voted to implement Red Fox management. Red Fox management had occurred previously in 2012.

In the past, Reservation policy has required APHIS WS to survey the beach in late winter/early spring to determine the presence of predators and make recommendations to the Reservation. Beginning in 2017, the Reservation policy has been amended to allow coyote and crow removal in late winter without a survey. The goal of the new approach is to create a window of time when unfledged plover and tern chicks are present, and the predator population is somewhat diminished. Similar to coyote and crow management, fox management will begin in late winter to ensure there is a window of time with a diminished fox presence on the site. These changes to the predator management program will continue in 2018.

The Reservation board voted to continue the predator management program, maintaining the current list of target species (American Crow, Eastern Coyote, Red Fox) on November 14, 2017. The Reservation will continue to evaluate the set of species approved for lethal removal annually and throughout the season based on predator presence and recommendations from APHIS WS.

Habitat enhancement: Based on discussions with Dr. Scott Melvin (NHESP), the Reservation began creating artificial nesting habitat areas in 1999. The Reservation placed 1,300 cubic meters (1,700 cubic yards) of quarry sand on the bayside beach between High Pines and Crossover 3 to form a large rectangular area measuring approximately 91 meters by 45 meters (100 yards by 50 yards). Part of this area was veneered with natural beach sand to help determine if nesting pairs prefer natural beach sand to quarry sand. One pair of Piping Plover nested in this area in 1999, suggesting preference for natural beach sand and helping to determine territory size on Duxbury Beach.

The project continued in 2000 with two additional habitat areas, each 53 meters in diameter (58 yards), just south of High Pines. In these cases, natural sand was spread over the entire area of quarry sand placed over the vegetation. Two pairs nested on the three enhancement areas, fledging three chicks. Two additional areas were added south of High Pines in 2001, created in the same way as in 2000. No birds nested on the newly created areas, possibly because access for chick foraging was limited by the marsh. Lack of funding stalled the project in 2002, and vegetation regrew in the habitat enhancement areas – no plovers nested in these areas in 2002. An attempt was made to restore the areas in 2003 by rototilling the grass. This was deemed an ineffective method as the finished surface was rough with vegetation only partially buried. Again, no pairs nested in the habitat areas.

In 2005, DBR received a five-year permit from the Massachusetts Department of Environmental Protection to burn grass to create replicated habitat areas. This was first done in the fall of 2005 and in the spring of 2006, plovers nested on three of the five burned areas. Unfortunately, burning was deemed to be an unsuitable solution as the vegetation grew back too quickly. DBR then instituted the method of scraping replicated habitat areas using a small "bobcat" in the early spring to scrape and bury vegetation. This method was deemed effective because while the grass grows back, it allows a window of no vegetation during egg laying and hatching. In 2010, at the recommendation of Mass Audubon Coastal Waterbird Program staff, DBR began to scrape areas to resemble a naturally occurring washover rather than the previously used 53 meters diameter circle (58 yards). Each area was approximately 279 and 371 square meters (334 and 444 square yards) and is level with the surrounding beach, typically 0.3 meters (1 foot) above the extreme high tide.

The "scraping" enhancement method continued in 2011, 2012, and 2013 with moderate success as at least one nesting pair used the areas each season. No maintenance work was performed at the habitat enhancement

areas in 2014 and 2015 due to winter storms which either diverted DBR resources or prevented access to the areas. In 2016, three areas were scraped, and two pairs of plovers nested at the enhanced habitat areas, fledging three chicks.

In 2017, habitat enhancement occurred at three existing areas of replicated habitat and at three new locations on the west side (bayside) of the site. Three pairs of Piping Plover established territories and nested within three of the replicated habitat areas in 2017. Three chicks survived to fledge from the nests located in the enhanced habitat. Based on the work that occurred in 2017 and observations made over the previous 17 years, habitat enhancement was deemed effective in attracting nesting pairs, providing suitable chick rearing habitat, and reducing interactions between endangered species conservation efforts and beachgoers on Duxbury Beach.

The Reservation plans to maintain the five existing replicated habitat areas to promote Piping Plover and possibly Least Tern nesting in these areas. Work in 2018 will be dependent on vegetation regrowth, and scraping will occur if deemed necessary to maintain the habitat.

Exclosures: Much of Duxbury Beach is unsuitable for exclosures due to the narrow width, slope, rocky substrate, and dense vegetation. These factors may increase the tendency for overwash or destruction of the exclosure and increase the likelihood of abandonment due to disturbance and limited visibility of predators. Clutches located in replicated habitat areas may be candidates for exclosures, as exclosures are primarily open, flat, sandy, and at less risk of overwash by being on the bayside of the site. The Reservation and partners will determine where exclosures may be a viable option as territories are established and eggs are laid.

The Reservation Coordinator for Duxbury Beach Reservation holds the exclosure permit for Duxbury Beach. Under the permit, the erection of exclosures will be completed by the Reservation with assistance from the ESOs and Mass Audubon biologists. The Reservation and Mass Audubon designee will be present during construction of any predator exclosure to ensure there is complete knowledge of the nesting pair and the exclosure protocol. Any changes in procedure relating to exclosure placement, assembly, and current issues should be communicated to the ESOs and reviewed at a training session involving ESOs, Mass Audubon, and the Reservation.

Vegetation management: Extensive effort has been made to establish and maintain beach grass and woody plants on Duxbury Beach to stabilize the dune and entire barrier beach system. Plantings occur each spring in areas where work has been performed or where vegetation has been destroyed by winter storms after approval from the NHESP. In order to maintain suitable nesting habitat - sparsely vegetated, sand-cobble areas - all plantings are spaced 36 inches (91 cm) on center). The Reservation applies maintenance-blend fertilizer to beach vegetation annually, primarily through the use of a helicopter. However, because placing fertilizer by hand is more effective, in areas where it is critical to control placement, the Reservation will fertilize by hand rather than by helicopter.

Duxbury Beach Endangered Species Monitoring Program

Monitoring of listed species on Duxbury Beach is multifaceted with in-field and reporting responsibility in the hands of two groups - the Town of Duxbury Harbormaster Department and Mass Audubon. A successful monitoring program requires strong communication among the individuals on the ground doing the monitoring as well as with the Reservation, which performs the overall maintenance and oversight of the beach year-round. To ensure all parties are aware of concerns, current status of nesting and protection work, and ongoing training of staff, weekly meetings occur among the ESOs, Monitor Supervisors, Mass Audubon biologists, and the

Reservation Coordinator. The effort spent monitoring is extensive to ensure that adequate protection through fencing and signage is in place.

Mass Audubon: Mass Audubon biologists, including one crew leader, one Field Assistant II, and one part-time trainee, begin monitoring Duxbury Beach the third week of March, with visits three to five times per week in March and April. In May, monitoring visits increase, with daily visits beginning shortly before the first plover nest is due to hatch. Biologists collect information on plovers and terns during each site visit, focusing on pair abundance, nest status and location, brood status and location, nest and chick loss, flight status, predator presence, and staging activity. During the course of monitoring, the biologists inspect symbolic fencing and communicate issues or changes to ESOs.

In addition, Mass Audubon biologists, alongside the ESOs, are responsible for determining the location and status of all broods prior to the beach being opened - this monitoring occurs from 06:00 to 08:00 every day beginning two days prior to the first nest hatching until all chicks are fledged. Staff work with ESOs to determine necessary changes to closed or Restricted Area fencing and placement of Coastal Natural Resource Monitors. Monitoring efforts by Mass Audubon also serve to inform the ESOs and Monitor Supervisors of the anticipated need for Coastal Natural Resource Monitors day to day and over the course of the season by communicating hatch dates and helping to determine the north-south and east-west extent of Restricted Areas.

Mass Audubon biologists complete the NHESP short form and submit the preliminary data for Duxbury Beach each July. Mass Audubon also completes annual census reports, and site maps for Duxbury Beach to be submitted to the state each September. These forms are completed based on the field book data and nest form data captured during each site visit by each staff member.

Monitor Supervisors and Coastal Natural Resource Monitors: Coastal Natural Resource Monitors (monitors) begin on the beach at least two days before the earliest plover nest is due to hatch. From this point, monitors are scheduled in two shifts per day, from 06:00 to 20:00, seven days per week while unfledged chicks are present. First-shift monitors arrive at 06:00 and begin monitoring at their assigned location at 06:15. A minimum of one monitor is assigned to each brood, regardless of location and tendency to range near or cross the roadway. An additional monitor is placed on the roadway in areas where crossings have historically occurred, there is suitable habitat on both sides of the road, or the brood is observed to range near to or cross the road. The total number of monitors in a brood area on oceanside and the roadway may depend on several factors, including: number of broods in the area, brood range size, recreational use, and location. For example, in some areas where the brood's Restricted Area is adjacent to an OSV area to the north and south, two monitors may be assigned to monitor one brood on oceanside in addition to a monitor on the roadway (if possibility of crossing activity). In the event of rain or storm conditions, monitoring may cease because the broods seek shelter and searching for them could cause chick mortality. In bad weather, enough monitors are kept on for coverage of known plover road crossing areas and areas adjacent to any non-restricted over-sand areas if the crossovers remain open.

The primary responsibility of the monitoring program is ensuring the protection of unfledged chicks from vehicles and that broods remain undisturbed. Coastal Natural Resource monitors, supervised by two Monitor Supervisors, are placed on either side of the oceanside Restricted Areas where recreational use is greater, to watch chicks and prevent beachgoers from disturbing the broods. If the chicks are foraging at the water line, monitors may escort beachgoers around the brood to ensure chick safety or keep the area closed to pedestrians until the brood moves to a different area. Monitors also act as an additional deterrent (besides fencing and signage) for any vehicles approaching the Closed Areas on the oceanside beach. Monitors primarily remain on

the outside of Restricted Areas so as not to disturb the brood or any incubating adult plovers, terns, or tern chicks. However, in instances where the Restricted Area is expansive due to the size of the brood's range, the presence of multiple broods within one Restricted Area, or the extent of a tern nursery area, monitors will enter the Restricted Area in order to make observations and ensure that necessary notice is given to ESOs and roadside/bayside monitors of probable crossings. Monitors will also enter Restricted Areas in order to obtain accurate chick counts once per data collection period (20 minute intervals) if necessary. Monitors are instructed to stay below the high tide line and as far from the brood as possible to lessen any disturbance. In addition, monitors are trained in plover and tern behavior in order to recognize signs that the birds are being disturbed by monitor presence. Monitors do not access Closed Areas where unhatched nests are located.

In areas where crossings are possible, monitors are responsible for identifying movement toward Gurnet Road and for then informing the monitor stationed on the road, the ESO on duty, and the Monitor Supervisor on duty of the probable crossing. This communication occurs as soon as the brood or adults begin moving away from the water line and toward the dune/vegetation so that the monitor and enforcement staff can be in place well before the chicks approach the road. The monitor located on the road and the ESO stop traffic in both directions, including pedestrian traffic, once the brood reaches the snow fence or permanent symbolic fencing which is located at the toe of the dune or crest of the dune. The oceanside monitor maintains visual contact with the brood until the roadside/bayside monitor confirms that responsibility has shifted. Traffic remains stopped for as long as it takes the brood to cross the road and commit to the movement. Once off the road, the ESO maintains the closure while the monitors observe the brood to determine whether they are likely to stay on the present side or return to the original location. Typically, it is determined that the brood is going to stay at the current location once the chicks have reached the high tide line.

Once on the bayside, the brood is monitored by the monitor stationed on Gurnet Road while the oceanside monitor remains at the oceanside Restricted Area. Pedestrian use of the bayside is much less and due to the topography and lack of structures (snow fence and sturdy drift fence), monitors stationed on the road are able to easily intercept pedestrians approaching Restricted Areas on the bayside beach. In addition, because the road is above the bayside beach, monitors are more easily able to locate chicks and record observations without causing unnecessary disturbance.

The exact placement of monitors and number of monitors assigned to a brood varies as there are countless scenarios that may occur on the site, requiring more or less effort and oversight from enforcement staff. Factors in these scenarios include original nest location (oceanside vs. bayside), presence on OSV or pedestrian beach, extent of habitat moving east or west (whether a crossing is feasible), number of chicks and number of broods, presence of Least Tern nests or chicks, and a multitude of other details. In an effort to anticipate need during the season, Reservation management, ESOs and Monitor Supervisors perform a walk-through of the oceanside, bayside, and road to map potential crossing locations and other potential factors influencing management.

Monitors carry log books specific to each brood, in which they record data, such as brood crossings, time and length of crossing, brood identification, and number of vehicles stopped. In addition, monitors are responsible for checking broods every 20 minutes and recording information, including brood location and number, adult location and number, behavior, and habitat type. Throughout shifts, monitors record predator presence or tracks, public interactions (e.g., with dog walkers or bicyclists), and information on special projects. Based on observations, the monitor informs the ESO if a brood moves within 100 meters (109 yards) of an OSV area so that the Restricted Area boundary can be adjusted. The information captured at the end of the second shift each day aids in locating broods the following morning prior to the beach being opened.

In addition to the information captured on plover nesting and chick rearing, monitors are trained to recognize Least Tern nesting and to capture information on chick number and locations within colonies. As all of the tern nesting locations include plover nests, the monitors do spend time stationed at Restricted Areas set up for tern nurseries. Monitors are trained to inform Mass Audubon and ESOs of changes to tern nursery boundaries so that protection measures can be adjusted accordingly.

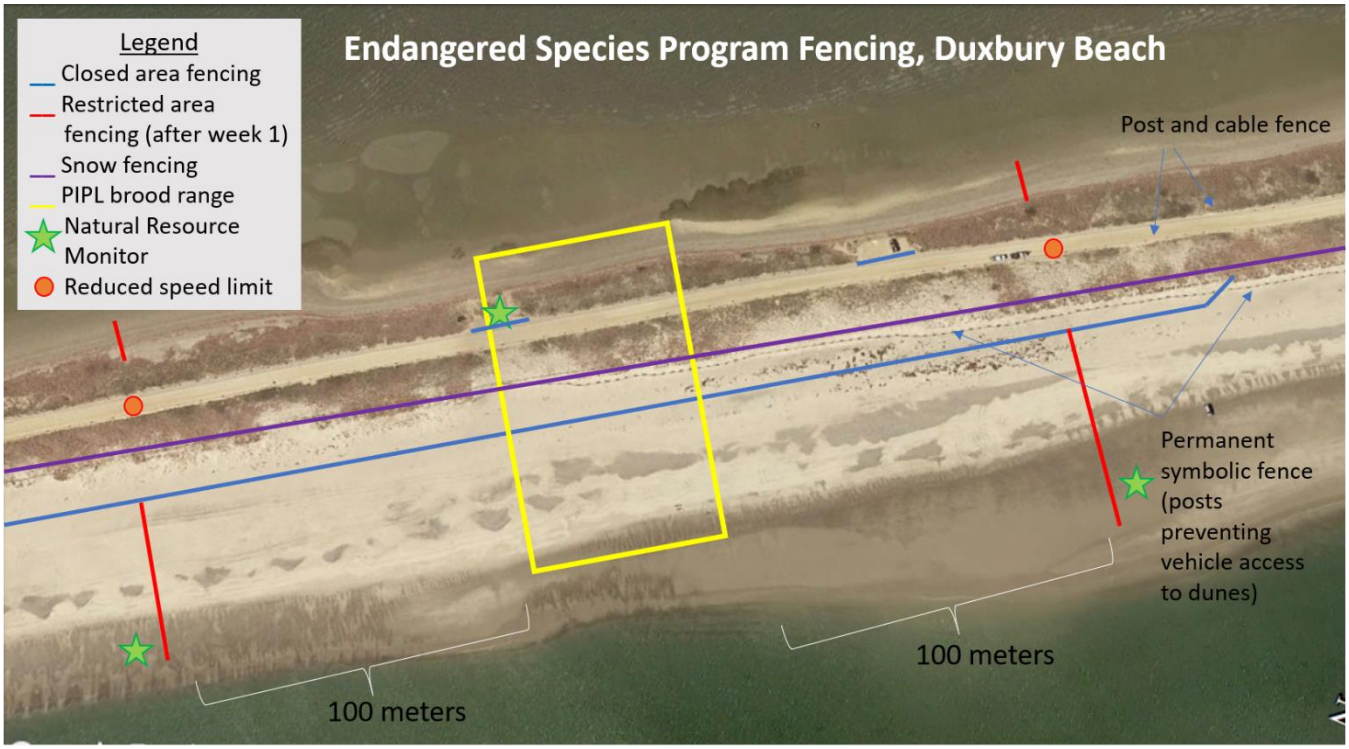
The Monitor Supervisors are responsible for overseeing the monitoring and data collection work of the monitors. In addition to this oversight role, a Monitor Supervisor checks the mock exclosures placed for avian predator management by APHIS WS, and records data on predator sign and uptake and communicates exclosure status and observations to APHIS WS and the Reservation Coordinator.

Endangered Species Officers (ESO, Deputy ESO): A team of Town of Duxbury ESOs and Deputy ESOs are stationed on Duxbury Beach during the entirety of the nesting season. The team of four to seven officers present during the season are responsible for patrolling the beach from 06:00 to 21:00. They have dual responsibilities of protecting nesting plovers and terns on Duxbury Beach and enforcing all rules and regulations that apply to beach goers. In addition, the officers respond to emergency situations on the beach.

The ESOs oversee the Endangered Species Monitoring Program, including the efforts of the Coastal Natural Resource monitors on the site. The ESOs work with the Monitor Supervisors to schedule and direct the monitors watching plover broods. In addition, the ESOs assist in brood location prior to the beach opening to OSVs at 08:00. They also check Closed and Restricted Area fencing and make repairs and adjustments as necessary based on their observations and those of Coastal Natural Resource monitors and recommendations by Mass Audubon biologists. Using historical knowledge and current beach observations, the ESOs take part in the discussions regarding the likelihood of chick crossings in different locations and the extent of Restricted Areas (east to west).

In addition to protected species monitoring, ESOs are responsible for determining the number of vehicles allowed on the beach dependent on the amount of space required for the listed species. The ESOs also monitor the number of vehicles on the beach and close beach access when the limit is reached (the maximum is 500 vehicles). Officers also monitor for pedestrian and vehicle operator compliance with beach rules and regulations related to endangered species. This is particularly important as it pertains to chick crossings. The ESOs are alerted by the brood monitor of a potential crossing, and an officer is on site to stop traffic and act as show of force (uniform and truck).

The Endangered Species Officers and Deputy ESOs also record essential vehicle use within Restricted Areas, vehicle numbers on site and beach rule violations. They are responsible for writing reports regarding protected species suspected takes and completing an end-of-season report, which includes the number of speeding, parking, and dog tickets issued.



Map 3-1. Fencing erected in order to protect nesting adults, clutches, and chicks from disturbance and vehicles. This diagram illustrates one scenario of nesting, fencing, and monitoring activity on Duxbury Beach. Fencing and monitoring efforts are dependent on brood number, location, recreational use, and accessibility to the road (habitat configuration).

4.0 Covered Activities

Duxbury Beach Reservation is requesting to implement the Covered Activity, "Use of Roads and Parking Lots in the Vicinity of Unfledged Piping Plover Chicks" under the Massachusetts Habitat Conservation Plan (HCP). Review of the past three years of Piping Plover activity on Duxbury Beach has determined that 11 Piping Plover broods (estimated 41 percent of the 27 onsite breeding pairs based on 2017 plover census) may be impacted (Table 4-1). The area affected will be the length of Gurnet Road from the north edge of the property (Lagerstedt Lot) to the Gurnet Guardhouse in the south covering 6.4 kilometers (4 miles) of improved gravel roadway. Exposure encompasses the area of the maximum width of crossing area and the width of the road (25 feet) for a total of 11 Piping Plover broods. The maximum width of a single crossing area of a brood observed on Duxbury Beach is 10 meters (30 feet). Based on historic crossing activity, this equates to a total crossing area (exposure area) of 0.19 acres. Since Gurnet Road provides court-protected access for residents and visitors to Gurnet-Saquish, the road can only be closed temporarily to allow the crossing of listed species. The Reservation finances the employment of brood monitors to safeguard chick passage during road crossings. As mentioned previously, not all broods cross the road during the nesting season however each season there are crossing events. Some broods are frequent or daily crossers, whereas others may cross once during the season (Table 4-1). DBR is requesting coverage for up to 11 broods crossing per season, for the three-year life of COI,

recognizing that under the HCP as currently approved by USFWS, coverage would be limited to up to 8 broods in 2018 (29.6% of the 27 onsite breeding pairs based on 2017 plover census).

		Overall crossing data			**# broods north of Crossover 1**			**# broods south of Crossover 1**			
Year	Total Pairs	# of broods that crossed	# of locations crossed	# of broods crossing north of crossover 1	Pavilion to north end of Resident lot	Resident lot to Guard-house	Guard-house to Crossover 1	Crossover 1 to Crossover 2	Crossover 2 to Crossover 3	Crossover 3	Crossover 3 to Plum Hills
2017	28	3	2	0	0	0	1	2	0	0	0
2016	23	11	3	3	0	0	3	5	0	3	0
2015	25	11	3	3	3	0	0	4	0	4	0
2014	26.5	6	4	2	1	0	1	1	0	3	0
2013	17	2	1	0	0	0	0	0	0	2	0

Table 4-1. Piping Plover brood crossing data on Duxbury Beach, 2011-2017.

2012	14	1	1	0	0	0	0	0	0	1	0
2011	12	4	2	0	0	0	0	3	0	1	0

4.1 Use of Roads and Parking Lots in the Vicinity of Unfledged Piping Plover and Least Tern Chicks

Gurnet Road is an improved gravel road that provides the only access to 248 private residences in the Town of Plymouth, of which six residences are occupied throughout the year. In addition, the Town of Duxbury has a mutual aid agreement with the Town of Plymouth to respond to fire, police, and other emergency calls utilizing Gurnet Road for access to assist property owners and their guests. Gurnet Road also provides access to recreational areas. Under the covered activity, the Reservation would provide unrestricted access for essential and non-essential vehicles.

Gurnet Road is graded up to three times a year under OOC SE18-1198 to reduce ruts that may entice Piping Plover chicks to rest or hide. During grading of the roadway surface, care is taken to minimize the gravel berm that builds up along the edge of the roadway. Transition areas in Piping Plover habitat areas, a minimum of 1 meter (3 feet) wide and spaced every 15 meters (16 yards) along the roadway edges are created by flattening the berms. These smoothed-out transition areas facilitate the passage of Piping Plover chicks crossing from east to west and back to access both the bayside and oceanside beach.

4.1.1 Impact Minimization Measures

Impact minimization measures will limit the number of takes by reducing exposure of adults and chicks to vehicles traveling on Gurnet Road. There are four impact minimization measures outlined in the HCP that may be implemented as a condition of the covered activity "Use of Roads and Parking Lots in the Vicinity of Unfledged Piping Plover Chicks." The three measures to be employed on Duxbury Beach include signage, managing traffic, and staff training. In addition, intensive monitoring will be required when chicks are near roads and parking lots, as mandated in the HCP, and described in detail above and in section 4.1.2, below.

The following two shorebird management practices are not practiced at Duxbury Beach: placing barriers and herding birds. Establishing barriers such as silt fencing to deter or prevent chicks from accessing parts of the beach is not utilized as these types of barriers impede the plovers' access to foraging and resting habitats and create a negative impact that would hinder chick movement. Herding, or otherwise corralling shorebirds, impacts a bird's behavior, and the Reservation's monitoring program disallows impacting a bird's behavior. The Reservation believes that plover monitoring is best handled by qualified monitors; therefore, self-escorting vehicles is not part of the Reservation's beach management.

Signage

Signage on Duxbury Beach is extensive and varied depending on purpose and audience (vehicle versus pedestrian). Signage notifying beachgoers of protected areas and certain beach rules (such as dogs and speed limits) are plentiful and enforced by the presence of enforcement and monitoring staff.

Seasonal symbolic fencing consisting of rebar posts and orange twine is erected the last week of March each season to proactively protect potential habitat. As the season progresses, symbolic fencing may be placed around new nesting areas or areas of recreational use as brood refuge and for dune protection. "Closed Area" signs are placed on every other post, and speed limit signs are placed every 15 meters (16 yards). These symbolically fenced areas are referred to as "Closed Areas." Signage is placed 50 meters (55 yards) north and south of active nests to prevent OSV parking within the buffer zone as well as seaward of the nest.

Although Closed Areas provide protection for nests and incubating adults, additional fencing is erected two days prior to a brood's estimated hatch date to provide protected areas for the chicks. Restricted Areas extend 100 meters (109 yards) north and south of the brood range or tern nursery (adjusted as necessary) and include the entire site east to west (oceanside beach to bayside beach), provided that vegetation or topography of the beach makes habitat east to west accessible. If the brood is adjacent to an OSV area, the Restricted Area is located 200 meters (218 yards) on the vehicle adjacent side(s) during the first week after hatching. Restricted Areas on oceanside and bayside are delineated with symbolic fencing running perpendicular to the beach. Signs informing visitors of the restrictions are located on the perpendicular fences with arrows indicating that pedestrians must walk around fencing rather than ducking under. If there are established vehicle paths approaching a Restricted Area, sawhorses with "no vehicle access" signage are placed in front of the perpendicular fencing to provide additional visual deterrents for OSV operators.

In cases where vehicle pull-offs fall within the Restricted Area, these pull-offs are closed to all vehicles (not including enforcement and monitoring staff). Pull-offs are closed with temporary symbolic fencing, "area closed" signage, and orange cones. Sections of roadway within a Restricted Area are delineated with orange cones and reduced speed limit signs (speed drops to 5 mph) placed in the center of the road. These signs designate the Restricted Area on the roadway and thus are the location where vehicles are stopped where there is a crossing.

Pamphlets listing beach rules and regulations are available at the Harbormaster Guardhouse and additional signage in in place at the beach entrance and parking lots regarding vehicle access, speed limits, and dog rules. Beach rules and regulations are available on-line via the Reservation and Town websites.

Managing Traffic

Multiple parties are responsible for identifying the need for alterations to traffic flow on Duxbury Beach. In order to properly determine where vehicles are permitted on the site, a full sweep of the beach is performed each morning from 06:00-08:00 by Mass Audubon biologists and ESOs once broods are present. Both groups are scheduled to be on the beach at 06:00 each day which serves to make it easier and quicker to locate broods before the beach is open to non-essential OSVs. Once the sweep is complete and any necessary adjustments are made to Restricted or Closed Areas, the ESOs then open the appropriate crossovers to over-sand permit holders after 08:00. At the Harbormaster Guardhouse, attendants remind all visitors that there are nesting shorebirds and all speed limits are strictly enforced throughout the reservation (on oceanside beach, as well as, Gurnet Road). Once the beach is closed, traffic to Gurnet-Saquish is limited to residents and authorized visitors.

There is flexibility to the management of vehicles on the oceanside beach based on shorebird activity as there are three vehicle crossovers available if nesting or brood locations make one or more inaccessible. In addition, the presence of enforcement staff means that the number of vehicles on the beach can be adjusted if protected areas expand.

Monitoring efforts by Mass Audubon biologists and Coastal Natural Resource Monitors prior to the beach opening and throughout the day determine the locations of Restricted Areas and thus the location and number of vehicles permitted on the beach. The OSV corridors may be adjusted or closed if vehicle presence is deemed a disturbance to courting or incubating adults. Coastal Natural Resource Monitors are stationed at Restricted Areas on the bayside beach and are able to inform OSV operators of the closed-off areas and provide education about the protected species work.

ESOs are responsible for enforcing traffic regulations on the OSV beach, requesting that vehicles move if protected areas shift, and providing support for monitors. In addition, ESOs are responsible for monitoring vehicle numbers on the beach and closing beach access when the limit is reached (this varies depending on available space, though always a maximum of 500). Prior to monitor departure at 20:00, a final assessment of Restricted Area locations is performed to best ensure that vehicle use areas do not overlap, or come within 100 meters (109 yards), of unfledged chicks and no parking can take place within 50 meters (55 yards) of active nests. All crossing brood locations are captured and reported After 20:00 while chicks are present, a deputy ESO is stationed at Crossover 1 to ensure that nonessential vehicles do not continue south of this point. This action serves to enhance protection of unfledged plover and tern chicks at night.

Traffic along Gurnet Road is preemptively managed with decreased speed limits (5 mph), posted on orange traffic barrels in the center of the road in areas where crossings are possible. Visitors to the site are informed of reduced speed limit areas by the attendants at the Harbormaster Guardhouse. Coastal Natural Resource Monitors stationed with the brood are responsible for identifying movement toward Gurnet Road and informing the Natural Resource Monitor stationed on the road, the ESO on duty, and the Monitor Supervisor on duty that a brood is likely to cross. This occurs as the brood begins moving toward the dune or vegetation. The monitor located on the road and the ESO stop traffic in both directions, including pedestrian traffic, once the brood reaches the snow fence or permanent symbolic fencing which is located at the toe of the dune or crest of the dune. The oceanside monitor maintains visual contact with the brood until the roadside/bayside monitor confirms that responsibility has shifted. Traffic remains stopped for as long as it takes for the brood to cross the road and commit to the movement. Additional details regarding monitoring during road crossings are discussed in section 3.7.

Vehicles use occurs on two additional areas of Duxbury Beach – on vehicle pull-offs along Gurnet Road and the bayside beach. In order to prevent vehicles from parking within Restricted Areas along the road, all pull-offs within restricted areas are blocked with symbolic fencing and “Area Closed” signs as well as orange traffic cones. Endangered Species Officers monitor vehicle use on the Gurnet Road and enforce rules regarding parking, beach permits, and speed limits. Recreational driving is prohibited year-round on the bayside beach. In order to ensure that chicks are not harmed or disturbed from accessing this optimal foraging area, all shellfishermen traffic is stopped on the bayside beach two days prior to the first nest hatching and the area remains closed until all chicks have fledged.

Staff Training

Duxbury Beach benefits from a team of professionals with wide-ranging experiences from three different organizations: Duxbury Beach Reservation, Town of Duxbury Harbormaster Department, and Mass Audubon

Coastal Waterbird Program. The result is a comprehensive monitoring program that provides both formal and informal trainings throughout the season.

Year-round ESOs and Reservation employees serve to provide continuity season to season and therefore are able to train new or seasonal staff on protocols or updates to protocols. The largest aspect of the training program is that provided for the Coastal Natural Resource Monitors. Approximately 50-60 monitors are employed May through August by the Town of Duxbury to assist in the protection of the listed shorebird species nesting on Duxbury Beach, including Piping Plover and Least Tern. Monitors are required to attend a training held jointly by the Duxbury Beach Reservation, Mass Audubon biologists, and the Harbormaster Department at the commencement of the monitoring season. This training includes plover and tern nesting biology, chick monitoring protocols, data collection, beach rules and regulations, public interaction protocols, focal species and predator tracking, and special projects. In addition, the monitors receive ongoing in-field training to ensure classroom instruction is carried out correctly. Throughout the summer, additional classroom training is held as the season progresses as part of a formal training program and informal support while on the beach.

Specifically related to crossings, monitors are trained on adult plover behavioral tendencies including the following: warning/alarm calls, foraging practices, prey habitats, tidal fluctuations, brooding characteristics, weather-induced behavioral traits, chick appearance (aging chart) and behaviors, habitat use, etc. As over 95 percent of chick crossings involve the adult flying into the road and then calling to chicks, becoming familiar with auditory cues is a focus of training. Monitors are trained to recognize signs of disturbance of plovers and terns and proper techniques to limit disturbance to ensure that monitoring efforts do not impact bird activity and protection measures are adequate. In addition, monitors are trained to properly use provided equipment, including binoculars, the WhenIWork App (used for scheduling and monitor communication) and any other equipment needed to complete specific tasks. Lastly, a thorough review of the crossing datasheet during classroom and in-field instruction is held to ensure that observations are crossing observations are collected accurately.

Opportunities for in-field training are plentiful throughout the season, including answering questions from monitors as issues come up. The presence of two Monitor Supervisors working alternate shifts ensures that monitors always have someone on call for support or questions. In addition, ESOs are present each day to provide informal training on beach rules and regulations, and Mass Audubon biologists are available to provide additional information on current nesting activity and bird biology and behavior. The Duxbury Beach Reservation's Reservation Coordinator is on site throughout the season to answer questions and ensure all communications run smoothly.

4.1.2 Monitoring

As mentioned above, monitoring of Piping Plovers and Least Terns on Duxbury Beach is multifaceted with in-field training and reporting responsibility in the hands of multiple groups. Intensive, yet flexible, protocols are in place to help ensure success of nesting shorebirds throughout the site. The extensive monitoring that occurs helps to inform staff of vulnerabilities and potential for additional protection. Regardless of propensity for road crossings, monitoring intensity is retained throughout the period of chick rearing. Efforts do not shift with changes in traffic flow, but remain comprehensive throughout the season.

Although Duxbury Beach is 7.2 kilometers (4.5 miles) in length, several physical obstacles impede shorebird access to the road. Deterrents to road crossing include thick vegetation, sharp scarp incline, and lack of foraging habitat on the bayside of the barrier beach. This has led historically to only a few locations where crossings have

occurred rather than throughout the entire length of the road. As the beach is dynamic and storm alterations can build up or reduce dunes significantly during the winter, crossing areas that were utilized one year may not be a crossing site the following year. With that being said, over the past three years, the broods that consistently crossed the road throughout the season have utilized the area between Crossover 1 and Crossover 2 and north of Crossover 3. Since Piping Plover accessible passage changes, prior to the start of the nesting season, experienced shorebird monitors walk the beach and road to determine all locations where crossing is attainable. All crossing areas are noted, and as Piping Plovers start to nest, possible corridors are mapped.

In order to decrease risk posed to broods north of Crossover 1 between 20:00 and 23:00, information regarding crossings is relayed to staff on duty after 20:00. During the day, Coastal Natural Resource Monitors are stationed on Gurnet Road in areas where brood crossings may occur based on access. The monitors are responsible for monitoring crossings of specific broods during each shift. The monitors working during the second day shift (ending at 20:00) are responsible for filling out a brood location data book for all broods that may cross the road. Data captured includes brood ID, number of chicks and adults, age of chicks, location when last observed (bayside/oceanside and along the length of the site), location of last crossing, and other details (which may include tendency to cross at specific tides, etc.). The monitor (oceanside or roadside) responsible for recording the information for a brood is dependent on whether the brood is located on the ocean or bayside beach at the end of the shift. If the brood is located oceanside then the oceanside monitor is responsible for recording the data at the Guardhouse. If the brood is located bayside, the roadside monitor is responsible. In either case, monitors are encouraged to communicate at the end of the shift to ensure that accurate and complete information is relayed to the ESO or deputy ESO on duty that night.

Brood location information will be recorded in the brood location data book for every brood that has been known to cross the road, however, special consideration will be given to those that cross north of Crossover 1. In general, additional monitoring will not occur by ESOs/deputy ESOs so as not to increase risk with additional driving on the dark roadway. However, in cases where there is special concern (for example, the brood is known to return to oceanside at each high tide), a trained ESO or deputy ESO may patrol the typical crossing location and stop traffic if necessary. The ESO/deputy ESO on duty at the Harbormaster Guardhouse reminds arriving vehicles of the restricted areas and reduced speed limits throughout the site, with particular focus on the broods north of Crossover 1 for those operating non-essential vehicles. In addition, speed limit cones are located on either side of the Restricted Area to remind drivers of brood presence.

The Reservation believes Duxbury Beach has one of the most thorough monitoring programs for plover chicks in the state as monitoring for each brood is from 06:15 to 20:00. An essential component of the Duxbury Beach monitoring procedure is the “brood monitor approach,” in which a monitor is responsible for continuously monitoring a brood. Regardless of where the brood is located at the beginning of the day (oceanside or bayside), a monitor is stationed to observe that brood (the monitor may change depending on location and time of day). In the event of rain or storm conditions, monitoring may be reduced because the broods seek shelter and searching for them could cause chick mortality. In bad weather, enough monitors are kept on for coverage of known plover road crossing areas and areas adjacent to any non-restricted over-sand areas if the crossovers remain open. The level of monitoring proposed, far exceeds the level of monitoring described in the HCP for the road and parking lot covered activity (HCP, pages 3-5 and 3-6).

In areas where crossings are possible, monitors are responsible for identifying movement toward Gurnet Road and informing the Natural Resource Monitor stationed on the road, the ESO on duty, and the Monitor

Supervisor on duty. This communication occurs as soon as the brood or adults begin moving away from the water line and toward the dune/vegetation so that the monitor and enforcement staff can be in place well before the chicks approach the road. The monitor located on the road and the ESO stop traffic in both directions, including pedestrian traffic, once the brood reaches the snow fence or permanent symbolic fencing that is located at the toe of the dune or crest of the dune. Traffic remains stopped for as long as it takes for the brood to cross the road and commit to the movement. Once off the road, the ESO maintains the closure while the monitors observe the brood to determine whether they are likely to stay on the present side or return to the original location. Typically, it is determined that the brood is going to stay at the current location once the chicks have reached the high tide line. Bird crossings take as little as two minutes or longer than 45 minutes; the timing depends on how long it takes the brood to cross the road. There are many instances in which the brood will linger in the road and then change direction and return to the original site.

In addition, monitors are trained to recognize Least Tern nesting activity and to capture information on chick number and locations within colonies. As the tern colony areas oftentimes contain plover nesting territories, the monitors do spend time stationed at Restricted Areas set up for tern nurseries. Monitors are trained to inform Mass Audubon and ESOs of changes to tern nursery boundaries so that protection measures can be adjusted accordingly. In such cases as monitors are not consistently stationed at a Restricted Area protecting a tern nursery due to a lack of plover chicks, the area is monitored three times per day. One of these monitoring sessions will occur between 06:00 and 08:00, prior to the beach opening. The goal of this monitoring is to determine if nursery areas have shifted or expanded and Restricted Areas need to be adjusted or if tern chicks are moving towards the back road and require a Coastal Natural Resource Monitor be assigned to the area.

The Reservation strives to ensure monitoring protocols are constantly evaluated to confirm the program maintains a comprehensive shorebird monitoring and observation program.

Compliance and Effectiveness Monitoring

Compliance monitoring will document that impact minimization and mitigation measures associated with the covered activity are implemented. The Reservation will ensure that the annual Piping Plover and Tern Census forms will continue to be submitted along with associated maps indicating where nesting occurred. The monitors will keep a log of all crossing events capturing time, direction of movement for adults and the brood, estimated chick age, GPS points, amount of time the crossing took, and start and end time of road closure. Monitors capture brood location (including proximity to road) in the course of regular monitoring, which occurs every 20 minutes to better inform data regarding possible crossing attempts. A Crossing Summary Report will be submitted to the Massachusetts Division of Fisheries and Wildlife (MADFW) by October 15 outlining crossing activity and associated brood success. If applicable, any documented “take” of chicks resulting from the covered activity will also be reported. Any incidents or accidents associated with the covered activity, including take of a chick(s) shall be reported to MADFW and the United States Fish and Wildlife Service (USFWS) staff as standard Reservation practice.

5.0 Budget

The implementation of the Impact Avoidance and Minimization Plan (IAMP) will be covered through the extensive monitoring program currently in place with the additional benefit of the participation of the Reservation's Executive Director and Reservation Coordinator. Table 5.1 reflects the budget over the past four years with a partial list of additional expenses. The program is funded, in part, through the lease agreement with the Town of Duxbury. For the 2018 nesting season, the funding was authorized in part by the 2017 Spring Town Meeting, and the FY19 budget will be authorized by the 2018 Spring Town Meeting held on March 10, 2018.

Table 5-1. Duxbury Beach Endangered Species Program budget, 2014-2017.

	2014	**2015**	**2016**	**2017**
Full Time Salaries (no. positions)				
DBR Executive Director (15%)	0	0	0	**$13,500 (FY18)^**
DBR Reservation Coordinator (45%)	0	0	0	**$18,000 (FY18)^**
Endangered Species Officers (2) & Seasonal Coastal Natural Resource Officers (5)	$130,764.13	$132,839.44	$128,674.14	$99,523.47
Seasonal Salaries				
Monitor Supervisor & Coastal Natural Resource Monitors (57 in 2017, 53 in 2016, 32 in 2015)	$34,828.08	$40,532.65	$87,952.50	$139,720.14
Mass Audubon monitoring	$16,010.00	$15,600.00	$26,414.87	$21,473.00
Additional Expenses: education, predator management, signage, artificial habitat creation, equipment	$21,075.99	$29,193.22	$39,852.74	$64,535.65
Total Endangered Species Program Expenses	**$202,678.20**	**$218,165.31**	**$282,894.25***	**$325,252.26**

^ Salaries were not included in 2017 budget but will be in 2018

*Significant increase from prior year due to increase in Piping Plover pairs

6.0 Mitigation Plan

In summary, the Reservation will self-fund a $18,500 selective predator management plan in 2018. This plan is expected to benefit approximately 27 pairs of Piping Plover based on 27 breeding pairs in 2017. Additional information about the proposed 2018 mitigation is provided in the attached APHIS WS Proposal for FY18; the work plan has already been approved by MADFW and USFWS as required pursuant to the HCP. As set forth in the HCP, the Reservation will provide a selective predator management work plan to MADFW on an annual basis in order to ensure that at least 3 Piping Plover pairs benefit from selective predator management for each brood exposed to the use of roads and parking lots. After the work plan and budget are approved by MADFW, selective predator management will be implemented in advance of carrying out the covered activities during the beach season. Although no take exposure of Least Terns is proposed, an estimated 147 pairs of Least Terns will benefit as well, based on a total of 196 nesting tern pairs in 2017. In the event that DBR runs a mitigation deficit in a given year (e.g. due to between year decline in Piping Plover breeding population), DBR will make up any deficits by providing additional selective predator management and/or other supplemental mitigation approved by MADFW during the life of the three-year COI.

To mitigate for the potential impacts of the covered activity on Piping Plovers, the Reservation has contracted with the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service Wildlife Services (APHIS WS) to conduct on-site selective predator management of both avian and mammalian predators in concert with a robust comprehensive non-lethal predator management plan.

The cost for an APHIS WS Cooperative Service Agreement (CSA) that provides six months of control, consisting of a minimum of twenty (20) control visits will be $18,500.00. These visits may be used for any of the activities: trapping, shooting, or DRC-1339 COR applications. Wildlife Services will schedule control visits and may increase or decrease visits during the agreement depending on predator presence and activity.

The Reservation will provide a selective predator management work plan to MADFW on an annual basis in order to ensure that at least three breeding pairs benefit from selective predator management for each brood exposed to the use of roads and parking lots activity (3:1 mitigation ratio for both Piping Plover and Least Terns as described in the HCP for Use of Roads and Parking Lots in the Vicinity of Unfledged Piping Plover Chicks).

A variety of non-lethal predator management measures also may be instituted to control the predator impact on nesting shorebirds including predator tracking, thorough refuse management, predator exclosures, electric fencing, elimination of perching availability, replicated habitats, and wooden chick shelters.

- The Reservation's Endangered Species Monitoring Program serves as a non-lethal deterrent to predators as there is heavy human presence near broods and nests, which are monitored by multiple parties. During the plover nesting season, between the hours of 06:30 and 20:00, the program requires the presence of an Endangered Species Officer, a Monitor Supervisor, a Mass Audubon biologist, and numerous Coastal Natural Resource monitors resulting in 25-30 people at any one time on the beach. There is at least one monitor per brood of unfledged chicks. As some predators are more active in the early morning when beaches are typically less populated by people, the presence of monitors and ESOs in nesting areas beginning at 06:00 may deter some predators.

- All monitors and ESOs attend a tracking class provided by the Reservation and USDA WS at the commencement of the monitoring season. This training educates monitors in the identification of common avian and mammalian predator species of Massachusetts shorebirds and the tracks of common species (domestic and wild) observed on area beaches. Special focus is given to differentiating dog,

coyote, and fox tracks, due to their similarities and prevalence on Duxbury Beach. An intensive in-field training compliments the classroom training to ensure field monitors can conduct routine predator surveys to evaluate the impact enhanced predator management has on the reproductive success of the Piping Plovers and Least Terns on Duxbury Beach.

- A thorough refuse management plan is in place to ensure that predators are not attracted to Duxbury Beach (see Section 4.3 for details).

- Predator exclosures have been tied to both nest abandonment and adult mortality, and so prior to erecting a predator exclosure, consideration must be given for predator community, plover pair behavior (tendency to abandon nests), and site characteristics. Much of Duxbury Beach is unsuitable for exclosures due to the narrow width, slope, rocky substrate, and dense vegetation of the beach. Clutches located in replicated habitat areas may be candidates for exclosures as these areas are primarily open, flat, sandy, and at less risk of overwash being on the bayside of the site. The Reservation and partners will determine where exclosures may be a viable option as territories are established and eggs are laid.

- Electric fencing is typically utilized to protect multiple shorebird nests (Piping Plover, Least Tern and/or American Oystercatcher) from mammalian predators. Electric fencing has not previously been employed on Duxbury Beach as narrow beaches at high tide are not ideal candidates due to the limited space and potential for overwash. Small areas of electric fencing may be possible in some areas, such as the replicated habitats; however, these areas are typically small and used by only one pair. Three-sided electric fencing, connected only by a ground wire on the water side, may be considered around tern colonies to deter coyotes. Electric fencing will be considered for use on a case-by-case basis, depending on location and predator community.

- Prior to nesting season, a thorough review of perching post availability will be undertaken and all unnecessary posts will be removed. Thin posts are less likely to be used by potential avian predators as perches. Posts erected to mark the replicated habitat areas on the west side of the site are thin, rebar posts, thought to be poor perches. The Reservation will review and consider placing anti-perching materials (e.g., nails) on top of posts, depending on location and proximity to nesting.

- Five individual replicated habitats were constructed in 2017. The constructed habitat areas have minimal vegetation and provide nesting sites that allow adult plovers to see predators approaching the area. The five replicated habitats will be maintained in 2018 with a thorough replicated habitat monitoring to identify nesting site preferences through observation.

- Wooden chick shelters are thought to protect tern, and less commonly plover, chicks from exposure and potential predators. Shelters can be used in areas where vegetation is limited and chicks have few options for cover. To date, they have not been used on Duxbury Beach.

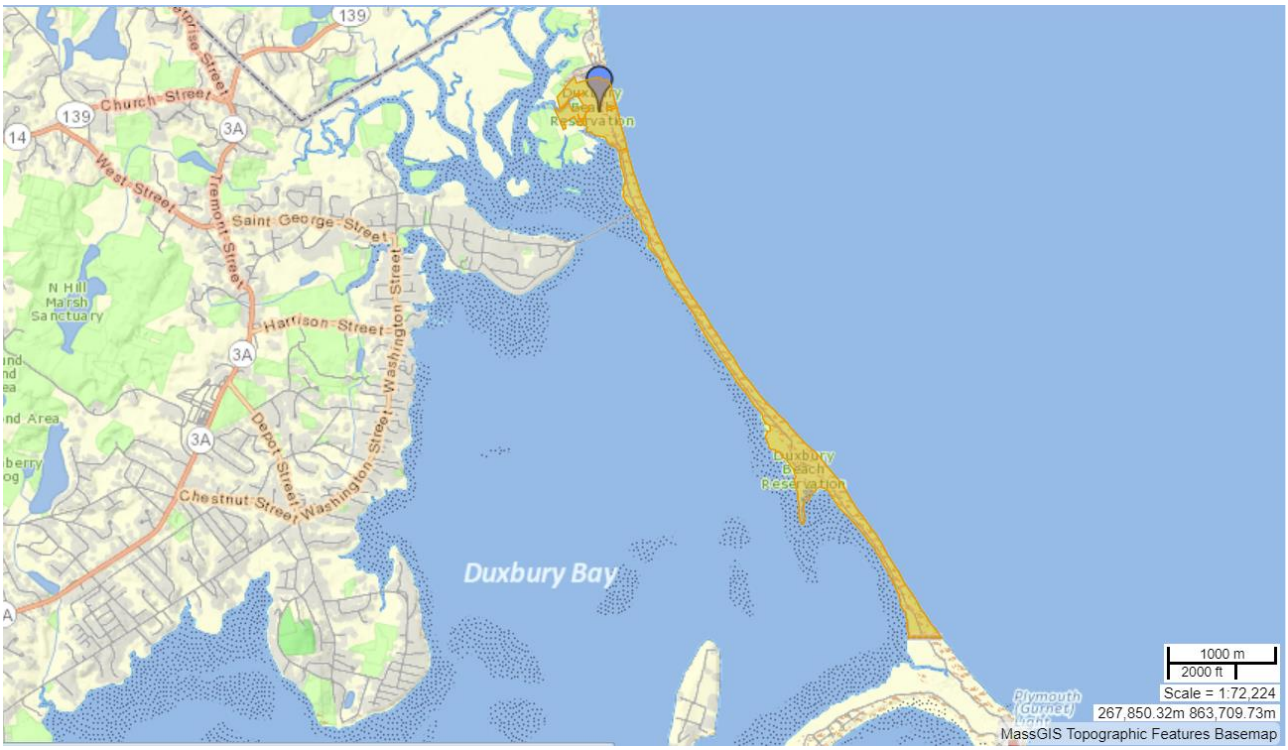
In addition to the predation management program, the Reservation sponsors robust educational programs throughout the season. During the 2017 season, the Summer Education Programs at Duxbury Beach hosted 25 classes offering 17 distinct topics. These hour-and-a-half-long classes were offered on Tuesdays, Thursdays, and Saturdays throughout the months of July and August. Three classes are specifically directed or related to Piping Plovers: “Piping Plovers,” “Shorebird Feeding Adaptations,” and “Shorebird Migration.” The Reservation’s partners at Mass Audubon’s South Shore Sanctuaries presented these programs. The cost of running the three Plover-centric courses is $736.

6.1 Mitigation Monitoring Plan

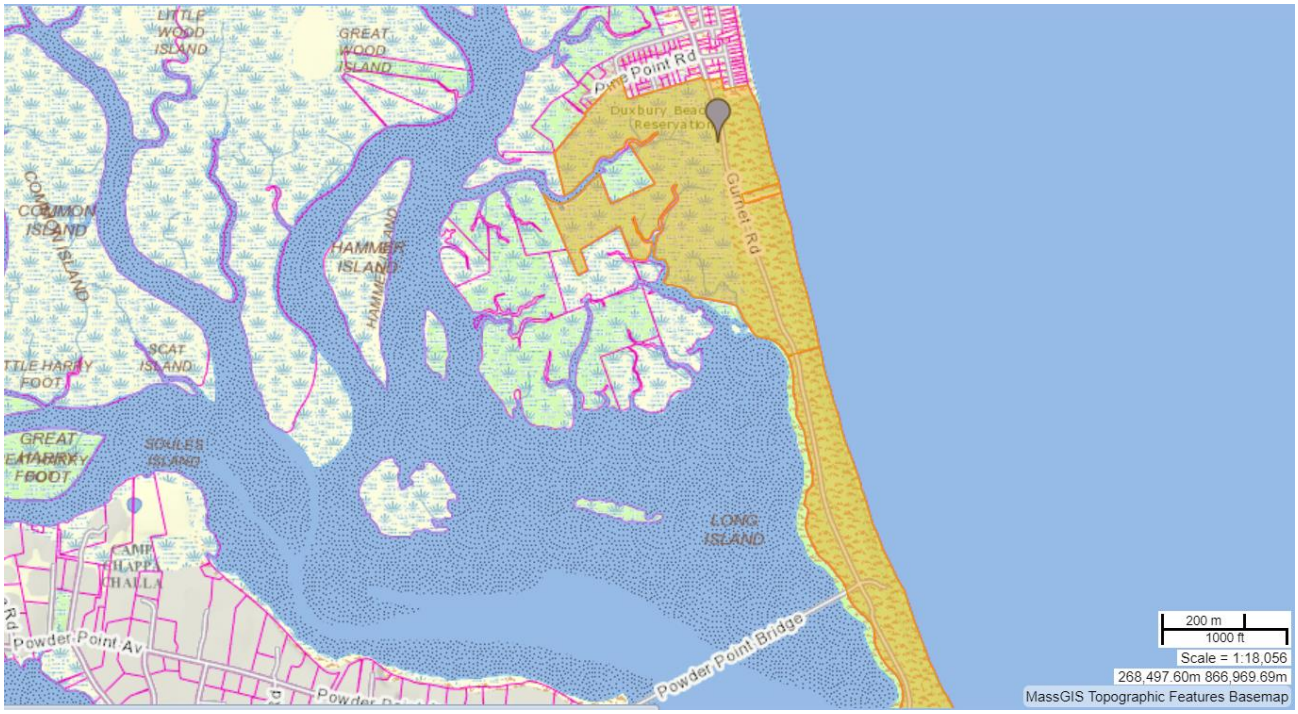
To assess effectiveness of the mitigation plan, the Reservation will monitor and report the following to MADFW annually:

- The actual number of Piping Plover broods exposed to covered activities
- The actual number of Least Tern chicks exposed to covered activities
- Actual number of breeding pairs of Piping Plovers that benefited from selective predator management
- Actual number of breeding pairs of Least Terns that benefited from selective predator management
- Piping Plover productivity from the site
- Least Tern productivity from the site
- Causes of nest and chick loss
- Any mitigation credits or deficits that will be carried over into the following season

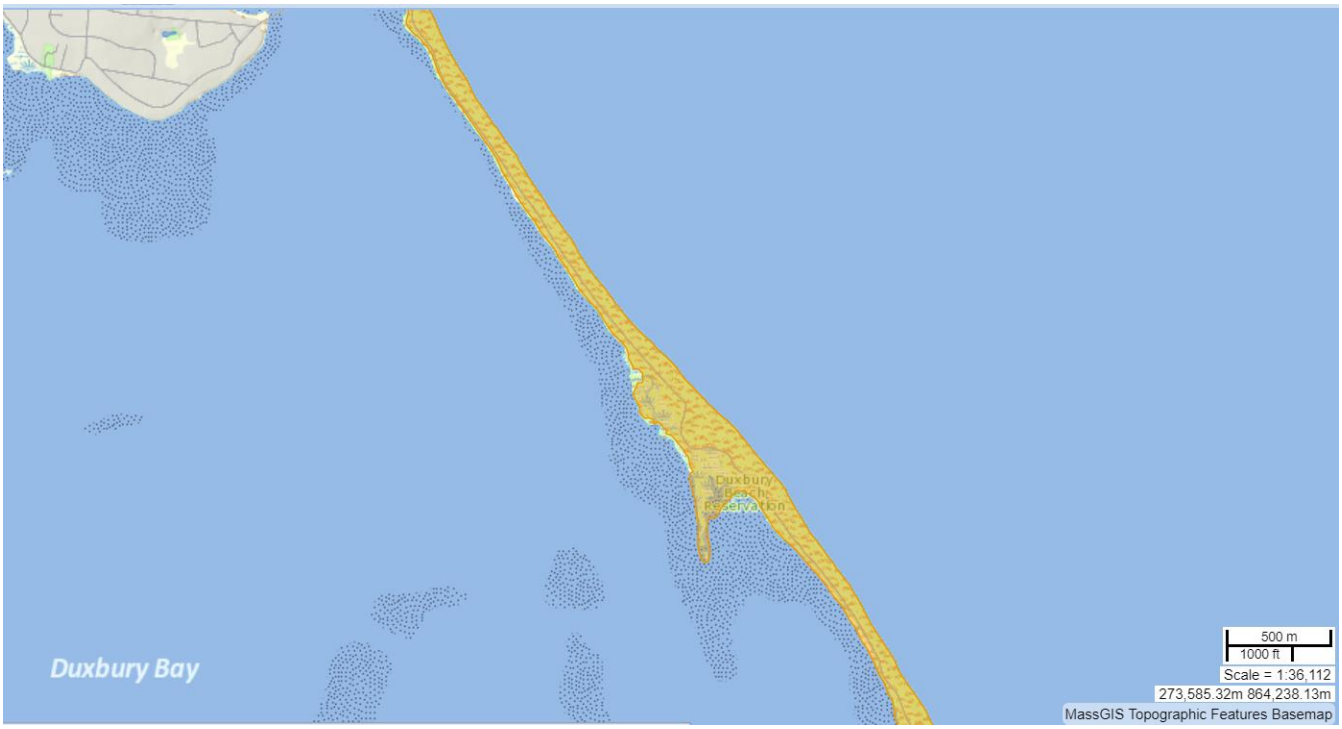
Appendix 1. Duxbury Beach Maps


139
Church Street
14
139
3A
West Street
Tremont Street
Saint George Street
N Hill
Marsh
Sanctuary
Harrison Street
3A
Washington Street
3A
Depot Street
Chestnut Street
Washington Street
Duxbury Bay
Duxbury
Beach
Reservation
1000 m
2000 ft
Scale = 1:72,224
267,850.32m 863,709.73m
MassGIS Topographic Features Basemap

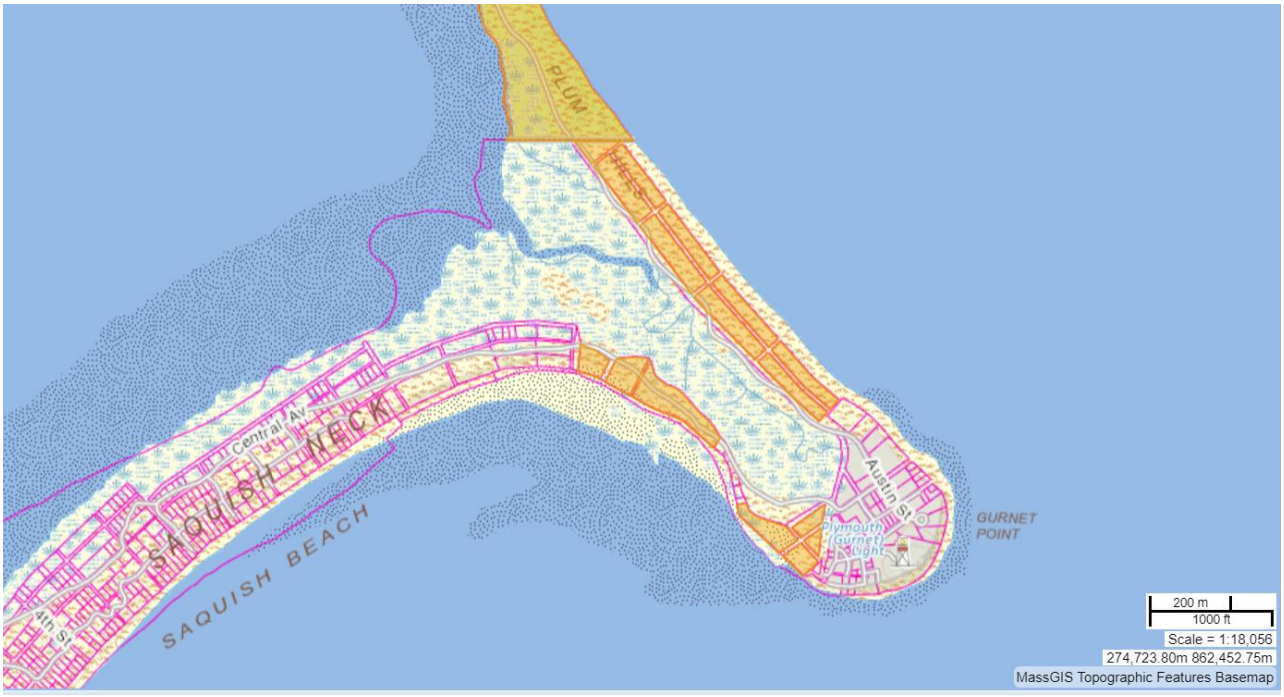
Map 1. Duxbury Beach Reservation property located in the Town of Duxbury. Including parcels: 145_400_000 and 141_421_900



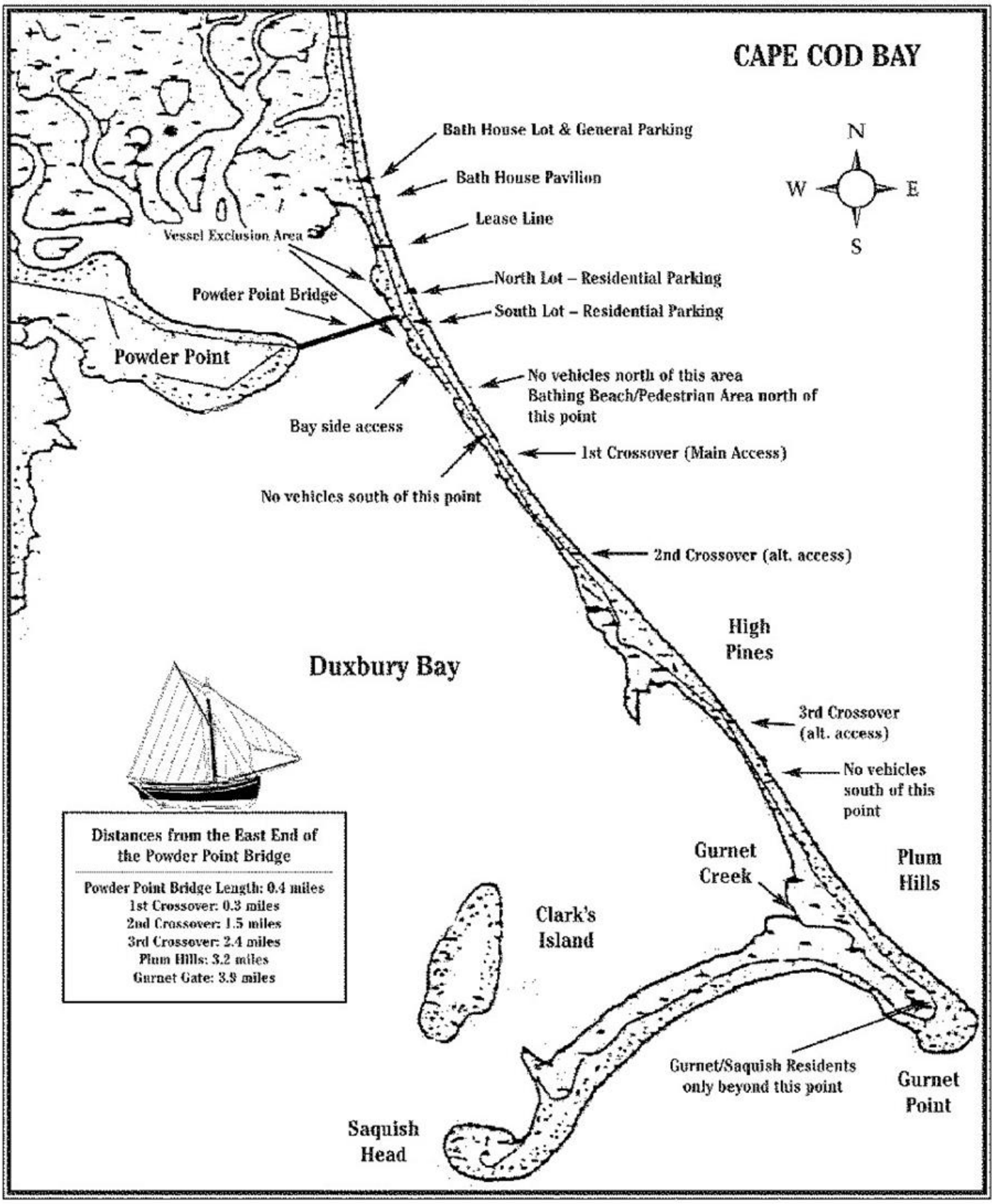
Map 2. Duxbury Beach Reservation Property, including Lagerstedt Lot, McLaughlin Cottage, Duxbury Beach Park, and Town of Duxbury Resident Lots/Pedestrian Beach.



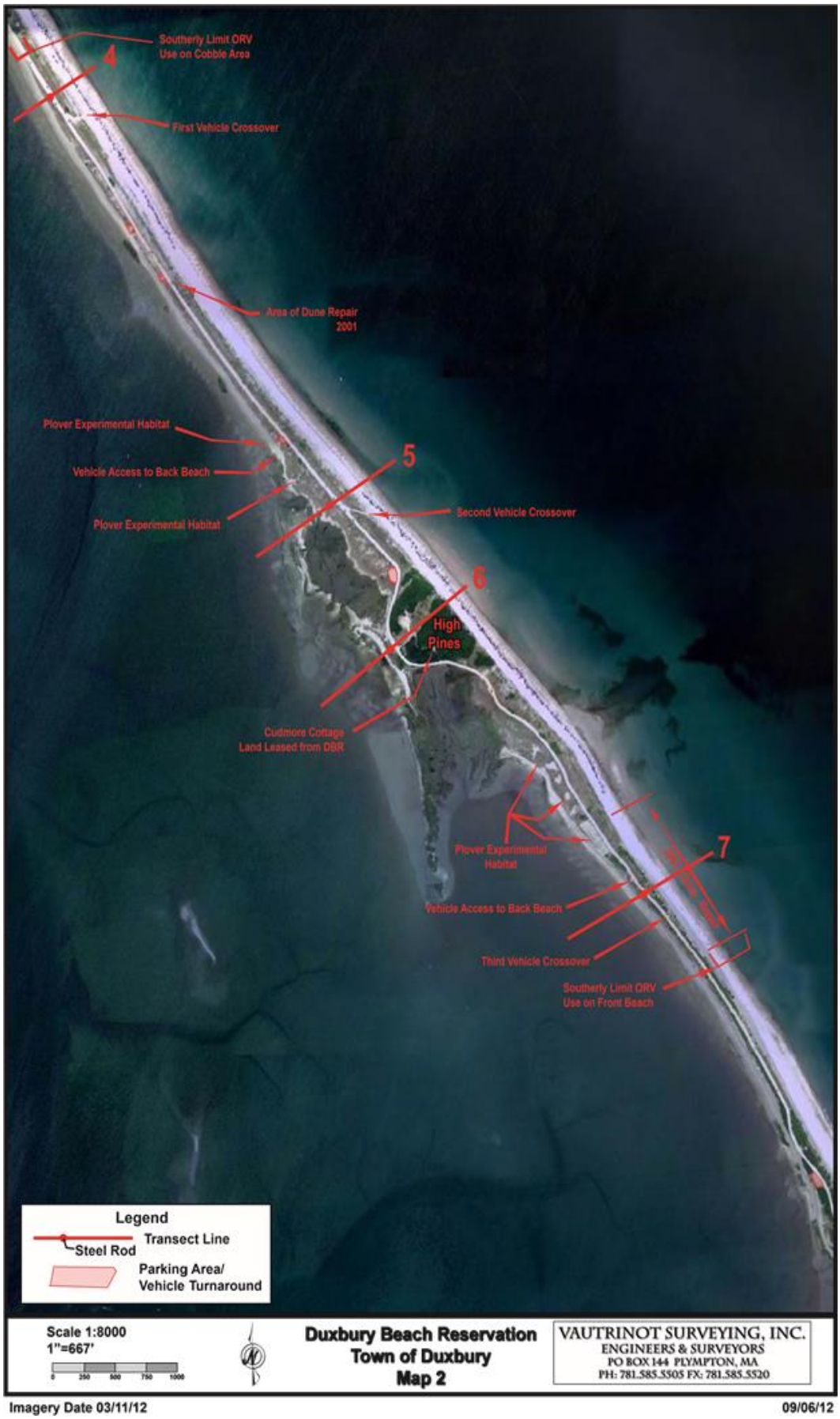
Map 3. Duxbury Beach Reservation property, including OSV beach (Crossover 1 to Crossover 3) and up to Town of Plymouth Line.



Map 4. Duxbury Beach Reservation property located in the Town of Plymouth. Property ID: 132-000G-096-000.


CAPE COD BAY
N
W
E
S
Bath House Lot & General Parking
Bath House Pavilion
Lease Line
Vessel Exclusion Area
North Lot – Residential Parking
South Lot – Residential Parking
Powder Point Bridge
Powder Point
No vehicles north of this area
Bathing Beach/Pedestrian Area north of this point
Bay side access
1st Crossover (Main Access)
No vehicles south of this point
2nd Crossover (alt. access)
High Pines
Duxbury Bay
3rd Crossover (alt. access)
No vehicles south of this point
Gurnet Creek
Plum Hills
Clark's Island
Distances from the East End of the Powder Point Bridge
Powder Point Bridge Length: 0.4 miles
1st Crossover: 0.3 miles
2nd Crossover: 1.5 miles
3rd Crossover: 2.4 miles
Plum Hills: 3.2 miles
Gurnet Gate: 3.9 miles
Gurnet/Saquish Residents only beyond this point
Gurnet Point
Saquish Head


Southerly End of Concrete Seawall
Pedestrian Crossover
McLaughlin Cottage
Land Leased from DBR
Pedestrian Crossover
1
Pedestrian Crossover
Historic Saltmarsh Exposed at Low Tide
Pedestrian Crossover
Handicapped Access Ramp
Emergency Vehicle Access
Blakeman's Pavillion
Pedestrian Crossover
Handicapped Access Ramp
2
Emergency Vehicle Access
Sandfilled By-Pass
South Parking Area (Paved)
POWDER POINT BRIDGE
3
Pedestrian Crossover
Northerly Limit on ORV Use on Front Beach
Powder Point
Northerly Limit on ORV Use on Cobble Area
DUXBURY BAY
Vehicle Access to Cobble Area
Pedestrian Crossover
Legend
Transect Line
Steel Rod
Parking Area/ Vehicle Turnaround
Scale 1:8000
1"=667'
0 250 500 750 1000
Duxbury Beach Reservation
Town of Duxbury
Map 1
VAUTRINOT SURVEYING, INC.
ENGINEERS & SURVEYORS
PO BOX 144 PLYMPTON, MA
PH: 781.585.5505 FX: 781.585.5520
Imagery Date 03/11/12
09/06/12


Southerly Limit ORV
Use on Cobble Area
4
First Vehicle Crossover
Area of Dune Repair
2001
Plover Experimental Habitat
Vehicle Access to Back Beach
Plover Experimental Habitat
5
Second Vehicle Crossover
6
High
Pines
Cudmore Cottage
Land Leased from DBR
Plover Experimental
Habitat
7
Vehicle Access to Back Beach
Third Vehicle Crossover
Southerly Limit ORV
Use on Front Beach
Legend
Transect Line
Steel Rod
Parking Area/
Vehicle Turnaround
Scale 1:8000
1"=667'
0 250 500 750 1000
Duxbury Beach Reservation
Town of Duxbury
Map 2
VAUTRINOT SURVEYING, INC.
ENGINEERS & SURVEYORS
PO BOX 144 PLYMPTON, MA
PH: 781.585.5505 FX: 781.585.5520
Imagery Date 03/11/12
09/06/12


Duxbury
Plymouth
Town Line
Plum
8
Hills
Parking Access for Lighthouse
Gurnet Gate
Guard House
The Gurnet
Fort Andrew
1776
Gurnet Lighthouse
Legend
Steel Rod
Transect Line
Parking Area/
Vehicle Turnaround
Scale 1:8000
1"=667'
0 250 500 750 1000
Duxbury Beach Reservation
Town of Duxbury
Map 3
VAUTRINOT SURVEYING, INC.
ENGINEERS & SURVEYORS
PO BOX 144 PLYMPTON, MA
PH: 781.585.5505 FX: 781.585.5520
Imagery Date 03/11/12
09/06/12