Nantucket National Wildlife Refuge

Alternative Transportation Study

October 2014

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John A. Volpe National Transportation Systems Center

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This study for the Fish and Wildlife Service (FWS) identifies and analyzes options for enhancing alternative transportation access to the Nantucket National Wildlife Refuge (Nantucket NWR) at Great Point in Nantucket, Massachusetts. The study team developed and evaluated multiple scenarios for enhancing alternative transportation access to Nantucket NWR. The team developed an initial set of land- and water-based scenarios, and then refined them with further research on visitor demand, site conditions, financial projections, and implementation requirements. After arriving at a core set of access options, the study presents specific considerations and recommendations for FWS and its partners as they move to implement enhanced service. The project team recommended that rather than implement a drastically new service model, FWS implement flexible enhancements to the current tours.

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(All photos by Volpe Center or US Fish and Wildlife Service unless otherwise noted)

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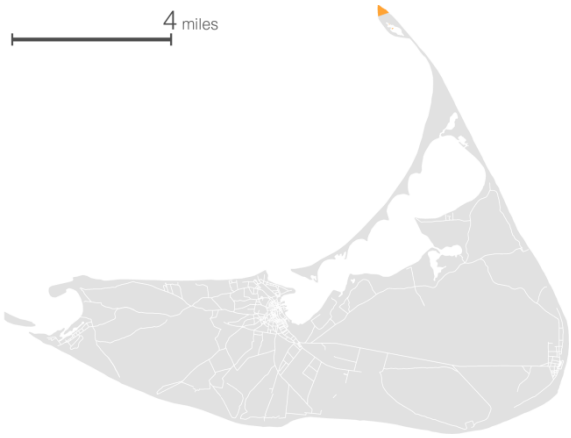
Executive Summary

This study by the Fish and Wildlife Service (FWS) and the U.S. Department of Transportation Volpe Center (Volpe) analyzes options for enhancing alternative transportation access to the Nantucket National Wildlife Refuge (Nantucket NWR) at Great Point in Nantucket, Massachusetts. While located on an island that is a renowned destination for vacationers, there are several challenges for refuge access:

- The rough beach terrain around the refuge can only be traversed using an over-sand vehicle (OSV).
- Seasonal shorebird nesting, often during June and July, requires closing the access route to the refuge to all vehicles.
- Renting and operating an OSV is expensive on Nantucket, especially for island visitors, who incur an extra expense to bring vehicles from the mainland.

Figure 1: Nantucket NWR (orange) on the island of Nantucket's road system



After evaluating multiple scenarios, the project team recommends that rather than implement a drastically new service model, FWS implement flexible enhancements to existing tour services to help overcome these challenges.

Methodology

The study team developed and evaluated multiple scenarios for enhancing alternative transportation access to Nantucket NWR. After developing an initial set of land- and water-based scenarios, it refined them with further research on visitor demand, site conditions, financial projections, and implementation requirements. After arriving at a core set of access options, the study presents specific considerations and recommendations for FWS and its partners as they move to implement enhanced service.

Figure 2: Panoramic view of Nantucket NWR. Source: FWS

Chapter Summaries

Existing Conditions

Nantucket is an island off of Massachusetts that is accessible via plane and ferry. Due to these constraints, it is expensive to bring a vehicle to Nantucket and operate it on the island. Nantucket has high rates of walking, bicycling, and transit use. The refuge is located 13 miles from Nantucket's downtown core, 5 miles of which are served only by over-sand routes. To travel to the refuge visitors must either obtain a seasonal ($140) or daily ($65) permit from The Trustees of Reservations (TTOR), the non-profit conservation organization that owns much of the land en route to the Nantucket NWR. TTOR also offers guided tours from downtown Nantucket to the refuge for $60 during the peak summer season. However, there is no access via either private vehicle or tours during the two-month shorebird nesting period, when shorebird nesting on the narrow access route through "the Galls" requires TTOR and FWS to limit access to pedestrians only. The long distances and soft sand around the refuge make pedestrian access challenging for most visitors. Bicycling on the over-sand route is not permitted.

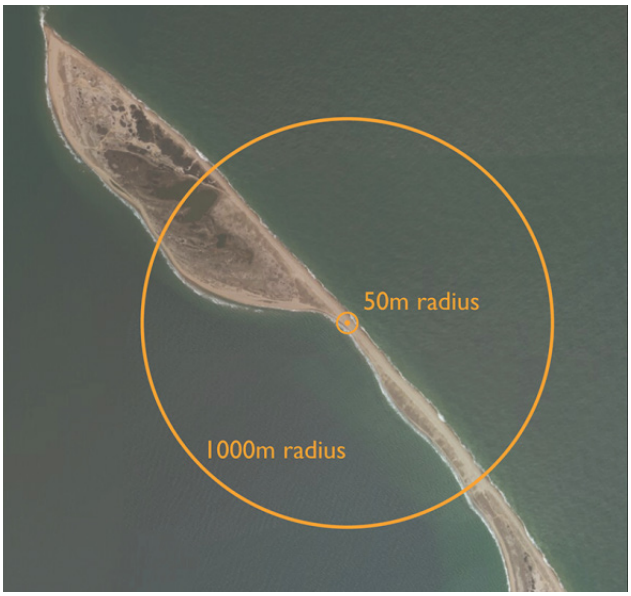
Demand Analysis

Members of the public visit the refuge to see its iconic lighthouse, enjoy its isolated beach location, and engage in wildlife dependent recreation activities such as fishing, observation, and photography. Despite its unique character, most of the many seasonal visitors to Nantucket do not visit the refuge and may instead visit other scenic beaches on the island that are easier to access via walking, cycling and transit. For example, a round-trip fare to Siasconset Beach is $4 with return trips every 40 minutes, compared to $60 for the current TTOR tour that runs twice daily.

Alternative Transportation System Scenarios

Potential access options for the refuge include both land-based and water-based transportation. In addition, a shuttle seasonally stationed on the opposite side of the Galls closure area could possibly allow visitors to leave their vehicles at the closure point, walk along the sensitive area, and ride the shuttle the remaining small distance to the refuge. The shuttle service would have to be very carefully implemented to protect wildlife and meet legislative requirements. For water-based transportation, an analysis of the wave patterns around Great Point shows that for roughly half of peak season boat trips would not be able to safely disembark at the refuge due to turbulent waters. The study team did not conduct further analysis of water-based options but advanced land-based scenarios, including those with a Galls shuttle, for further analysis.

Figure 3: Required vehicle (1000m) and pedestrian (50m) restriction areas around a typical shorebird nesting location



Vehicle Options

Either typical passenger vans or open-air trams could be used to bring visitors to the refuge. Vans are less expensive and easier to maintain, but trams would offer riders better views of the surrounding scenery. Vehicles must be modified for four-wheel drive capabilities, and must be fully accessible to passengers with disabilities. The need for OSVs increases the cost of both types of vehicles, to approximately $56,000 for a van and $119,000 for an open-air tram.

Scenario Financial Analysis

The operating cost of alternative transportation service also varies based on the scenario chosen and other implementation decisions. In particular, service could operate on a guided model, where each visitor returns on the same vehicle they used to arrive, or more of a transit-style service allowing visitors more flexibility in their arrival and departure times. Annual operating costs range from around $29,000 for a simple service that picks up at the end of paved roads to $67,000 for a version that includes the shuttle past the Galls during nesting closures. Combined with results from the demand analysis, these figures suggest that enhanced alternative transportation service to the refuge is financially feasible.

Implementation Considerations

There are many other considerations associated with operating, maintaining, and publicizing enhanced transportation service. For example, discussions with stakeholders revealed that there is a need for outreach about the refuge itself as well as any transportation service. Visitors to the island are presented with many recreation options and may not know about the refuge, and many year-round Nantucket residents did not know that they are permitted to hike to the refuge even during wildlife nesting closures.

Funding and Operating Arrangements

FWS and its partners could use a number of funding programs to help implement enhanced service. Sources such as the Federal Lands Transportation Program, the Federal Lands Access Program, and the Transportation Alternatives Program could fund vehicle purchases or even, in some cases, a pilot for improved service operations. Funding programs may influence how FWS and its partners choose to structure ownership and operational responsibility for the service. While the agency could operate the service directly or develop a concession agreement, the most flexible option is likely a defined partnership agreement that enables FWS to collaborate with a non-profit organization to operate and iteratively improve tours or transit to the refuge.

Recommendations

As a general approach, the study team recommends that FWS work with its partners to incrementally improve existing land-based alternative transportation service to the refuge. With additional coordination and funding through the programs above, the following actions in particular could improve visitor access:

- **Pursue federal funding programs** to obtain additional vehicles that would allow more frequent service.
- **Pilot a hybrid tour/transit model** in which tour visitors may choose—perhaps paying extra—to spend additional, unstructured time on the refuge by returning on a later trip.
- **Coordinate service schedules** with ferry boat arrivals and flight schedules to ensure even short-term visitors have the opportunity to visit the Nantucket NWR.

- **Develop interpretive and marketing materials** that inform visitors about options for getting to the refuge from downtown Nantucket, including the alternative transportation service.
- **Hold special event boat tours** that would give visitors and residents a chance to experience the refuge and engage in interpretation from the water a few times per season.

Formal and informal agreements with partners on Nantucket will be key in allowing FWS to implement these and other recommendations in this study. Great Point and the Nantucket NWR are valuable natural heritage assets for Nantucket and the country. Enhancing alternative transportation access to the refuge will give more members of the public the opportunity to experience this place while preserving its unique and remote character.

Introduction

Nantucket National Wildlife Refuge
Alternative Transportation Access Study

The Nantucket National Wildlife Refuge (Nantucket NWR) is located on the "Great Point" sand spit at the tip of the Coskata-Coatue Peninsula on the island of Nantucket, Massachusetts (See Figure 1). This narrow peninsula in the northeast corner of the island branches in two, enclosing Nantucket Harbor to the west and terminating at Great Point and the Nantucket NWR to the north.

The currents of the Atlantic Ocean and Nantucket Sound meet at Great Point, providing important coastal habitat for migrating birds, as well as a long tradition of wildlife-dependent recreation at the northeastern-most point on Nantucket Island. The northernmost tip, with approximately 21 acres of land, is owned by the U.S. Fish and Wildlife Service (FWS). En route to the refuge a visitor travels through the 450-acre Coatue Wildlife Refuge managed by the Nantucket Conservation Foundation (NCF), and the 960-acre Coskata-Coatue Wildlife Refuge managed by The Trustees of Reservations (TTOR). The entire peninsula is a wildlife conservation area, owned by the three partners.

Access to the refuge is limited; it is only possible to access by water or through five miles of over-sand travel on the Coskata-Coatue Peninsula. Shore bird nesting during the summer also requires seasonal vehicle restrictions on a portion of the peninsula that leads to the refuge. As part of improving access to the refuge, the 2013 Nantucket National Wildlife Refuge Comprehensive Conservation Plan (CCP) calls for an alternative transportation study "to determine feasible access alternatives to the refuge with the goal of reducing the number of individually operated over-sand vehicles (OSVs) travelling to the refuge."

The purpose of this study is to identify options for improving access to the NNWR, looking at both water-based and land-based transportation. The study will examine existing conditions for transportation access, evaluate alternative transportation options, assess partnership opportunities, and present recommended actions and considerations for implementation. The research process integrates data collection and analysis with input from key stakeholders such as local conservation partners, local public agencies, and nearby landowners.

Study Methodology

This study proposes and evaluates multiple improved access scenarios based on site conditions, discussions with stakeholders, financial analysis, and logistics for funding and operation. It then recommends a strategy for enhancing access to the refuge, including considerations for implementation and funding.

The project team, composed of staff from FWS and the U.S. Department of Transportation Volpe Center (Volpe), visited Nantucket NWR in spring 2013 to examine site conditions and reach out to partners and local stakeholders. Based on this visit and subsequent research and follow up visits, the team developed initial access scenarios for travel to the refuge via land vehicle, boat, or a combination. The team conducted further research on demand, logistics, and costs to narrow these down to a core set of land-based travel options. The team then developed more specific financial analyses for this final set of scenarios and identified strategies and funding sources for implementing improved access.

Chapter Outline

The methodology above is reflected in the structure of this study's chapters:

- **Chapter 1: Existing Conditions** – Introduces the Nantucket NWR, its context on Nantucket, and visitor and transportation challenges.

- **Chapter 2: Demand Analysis** – Analyses the demand for refuge recreational visitation and estimates potential ridership for alternative transportation service.
- **Chapter 3: Alternative Transportation System Scenarios** – Presents and refines different alternative transportation solutions for accessing the refuge from downtown Nantucket.
- **Chapter 4: Vehicle Options** – Identifies vehicles that could be used to serve the refuge.
- **Chapter 5: Scenario Financial Analysis** – Estimates the operating costs for each access scenario
- **Chapter 6: Implementation Considerations** – Identifies and discusses logistical considerations for operating, maintaining, and promoting alternative transportation service.
- **Chapter 7: Funding and Operating Arrangements** – Discusses in detail potential legal and financial arrangements under which alternative transportation to the refuge could operate.
- **Chapter 8: Recommendations** – Synthesizes the study team's recommendations for implementing enhances alternative transportation to Nantucket NWR.

Chapter 1: Existing Conditions

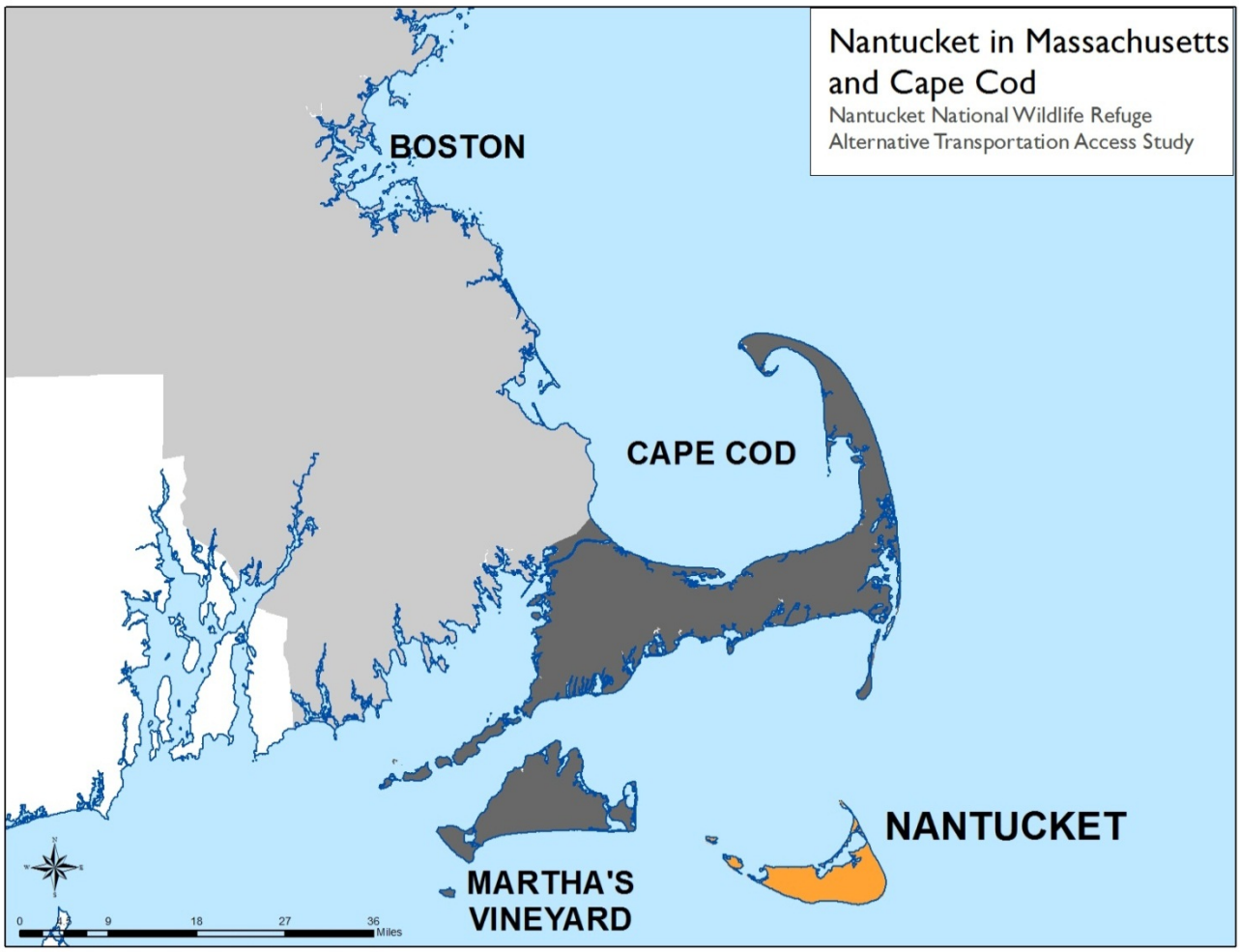
Nantucket National Wildlife Refuge
Alternative Transportation Access Study

This chapter discusses existing conditions related to the Nantucket National Wildlife Refuge and Nantucket Island, including sites of local interest, land use patterns, and transportation. This information establishes the context for the study, discussing transportation and access-related issues and constraints on the island and for the refuge. It provides the basis for the analysis that follows.

Location and Context

Nantucket Island has a land area of 47.8 square miles and is located approximately 30 miles off of Cape Cod on mainland Massachusetts (see Figure 4). The consolidated and coterminous County and Town of Nantucket include the entire island, in addition to the small nearby islands of Tuckernuck and Muskeget. Nantucket's historic and densely populated downtown is located in the north-center of the island along the mouth of Nantucket Harbor. The core area around downtown contains many of the island's services and attractions.

Figure 4: Nantucket and Cape Cod within Massachusetts



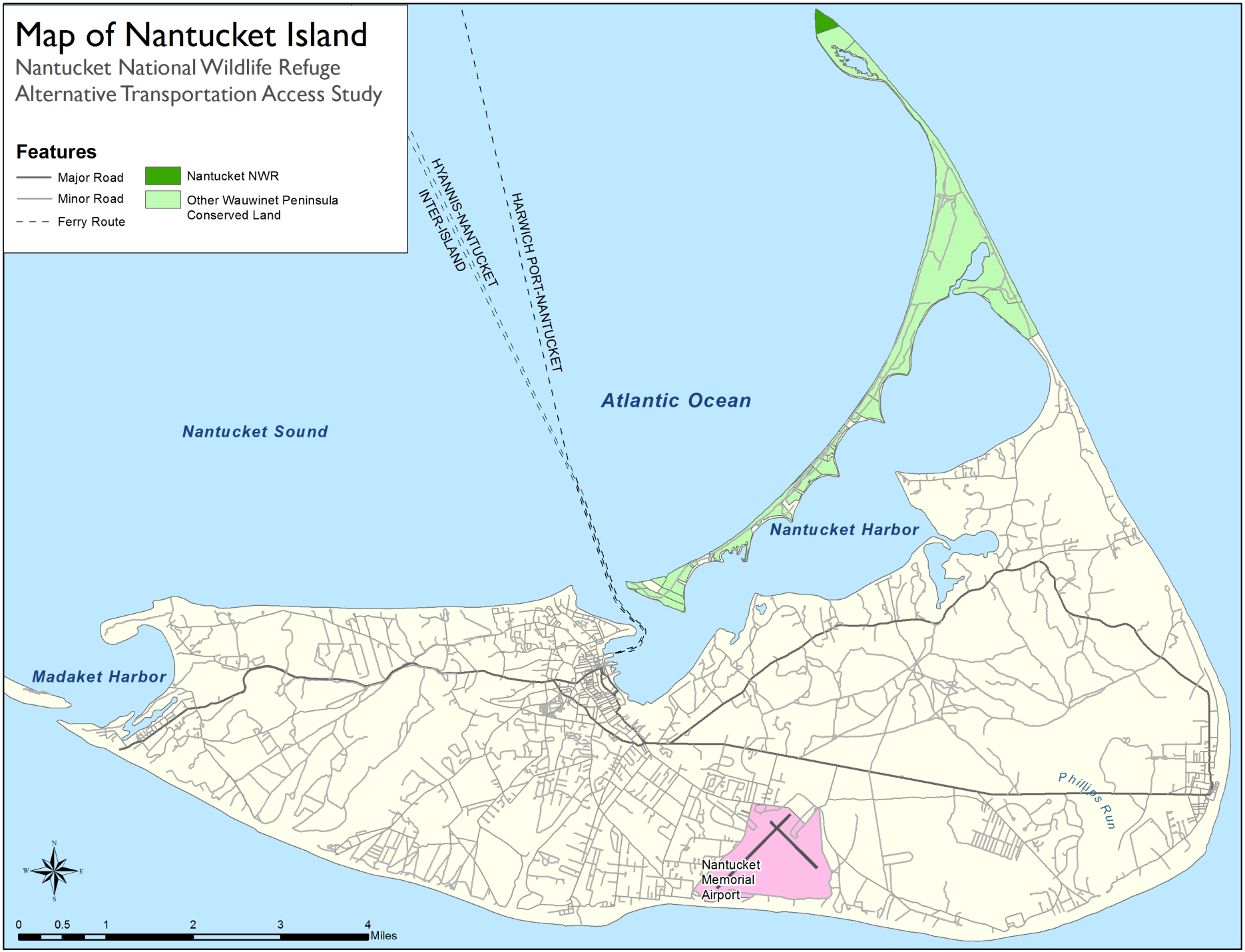


Figure 5: Map of Nantucket Island

Population and Demographics

Nantucket has a relatively small number of year-round residents—10,172 at the 2010 US Census. However, the Town of Nantucket estimates that the island's population grows to approximately 50,000-60,000 during the summer as seasonal residents come to the island for recreation or the employment opportunities created by summer tourism.[1] According to the US Census Bureau American Community Survey, of the 11,490 estimated housing units on Nantucket, 7,345 or 64 percent are seasonal homes.[2] The seasonal residents are joined in the summer by tourists and short-term visitors; there are 30 traveler accommodation facilities—such as hotels, inns, and resorts—on Nantucket.[3] While activity is low during the off-season, congestion, activity, and amenities increase dramatically in the summer.

The median household income for full-time residents on Nantucket is $84,979, which is 29 percent higher than the $65,981 value for Massachusetts as a whole. While the Census does not collect demographic data on seasonal residents, home prices on the island reflect Nantucket's popularity as a summer destination. The median owner-occupied home value is $993,900, or 2.9 times the median value across the state. Thus, in addition to tourism-associated industries such as lodging, retail, and recreation, construction and real estate services are important sectors in the local economy.[4]

Outdoor recreation opportunities on the island include water-based activities such as fishing, sailing, swimming, and yachting. Golf, tennis, birding, hiking, and bicycling are also popular. Development and urban amenities are concentrated in the center of the island near downtown and the Nantucket Memorial Airport to the southeast. Much of the remainder of the island, including the Coskata-Coatue Peninsula is protected land (see Figure 7). The Nantucket Conservation Foundation alone owns and maintains approximately one-third of the island land area.[5]

Figure 6: A typical walkable street with amenities in downtown Nantucket. Credit: Doug Kerr via Flickr

[1] Town of Nantucket Fact Sheet
[2] US Census Bureau, "Selected Housing Characteristics: 2007 – 2011 American Community Survey 5-Year Estimates," accessed July 12, 2013 from American Fact Finder: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.
[3] US Census Bureau, "2011 County Business Patterns: Geography Area Series: County Business Patterns," accessed June 12, 2013 from American Fact Finder: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.
[4] US Census Bureau, 2011 County Business Patterns."
[5] "Properties," Nantucket Conservation Foundation, accessed June 24, 2013, https://www.nantucketconservation.org/properties/.

Figure 7: Conserved land on Nantucket

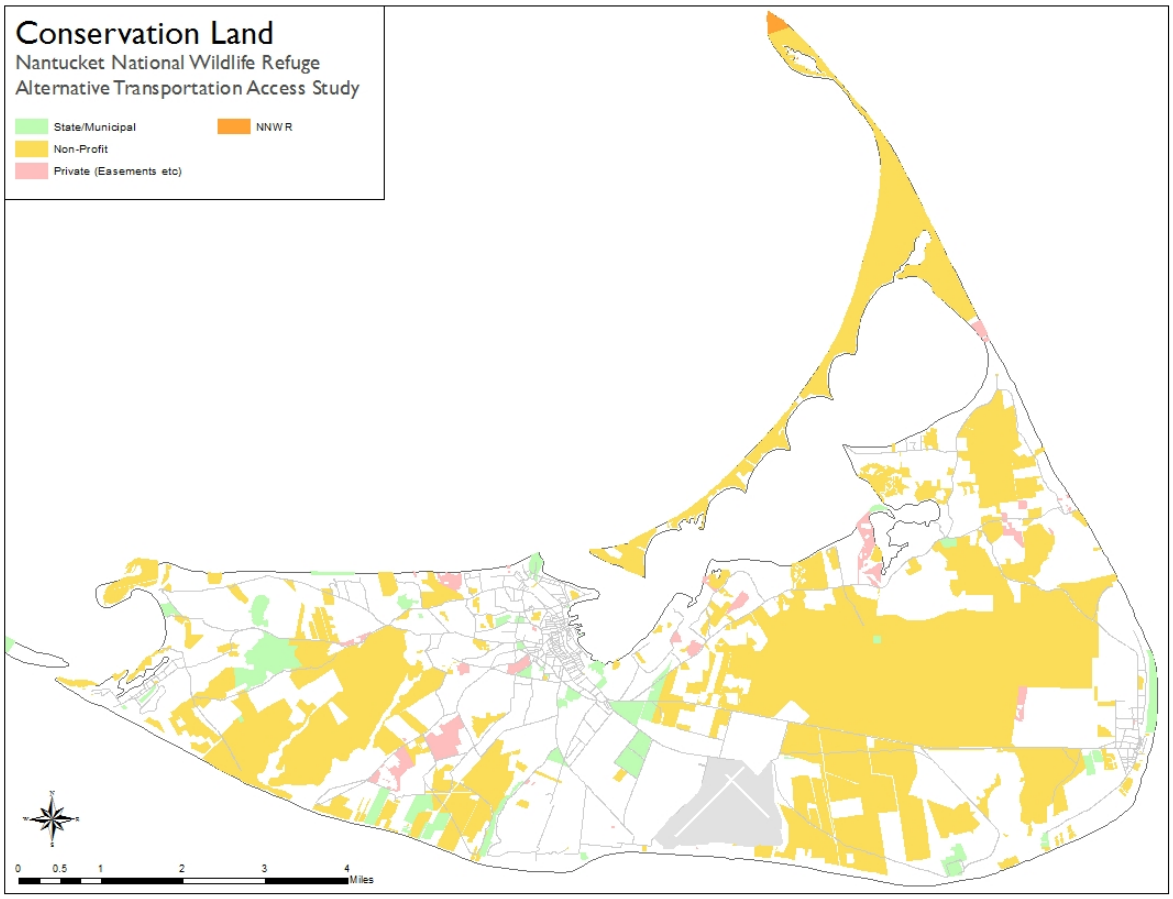
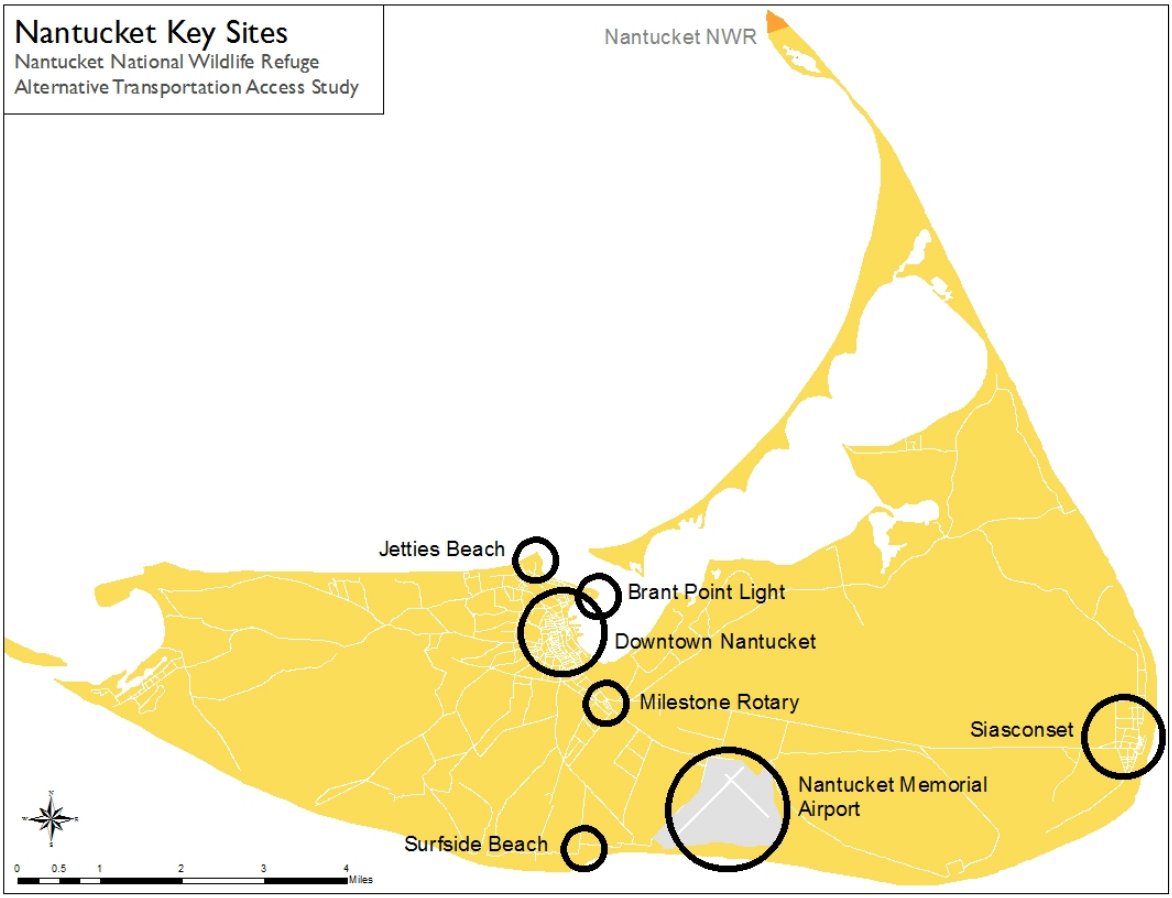


Figure 8: Key sites and attractions on Nantucket



Key Sites and Destinations

Following is a list of key destinations around the island for residents and visitors (see Figure 8):

- **Downtown Nantucket** is the walkable center of activity and transportation on the island. It includes a concentration of shopping, restaurants, civic institutions, and visitor attractions such as the Whaling Museum and the Maria Mitchell Center.
- **Nantucket Memorial Airport** is the island's airport; it is not far from downtown and near other lodging and car rental agencies.
- **Brant Point Lighthouse** is a lighthouse near downtown on Nantucket Harbor. The original lighthouse was the second constructed in America.
- **Siasconset** is a village at the eastern end of the island. It features restaurants, civic amenities, Siasconset Beach, and bluffs overlooking the water.
- **Milestone Rotary** is a key intersection southeast of downtown Nantucket that leads to Siasconset, the airport, residential neighborhoods, and other points south and east. It is the site of a grocery store, gas station, restaurants, and other amenities.
- **Jetties Beach** is a popular beach near downtown Nantucket and the mouth of the harbor. Like most beaches on the north side of the island it features warmer water and smaller waves.
- **Surfside Beach** is another popular beach near the airport. Like most beaches on the south side of the island, it features cooler water and larger waves.

Getting to Nantucket

There are two ways to reach Nantucket Island – either by air or by boat. Both methods are discussed in detail below.

Air Travel to Nantucket

Nantucket Island is served by Nantucket Memorial Airport, located three miles southeast of downtown. There is year-round commercial airline service to Nantucket on Cape Air, Island Airlines, and Nantucket Airlines from Boston, Hyannis, and Martha's Vineyard. Additional seasonal summer airplane service is also provided by Cape Air, JetBlue Airways, Delta Connection, United Express, and US Airways Express from the New York area, Boston area, and Washington, DC.

Year-Round Service

Regional airlines provide daily service between Nantucket and Hyannis, MA. These airlines use 9-passenger propeller aircraft for the approximately 20-minute flight between Nantucket and Hyannis. Both airlines operate 15-18 round-trip flights day between 6AM and 8:30PM. Fares range from $50 to $80 each way, with discounts for children, seniors, military, and bulk purchases.

Cape Air provides daily service to other Massachusetts destinations, including Boston (45 minute flight), New Bedford (25 minute flight), and Martha's Vineyard (20 minute flight). Using similar 9-passenger propeller aircraft, Cape Air operates eight daily round-trips to Boston, seven daily round-trips to New Bedford, and three daily round-trips to Martha's Vineyard. Schedules and cost vary by day and season.

Seasonal Service

There is additional air service to Nantucket in the summer months, with additional service from the Boston area, as well as New York and Washington, DC. JetBlue (using a 100-passenger jet) and Delta Connection (using a 50-passenger jet) each provide up to two daily round-trip flights to New York JFK airport. United Express uses 50-passenger propeller aircraft on up to three daily round-trip flights to Newark Airport. Cape Air uses a 9-passenger propeller aircraft on one daily round-trip flight to White Plains, NY.

From Boston, JetBlue uses a 100-passenger jet to provide one daily round-trip flight. Cape Air uses 9-passenger propeller aircraft for up to 7 round-trips per day to Providence, RI. US Airways Express uses 50-passenger jets to on up to 3 round-trips per day to Ronald Reagan National Airport in Washington, DC.

Ferry Services to Nantucket

Three operators – Steamship Authority, Hy-Line Cruises, and Freedom Cruise Line – provide commercial ferry service from mainland Massachusetts to Nantucket Island. Steamship Authority operates a traditional roll-on/roll-off vehicle/passenger ferry, as well as a high-speed passenger-only ferry. Hy-Line Cruises operates both a traditional and high-speed passenger-only ferry, and Freedom Cruise Line operates a high-speed passenger-only ferry. All of the ferry services load and unload from the downtown. One-way adult fares range from $17-$40 for the traditional ferries, and $36-$41 for the high speed ferries. One-way vehicle rates range from $140-265, depending on time of year and size of vehicle.

Steamship Authority

The Steamship Authority (SSA) is both the statutory and regulatory body for all ferry operations from mainland Massachusetts to Martha's Vineyard and Nantucket, and an operator of ferry service to these islands. SSA offers both traditional vehicle/passenger ferry and passenger-only high-speed ferry service from Hyannis, MA.

The traditional vehicle/passenger ferry service operates year-round; the trip from Hyannis to Nantucket lasts 2 hours and 15 minutes. During the peak season, SSA operates two traditional ferries, *M/V Eagle* and *M/V Nantucket*, on six round-trips per day. These ferries can carry approximately 800 passengers and 50 cars. During the off-season, SSA only operates one traditional ferry, *M/V Eagle,* on three round-trips per day.

SSA also operates a passenger-only high-speed ferry service from Hyannis to Nantucket from mid-April to late-December aboard the *M/V Iyanough.* The *M/V Iyanough* is a high-speed catamaran which can carry 393 passengers. The trip from Hyannis to Nantucket on *M/V Iyanough* takes one hour. SSA runs five round-trips per day during the peak season and four round-trips per day during the off-season.

Hy-Line Cruises

Hy-line Cruises operates passenger-only ferry service from Hyannis, MA aboard both a traditional ferry and a high-speed ferry. In contrast to SSA operations, Hy-Line Cruises operates the high-speed ferry year-round and operates the traditional ferry only from mid-May to late-October. Hy-Line's high-speed catamaran, *M/V Grey Lady II*, can carry 149 passengers on the one-hour trip from Hyannis. During the peak season, the *M/V Grey Lady II* makes six round-trips per day. The number of round-trips is reduced to five per day during the off-season.

The traditional ferry service, aboard the *M/V Great Point,* can carry 720 passengers on the 1 hour and 50 minute trip. During the peak season, there are three round-trips daily. There are two daily round-trips in late May and early June, and one in early May and the early fall.

Freedom Cruise Line

Freedom Cruise Line, Inc. operates a seasonal high-speed passenger-only ferry from Harwich Port, MA aboard the *M/V Freedom*. The *M/V Freedom* is a monohull ferry which can carry 80 passengers on the 1 hour and 20 minute trip to Nantucket. This ferry operates from Memorial Day weekend until the end of September. There are three round-trips during the peak season and one daily roundtrip during the shoulder season.

Getting Around on Nantucket

There are no freeways or traffic signals on Nantucket.[6] And while most town roads are paved, major roads are generally no wider than two lanes. As such, Nantucket's transportation network has limited capacity for automobiles. However, the island's concentration of activities around the downtown core and its flat topography make walking, bicycling, and transit a viable choice for many trips.

The 2012 Nantucket Regional Transportation Plan (RTP) notes that the community has prioritized maintaining the historic and rural character of the island over adding more capacity to accommodate seasonal automobile traffic.[7] The plan hence identifies as a key goal "to minimize the use of cars on Nantucket while providing a transportation system that is safe, convenient, economical, and sensitive to the character of the Island."[8] The provision and promotion of alternative transportation, including walking, bicycling, and transit, is identified as central to implementing this goal.

Limited automobile access to the island, a dense downtown core, and seasonal congestion on the island's system of narrow roads mean that many visitors in particular choose to primarily use alternative transportation to get around Nantucket. Destinations in downtown Nantucket are readily accessible by foot; bicycle infrastructure and seasonal transit provide access to natural attractions located farther away, such as beaches.

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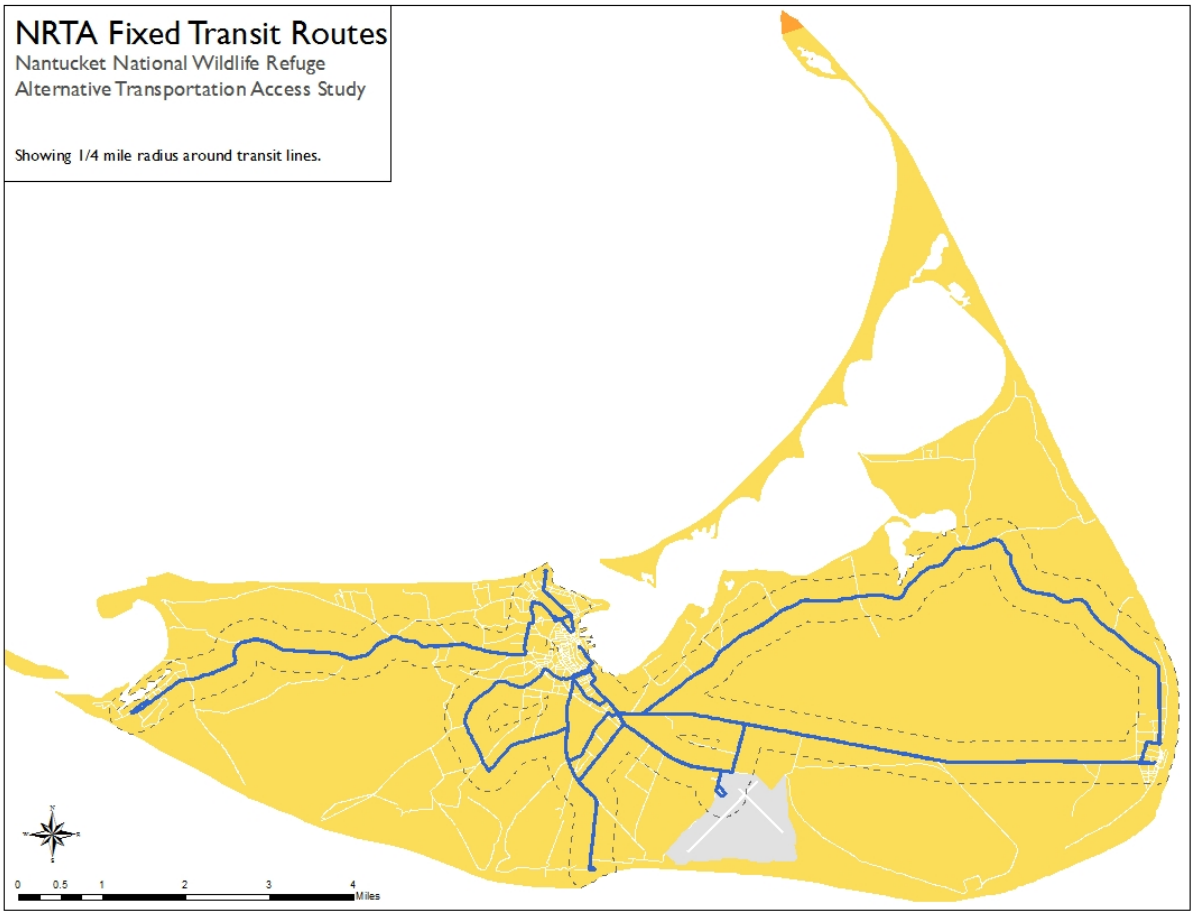
[6] Nantucket Chamber of Commerce, "Nantucket Island Trivia, Facts & Figures," August 2011. www.nantucketchamber.org/explore/nantucket_trivia.aspx

[7] The state and federally-recognized Metropolitan Planning Organization for Nantucket is the Nantucket Planning and Economic Development Commission, part of the Town of Nantucket. The transportation planning area is coterminous with the Town and County boundaries.

[8] Nantucket Planning and Economic Development Commission, *Nantucket Regional Transportation Plan: 2012 – 2035,* August 25, 2011, 3-35.

Figure 9: Nantucket Regional Transit Authority seasonal fixed-route transit service map



Transit service

The Nantucket Regional Transit Authority (NRTA) provides public transportation services on the island. Branded as "THE WAVE," NRTA operates seasonal fixed-route service and free year-round dial-a-ride service for the disabled and seniors above the age of 60. In total, the agency operates nine routes and maintains a fleet of 13 buses. Fixed-route service begins operation annually on May 20, increases in frequency of service and number of routes for July and August, and decreases in the fall, before concluding by October 14.

NRTA fixed-route services are focused on the most densely populated area around Nantucket's downtown and airport, with loop circulator routes that feature the system's shortest headways. Outside of this core, a few lines reach out across the island to the east and west along main roads. Most routes serve the Greenhound central transfer point in downtown Nantucket. Approximately 31 percent of the island area is located within a short, quarter-mile walk of fixed-route NRTA service (see Figure 6). During the five-month season service frequency varies, and it is lower in the spring and autumn months. Headways on fixed-route service range from 15 minutes on the Mid-Island Loop during the summer to 1.3 hours on the Polpis Road route, which only runs in the summer and is the closest line to the Coskata-Coatue Peninsula and the NNWR. To help plan for trips, NRTA provides real-time bus location information that riders can access through a smartphone or computer. Buses are equipped with bicycle racks and can accommodate up to two bicycles. A one-way fare costs between $1 and $2.

NRTA's seasonal fixed-route service has an average annual ridership of 249,987 over the past five years. The year-round dial-a-ride service has provided an annual average of 9,114 rides over the same period.

Figure 10: Town bike route along a typical major road

Automobile Use

Nantucket's geographic character and roadway infrastructure make driving more expensive and less convenient for residents and visitors than other locations in the Cape Cod area. The only means for visitors to bring a car onto the island is on one of the ferry services, which, as noted above, charges a considerable premium for carrying an automobile. Various national and local companies provide car rentals on Nantucket; the cost of renting a sedan during the peak season ranges from $100 to $179 per day compared to approximately $35 per day on the mainland in Hyannis. Renting a four-wheel drive vehicle costs approximately twice as much. Drivers also pay a premium for gasoline on the island. In June 2014, gas prices on Nantucket were around $4.50 per gallon, or 38 percent more expensive than prices on mainland Cape Cod. There are also several taxi companies on the island, which provide another option for visitors and residents without access to a car. Rates are established by the Town of

Nantucket, and a one-way fare from downtown to Wauwinet, close to the beginning of the Coskata-Coatue Peninsula, is set at $23.[9]

Walking and Bicycling

Walking and bicycling are common on Nantucket. The area in and around downtown Nantucket is pedestrian-friendly, with sidewalks and many destinations and services located close together. In addition, Nantucket's small size and relatively flat topography lead many visitors and residents to walk or bicycle to additional destinations. On Nantucket, 8.6 percent of year-round residents walk to work, compared to 14.9 percent in the City of Boston, 2.8 percent nationally, and 2.7 percent in Barnstable County, which covers mainland Cape Cod.[10] The bicycle and pedestrian mode-share for residents is highest is neighborhoods near downtown; 52 percent of commuters along the waterfront just north of downtown Nantucket commute via walking or bicycling.[11] The RTP notes that Nantucket's sidewalk system has notable gaps outside of the downtown area.[12] Nevertheless, even a few more remote parts of the island have a relatively high proportion of bicycle and pedestrian commuters. According to the RTP, the Wauwinet area, which includes the NNWR, features an 18 percent active transportation mode-share for work commutes. While work trips are only a small component of overall walking and bicycling activity on Nantucket, the generally high active transportation commuting mode-share suggests a high level of recreational bicycling and walking as well.

The Town of Nantucket manages a substantial 30-mile network of bicycle paths that branch outward from the island's core, toward the ocean. Bicycle paths, such as the one following Polpis Road towards NNWR (see Figure 7), typically are separated facilities that run mostly parallel to the roads. They cross many of the major roads, but are otherwise generally protected from conflicts with automobiles.

Ferry services to Nantucket will carry bicycles for an additional fee of $14 per round trip; airlines serving the island have varying bicycle policies, but most will only accept bicycles that have been properly packaged in advance. Bicycle shops located downtown also provide rentals and maps to Nantucket visitors.

Recreational Services

Visitors can also take advantage of recreational land and water tours that transport visitors to attractions around the island in an organized setting. These tours can be more or less formal, with some operators selling tickets for scheduled outings and/or providing charter service for individuals or groups. Nantucket's long and rich history is the basis for many sightseeing tours in particular.

Van Tours

Several small companies, often based locally on Nantucket, offer narrated van or small bus tours to tourists. Tours typically leave from a downtown location, often near the visitor center, and include visits to key sights such as the Brant Point area and lighthouse, Jetties Beach, and Siasconset Village. A typical tour is 90 minutes and costs approximately $15 per person.

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[9] "Town of Nantucket Taxi Rates," Town of Nantucket, modified July 20, 2011, http://www.nantucket-ma.gov/pages/nantucketma_clerk/taxirates.pdf.

[10] US Census Bureau, "Selected Economic Characteristics: 2007 – 2011 American Community Survey 5-Year Estimates," accessed July 19, 2013 from American Fact Finder: http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

[11] Nantucket Planning and Economic Development Commission, *Nantucket Regional Transportation Plan*, 2-22.

[12] Nantucket Planning and Economic Development Commission, *Nantucket Regional Transportation Plan*, 6-73.

Boat Tours

Several operators offer whale- and seal-watching cruises and sailing excursions from Nantucket Island. Leaving from either Nantucket's Town Dock or the Boat Basin (both downtown), tours range from one hour to full-day trips, some of which include narration and educational discussions about whaling history and marine life. Shorter trips typically cost $25 to $35 per person, while all-day trips can cost up to $100 per person. At least one operator provides a private water-taxi tour service on Nantucket. These private tours are for up to six people, and the costs range from $140 for a one-hour tour up to $375 for a three hour tour.

Chartered Vehicles

In addition to tour operators, there are also fishing vessel charters on Nantucket. These operators provide a range of options, depending on the duration, destination of the fishing trip, and the type of fish sought. Charters typically leave from either the town dock or the Boat Basin in downtown Nantucket. The cost to charter a fishing vessel ranges from approximately $400 for a shorter (four hour) trip up to $2000 for an all-day excursion. A few companies also provide chartered or personalized tours for groups.

Nantucket National Wildlife Refuge

Refuge History

The Nantucket National Wildlife Refuge was transferred to the U.S. Fish and Wildlife Service from the U.S. Coast Guard in 1973, because of "its particular value in carrying out the Migratory Bird Act."[13] The Coast Guard continues to own a one-acre inholding within the refuge. At the time of transfer the refuge comprised 40 acres, but storm events and long-term coastal erosion have since shifted the shoreline. As of 2013, the refuge now covers an area of 21 acres.

Climate events have also affected the NNWR's primary cultural resource, the Great Point Lighthouse. In 1984 a severe storm destroyed the 1818 historic lighthouse on the Refuge. The current lighthouse is a functional replica of the original, dedicated by U.S. Senator Edward Kennedy in 1986. The lighthouse is a popular destination. It continues to be owned by the Coast Guard and maintained by TTOR, which provides tours.

Refuge Management

NNWR is part of the U.S. Fish and Wildlife Service National Wildlife Refuge System. Its mission is to "administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the U.S. for the benefit of present and future generations of Americans." The refuge system is made up of more than 150 million acres of land on more than 550 wildlife refuges. Maintaining biological integrity, diversity and environmental health of refuge lands is important, as is providing opportunities for the public to engage in compatible, wildlife-dependent public use. These uses are hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation. At NNWR, all of these uses are permitted, except hunting.[14] Environmental education is a particularly important at NNWR due to its vulnerability and role as a dynamic barrier beach habitat.

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[13] Federal Register, April 5 2013, https://www.federalregister.gov/articles/2013/04/05/2013-07937/nantucket-national-wildlife-refuge-nantucket-ma-final-comprehensive-conservation-plan-and-finding-of

[14] U.S. Fish and Wildlife Service National Refuge System Website, U.S. Fish and Wildlife Service

Figure 11: Entering NNWR with the Great Point Lighthouse in the background

NNWR is a satellite of the Eastern Massachusetts National Wildlife Refuge (NWR) Complex, which is headquartered in Sudbury, MA. NNWR is one of eight refuges that make up the Eastern Massachusetts NWR Complex. The other refuges in the complex include: Assabet River, Great Meadows, Mashpee, Massasoit, Monomoy, Nomans Land Island, and Oxbow NWRs. The refuge complex is situated along the Atlantic flyway, and each of the ecologically diverse refuges provide critical habitat for migratory birds, plants, and other wildlife.

There are no full-time, year-round staff onsite at the refuge. Seasonal staffing consists of 1-2 biological and interpretive interns, who are onsite for 4-5 months, starting in May. The summer staff responsibilities include conducting wildlife surveys and other data collection, installing and maintaining seasonal closures to protect specific areas, collecting data on public use, and working closely with partners and the public. TTOR provides day to day management of the refuge, through a Memorandum of Understanding with FWS.

The refuge was established in 1973 to primarily serve migratory birds. The refuge provides habitat and haul out area for a burgeoning grey seal population often numbering in the 100's, potential nesting

habitat for the endangered piping plover, and is a feeding, resting, and staging habitat for common terns and the endangered roseate terns. [15]

Comprehensive Conservation Plan

In February 2013, FWS completed the first Comprehensive Conservation Plan (CCP) for Nantucket NWR.[16] The CCP presents the combination of management goals, objectives, and strategies to help achieve the vision and goals for the refuge; contribute to the mission of the National Wildlife Refuge System; achieve the refuge purposes; fulfill legal mandates; address key issues; incorporate sound principles of fish and wildlife management, and serve the American public. The CCP will guide management decisions and actions on the refuge over the next 15 years.[17]

The CCP established the following goals and objectives:

1. Perpetuate and enhance the biological integrity and diversity of coastal habitats on and around Nantucket Island to support and enhance native wildlife and plant communities, with an emphasis on species of conservation concern.
    1. Dune and Shoreline Habitat
    2. Landscape-level Conservation
2. Promote awareness and stewardship of our coastal natural resources by providing compatible, wildlife-dependent recreation and education opportunities on the refuge and within the local and visitor community on and around Nantucket Island.
    1. Visitor Access
    2. Environmental Education
    3. Interpretation and Public Outreach
    4. Wildlife Observation and Photography
    5. Fishing
3. Perpetuate and enhance long-term conservation and management of wildlife resources on and around Nantucket Island through partnerships and land protection with public and private landowners, Federal, State, and local entities.
    1. Protecting Land

This transportation study is the result of one of the strategies suggested in Objective 2.1, Visitor Access.

Key Conservation and Transportation Partners

FWS works closely with partners to protect wildlife and species habitat in the wider neighborhood of the NNWR and to perform education, research, and public engagement.

Some of the key partners include:

Government and transportation organizations

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[15] TRIP application

[16] The CCP was prepared pursuant to the National Wildlife Refuge System Administrative Act of 1996, as amended by the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 6688dd et seq.; Refuge Improvement Act). An environmental assessment (EA), required by the National Environmental Policy Act of 1969 (NEPA), was prepared with the draft CCP.

[17] Nantucket NWR CCP, Chapter 1. http://www.fws.gov/northeast/planning/nantucket/pdf/FinalCCP/01w_Chapter1_Purpose_and_Need%28491KB%29.pdf

- **U.S. Coast Guard** transferred the refuge site to FWS in 1973. It continues to own the Great Point Lighthouse and the small parcel of land on which it is located.
- **Massachusetts Department of Fish and Game, Division of Fisheries and Wildlife (MassWildlife)** collaborates with FWS on wildlife inventories and other protection activities for local species.
- **Town of Nantucket** is the consolidated town and county government on Nantucket. Collaborates with FWS on land conservation.
- **Nantucket Planning and Economic Development Commission** is the metropolitan planning organization responsible for transportation planning on the island. Part of the Town of Nantucket.
- **Nantucket Regional Transportation Authority** is the state-designated transit authority that provides seasonal fixed-route service and year-round dial-a-ride service on Nantucket (See earlier discussion in the Getting Around Nantucket section).

Neighboring conservation organizations

- **The Trustees of Reservations (TTOR)** is a statewide nonprofit conservation organization. Owns large areas of immediately adjacent land on the Coskata-Coatue Peninsula. Closely collaborates with FWS on protection activities, refuge management, as well as education and access. Currently provides paid interpretive van tours to the refuge and sells over-sand vehicle permits for its own land, which provides the only land-based access to the NNWR (as described later in this section).
- **Nantucket Conservation Foundation (NCF)** is a nonprofit conservation organization focused on Nantucket. NCF owns nearby land on the Coskata-Coatue Peninsula and collaborates with FWS on protection activities, refuge management, as well as education and access.

Other state and local organizations

- **Egan Maritime Institute** is a nonprofit organization that preserves, promotes, and educates the public about Nantucket's maritime history.
- **Linda Loring Foundation** is a nonprofit preservation and education foundation that owns and manages 86 acres of habitat on the western side of the island.
- **Maria Mitchell Association** is a nature and science education organization based on Nantucket that maintains a science center and other facilities downtown. Collaborates with FWS on education and outreach.
- **Massachusetts Audubon Society** is a statewide nonprofit conservation organization. Collaborates with FWS on wildlife and habitat protection efforts on Nantucket.
- **Nantucket Anglers Club** is a local organization that promotes fishing on Nantucket and sponsors related activities and social events. Many members actively use Great Point for fishing.
- **Nantucket Land Council, Inc** is a nonprofit land conservation organization on Nantucket. Collaborates with FWS on habitat preservation.

The refuge's closest partners are the two organizations that own and manage the majority of the Coskata-Coatue Peninsula: the Nantucket Conservation Foundation (NCF) and the Trustees of Reservations (TTOR). The lands owned by FWS and these other groups are deeply connected ecologically and the partners further the management and protection of wildlife and habitat across the peninsula. For example, under a Memorandum of Understanding with FWS, TTOR monitors and protects wildlife on the refuge. NCF and, especially, TTOR, are also key partners in providing access to the refuge and educating the public about conservation efforts on the refuge and the surrounding area.

Finally, TTOR also conducts van tours that provide overland alternative transportation access from the Maria Mitchell Center and the Wauwinet Gatehouse to the NWR.

Primary Refuge Users/Activities

Using information from an automated counter previously used at the Wauwinet Gatehouse, FWS estimates that approximately 20,000 visitors come to the refuge each year, with a daily summer peak in the range of 500. In addition to conservation and wildlife habitat protection, the refuge accommodates visitors seeking recreation, education, observation, and reflection. Wildlife-dependent recreation on Great Point, such as hiking, wildlife observation and photography, swimming and sunbathing, and surf fishing, are very popular. The Great Point Rip at the tip of the refuge is known as a world-class surf casting destination.

In recent years the seal population on the refuge has grown significantly, leading FWS to close the very tip of Great Point to visitors. While visitors continue to come to Great Point to fish, some anglers are upset about the increased competition with the growing seal population. The non-profit Seal Abatement Coalition is based on Nantucket. While not focused exclusively on the NNWR or Coskata-Coatue Peninsula in particular, the organization claims that seals are disrupting fishing and coasting recreational activities on Cape Cod and is campaigning for a local exception to Federal rules that protect marine mammals.

Access to the Refuge

The refuge is accessed by land (hiking or via over-sand vehicle) and water. The following sections discuss how to access the refuge and some of the issues related to each method.

Land Access

The refuge is located approximately 13 miles from downtown Nantucket over land. The last five miles of the journey are via various over-sand access paths. These are composed of loose sand and involve vehicle travel directly on the beach. While there is no entrance fee to the refuge, only four-wheel drive vehicles are suitable for using the access road and TTOR requires all private vehicles that travel through its land to purchase an over-sand permit. Permits cost $140 and are valid from April 1 to March 31. In 2013, TTOR also started offering a daily permit for $65.

All over-land access to the refuge and the Coskata-Coatue Peninsula as a whole passes through the Wauwinet Gatehouse, which is located at the end of Wauwinet Road and the beginning of the over-sand access road. NCF owns the gatehouse itself and works with TTOR to staff this access point. At the Gatehouse all drivers must deflate their tires in order to travel across the sand. Drivers who do not already have over-sand permits may purchase them at the Gatehouse. TTOR manages and sells the over-sand vehicle permits required to access the peninsula via automobile and shares collected revenues with NCF. Upon leaving the peninsula drivers may use two air pumps provided by NCF to re-inflate their tires. Visitors to the refuge may also hike in by foot over the access road. Sand conditions are not amenable to cycling and TTOR does not permit bicycles.

As most of the land route to the refuge is owned by TTOR, the organization also monitors road access to its land and the refuge site, enacting vehicular prohibitions when necessary due to nesting shorebirds, erosion, or weather events.

Figure 12: Refuge users in 2011. Credit: FWS

Key Sites

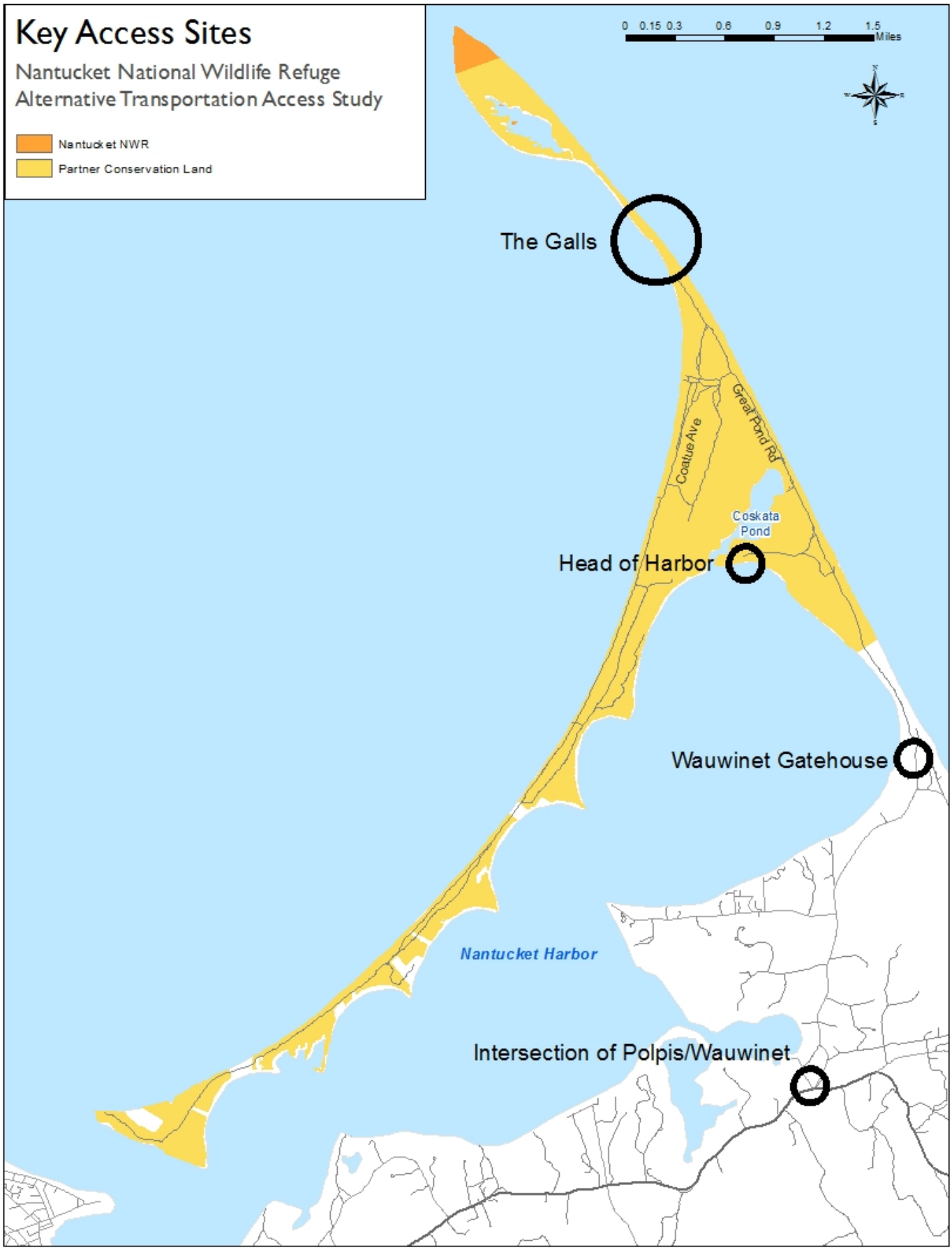
Following are key sites on Nantucket that visitors encounter while traveling over-land to access to the refuge from central Nantucket (see Figure 11):

- **Coskata-Coatue Peninsula** is a large peninsula on the northeast portion of Nantucket that includes the refuge at its northern terminus, Great Point. Most of the remaining land is owned and conserved by local refuge partners.
- **Intersection of Wauwinet Road and Polpis Road** is the site of the closest bike path and transit stop to NNWR.
- **Wauwinet Gatehouse** is the transition point between travel on paved town roads and over-sand routes controlled by TTOR, NCF, and the refuge.
- **Head of the Harbor** is the intermediate destination on peninsula at the far northeastern reach of Nantucket Harbor.
- **The Galls** are a Narrow point on the peninsula that is closed seasonally due to shorebird nesting.

Resource Restrictions

FWS and TTOR restrict vehicle access to, and close some portions of, Nantucket NWR and the Coskata-Coatue Wildlife Refuge at various times of the year to protect habitat. The restriction that most affects refuge access is on a portion of the access road, near the section of the Galls, which typically must be closed to vehicles in June and July to protect nesting shorebirds. OSVs impede foraging and can accidentally crush plover eggs and chicks. The nesting areas themselves may be quite small, but required 1000 meter buffers around them limit the ability for non-essential vehicles to access the refuge and Great Point. During the restricted period, some visitors park near the Galls and walk the remaining roughly 2.2 miles to Great Point, some park and then fish or picnic near the closure point, and others visit alternative destinations on TTOR and NCF land. FWS and TTOR regularly update their websites and Facebook pages and also post information at the Gatehouse to keep the public informed about closures. The restrictions are one of the reasons that FWS is interested in an alternative to private vehicles for access to the refuge.

Figure 13: Key locations en route to NNWR on Coskata-Coatue Peninsula



Alternative transportation

Given the need for a four-wheel drive vehicle to navigate the Coskata-Coatue Peninsula, the expense of obtaining and operating an automobile on Nantucket, and the many island visitors without access to a car, it is challenging for many visitors and residents to get to the refuge.

The nearest connection to the local bus service and bicycle paths is approximately eight miles away, at the intersection of Polpis Road and Wauwinet Road. The two mile stretch of Wauwinet Road from the intersection with Polpis Road to the Gatehouse is narrow and windy, without sidewalks or bicycle facilities. The town plans to develop an off-road bicycle path along Wauwinet Road, but this is a longer term project that is not estimated to begin for 15 to 20 years.

The main current alternative to a personal vehicle is a natural history tour through the Coskata-Coatue Wildlife Refuge, operated by TTOR. TTOR uses a 4x4 over sand 8-passenger van for the tour and provides narration to teach visitors about the refuge, wildlife, and other resources, and, when possible, includes a tour of the Great Point Lighthouse. In recent years TTOR has served approximately 1,200 visitors per year on its natural history and sunset tours. The tours have, in the past, have departed twice daily from the Wauwinet Gatehouse, lasted 2.5 hours, and cost $40 per person (adults, non-members of TTOR). Beginning in the 2013 season, TTOR is partnering with the Maria Mitchell Foundation to pick up passengers at their downtown location. There is still the option to join the tour from the Gatehouse; for passengers originating downtown, the tour duration is one hour longer and costs an additional $20 per passenger. In addition to the natural history tours, TTOR offers occasional bird-watching and sunset tours. These tours are currently the only way for non-permit holders to reach the refuge by car.

The scheduled destination of the tour is Great Point Light; however, when there are road restrictions due to plover nesting, the tours do not reach NNWR. Instead they typically bring visitors to other destinations on the peninsula, such as Head of the Harbor.

Water-based Access

The Nantucket CCP specifically identifies nonmotorized boat activity (e.g., kayaking) as a compatible use on the refuge. There is no fee or permit required for accessing the refuge by boat. The refuge is located approximately eight miles from downtown Nantucket by water. The first roughly two miles of the trip are operated from the boat docks to the breakwater, in the confines of Nantucket Harbor. The next six miles are in partially protected waters in Nantucket Sound between the breakwater and Great Point. Nantucket NWR has no fixed infrastructure for docking a boat. To access the refuge, many users anchor their boats nearby and then swim or wade ashore. Other users temporarily “park” their boats on the beach, allowing visitors to disembark through a bow door or boarding ramp directly to shore. The drivers then typically remove their boats from the beach and anchor offshore. This limits the chance of the boat accidentally being floated out to sea during rising tides or being stuck on the sand during lowering tides.

Nantucket NWR’s location at the intersection of the Atlantic Ocean and Nantucket Sound leaves it exposed to winds, waves, and intersecting currents from the two bodies of water. When wind and wave conditions are not favorable, safe boat access to the refuge is limited; there are no naturally protected areas for boat docking.

The Gatehouse area and Head of Harbor, around five miles from the NNWR, can be accessed from downtown without leaving Nantucket Harbor. However, connecting over-land access would still be subject to seasonal resource closures around The Galls. Currently, the Wauwinet Inn provides private boat service from downtown to Topper’s Restaurant (located at the hotel near the Gatehouse); this service is included free with purchase of lunch or dinner.

Resource Restrictions

While some portions of the refuge are restricted periodically for conservation purposes, the restrictions would not typically preclude access by boat. The seasonal road restrictions related to plover nesting near the Galls would not affect boat access to Nantucket NWR.

Alternative transportation

Given the restriction on commercial operators serving the refuge, and that there are no concession agreements, water based access to the refuge is currently by private boat only. However, some of the boat tours operating from the boat basin do bring visitors out near Great Point either to fish or to see seals. They come close to the refuge but do not provide an opportunity for passengers to disembark.

Chapter Summary

The following is a recap of the major transportation-related issues and constraints identified in Chapter 1. These findings inform the analysis in the alternative transportation study:

- FWS is interested in increasing visitation opportunities to Nantucket National Wildlife Refuge to enable more Nantucket residents and visitors to engage in wildlife-dependent recreation, especially environmental education, on this important site. In doing so, it would like to reduce the number of individually operated OSVs to the refuge due to vehicle impacts on the environment.
- Walking and cycling are popular means to access other destinations and attractions on Nantucket, especially in and around Nantucket's downtown core.
- The distance from the downtown to the refuge, along with the over-sand driving requirements, is a barrier for many visitors.
- The seasonal vehicle restrictions at the Galls make the refuge virtually inaccessible for much of the peak summer season.
- Water-based transportation could be successful and desirable, though wind and weather conditions may limit the operating season. This study will further explore the weather-related limitations of water-based transportation.
- Partnerships with other conservation, transportation, local governmental agencies, and possibly private organizations will be key to expanding transportation options to reach NNWR.

The study will explore several options for water- and land-based access to the refuge, considering various operational models and arrangements.

Chapter 2: Demand Analysis

Nantucket National Wildlife Refuge
Alternative Transportation Access Study

The level and type of transit service appropriate for FWS or its partners to provide depends on the environmental and logistical constraints of the refuge's surroundings, as well as the demand for alternative transportation access. FWS must account for user demand to correctly match service offerings and capacity, in order to provide a useful, cost-effective transportation service to its visitors.

Estimating alternative transportation demand for public lands sites can be difficult, and FWS faces particular challenges due to the unique conditions on and around the refuge. The approach to demand estimation in this section draws from the strategies presented in a 2011 report, "Alternative Transportation System Demand Estimation for Federal Land Management Agencies".[18] The report describes a framework for estimating alternative transportation demand at Federal public lands sites such as wildlife refuges, national parks, and national forests. In considering demand for transportation service to NNWR, the project team used overall visitation figures, ridership of existing tours, and transit service statistics for other Nantucket destinations to estimate demand for alternative transportation to the refuge and the appropriate market cost range. This chapter is not a formal market analysis, which is beyond the scope of this study and would be difficult given the limited available data, but instead provides perspective on the type and scale of service that could be suitable and sustainable for NNWR.

The analysis in this chapter leads the project team to conclude that there is a market for enhanced alternative transportation service if it is marketed and implemented to capture the many Nantucket visitors not aware of the refuge's unique character. Chapter 6 addresses implementation considerations in greater detail. However, the project team recommends that any alternative transportation implementation include flexibility for adjusting the operating characteristics. As FWS and partners continue to gain a better understanding of visitor demand and interests, they will want to be nimble enough to adjust operations accordingly.

Refuge Visitation

FWS estimates that approximately 20,000 visitors come to the refuge each year. This estimate is derived from a vehicle sensor at the entrance to the Coskata-Coatue peninsula, which NCF and TTOR installed and used in 2009 and 2010. The readings and related FWS and partner estimates indicate that 30,000 to 40,000 visitors cross the gatehouse each year depending on the timing and length of resource closures.[19] Of these visitors, FWS estimates that approximately 20,000 ultimately visit the refuge itself.

Daily visitation is highest during the peak season, and FWS estimates that, based on gatehouse sensor readings, 500 visitors per day access the refuge during the summer peak. Because vehicle access to the refuge is cut off by restrictions on the TTOR property during summer shorebird nesting, the duration and timing of the nesting period strongly affect visitation.

Most travelers to the refuge arrive by private vehicle, which requires a four-wheel drive-equipped vehicle and a TTOR permit for over-sand travel from the gatehouse. The Alternative Transportation System (ATS) demand estimation framework estimates that five to 10 percent of visitors at a Federal public lands site would typically use a non-mandatory transit service; given the access constraints and the specialized vehicles needed for entry to NNWR, demand for transit might be higher.[20]

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[18] Volpe Center for the U.S. Department of the Interior, "Alternative Transportation System Demand Estimation for Federal Land Management Agencies," September 2011, http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-alternative-transportation-system-demand

[19] Nantucket NWR CCP, Page 3-42.

[20] Volpe, "Alternative Transportation System Demand Estimation for FLMAs," 19.

User Types

The profile of a public lands site's users can strongly influence the demand for alternative transportation, as well as the type of service that best suits their needs.[21] For example, the access needs of a family with children differ from those of a group of young adults or a senior tour group. Similarly, anglers have different needs than those with an interest in historic lighthouses. In 2010 and 2011, FWS staff conducted small visitor counts that, combined with a survey of 68 visitors on three days in August 1999, reveal some information about refuge visitors and their interest in NNWR. The Nantucket CCP discusses these counts and surveys, which were not designed to be statistically significant across the year or season.

Based on these efforts, there are three broad categories of visitors to the refuge:

- Visitors to the Island of Nantucket
- Short-term or summer Nantucket residents
- Long-term or year-round Nantucket residents

Only around 21 percent of the over-sand vehicle permits that TTOR issued in 2013 were mailed to addresses on Nantucket—this is similar to the estimated proportion of Nantucket residents that reside year-round on the island (see Chapter 1). This suggests that the need to bring an automobile onto the island is not a barrier for many short-term residents and Nantucket visitors seeking to experience Great Point. This is consistent with the unscientific results of the August 1999 NNWR survey, in which only eight out of 68 respondents were year-round residents. Year-round residents may use the refuge more frequently during the shoulder seasons.

The 1999 survey notes that short-term and long-term residents primarily visited the refuge to fish, whereas visitors engaged in other kinds of wildlife and recreational activities. However, the 2010-2011 counts record only 15 percent of visitors to the refuge as anglers; the largest activity group is general beach recreation. Table 1 lists the full results from the 2010-2011 visitor observations. The table's information is reproduced directly from the survey results described in the refuge's CCP and is based on observed behaviors rather than a larger framework for refuge use, such as FWS's wildlife-dependent recreation priorities.

[21] ATS Demand Estimation Framework in Volpe, "Alternative Transportation System Demand Estimation for FLMAs," Section VII.

Table 1: Observed public use by category in 2010 and 2011, adapted from Nantucket CCP

User Group Description	2010 % of Visitors (n = 1876)	2011 % of Visitors (n = 2143)
General beach enthusiast (activity not covered by other descriptions)	56%	39%
Passenger [sitting] in [stationary] vehicle	10%	21%
Angler	17%	14%
Wildlife watcher (includes birds and seals)	5%	12%
Photographer	2%	1%
Lighthouse visitor	5%	11%
Tour group participant	5%	2%

Transportation needs may vary by the type of intended activity. Table 2 aggregates the popular uses on the NNWR and notes corresponding access considerations.

Table 2: NNWR recreational activities and related access considerations

Activity	Access Consideration
Bird and wildlife observation	Demand may depend on current wildlife activity and natural events (e.g. bird nesting, sunset/sunrise)
Fishing	Early morning demand, large and unwieldy equipment
Beach recreation	Strong morning and afternoon demand rather than at midday; may include gear
Lighthouse visitation	May desire to see inside of the lighthouse, which is only possible through an interpretive tour

Notably, visitors can engage in many of these activities, such as boating and beach recreation at other, more easily accessible sites around the island. However, the refuge offers unique opportunities for wildlife observation, fishing, and lighthouse visitation that users cannot experience at other Nantucket locations.

Private Transportation

All vehicles accessing the refuge through the Wauwinet gatehouse need to purchase a permit from TTOR. Private visitors may purchase a one-day permit for $65 or a seasonal permit for between $125 and $140 depending on the time of the purchase. While private cars make up the majority of seasonal visits, many visitors use rental cars to access the refuge due to the high cost of bringing a car onto Nantucket, and the need for a vehicle capable of driving on loose sand.

Using a personal vehicle to access the refuge and the surrounding peninsula allows for carrying equipment and flexibility in scheduling, but bringing a vehicle onto the island is expensive, and prices for renting a car or purchasing fuel are also significantly higher than on the mainland (see Chapter 1). Drivers not familiar with driving in loose sand also can get stuck en route to the refuge. TTOR reports that on average one vehicle per day typically becomes stranded on the peninsula during the peak season. A towing company rescues stranded vehicles at the expense of the owner.

Rental Automobiles

Agencies on Nantucket offer four-wheel drive vehicles for rental, which typically include special over-sand permits purchased from TTOR for driving on the peninsula. Rental car users must also pay an additional $35 fee to TTOR for daily access through the gatehouse. In 2013, TTOR sold 280 permits to rental car agencies and estimates that visitors made around 2,500 trips to the refuge using rental cars. Figure 14 shows an example of an over-sand permit. However, even without special permits, rental automobiles are expensive on Nantucket. An over-sand vehicle rental costs between around $200 to $350 per day in the peak season (see Chapter 1). Including the TTOR access fee but omitting the cost of fuel, a family of four would pay between $58 and $96 per person to drive a rental car to NNWR.

Privately-owned Automobiles

Most of the remaining 30,000 estimated annual visitors to the peninsula drive their own automobiles capable of over-sand travel. From 2010 to 2013, TTOR sold between 1,669 and 2,068 seasonal permits each year. Sales fluctuated possibly to due to weather, economic conditions, and shore bird nesting closures.

Figure 14: A 2013 TTOR automobile permit

Alternative Transportation

TTOR Tours

TTOR is the only entity that currently offers regular, scheduled transportation to NNWR. They provide or have provided the following van services during the peak or shoulder seasons:

- Twice-daily daytime interpretive van tours, including a lighthouse tour
- Weekend sunset tours, four trips per week
- Morning fishing trips (not currently offered)

TTOR reported a total ridership of 1,160 round-trips in 2013 for the interpretive and sunset tours. This is slightly higher than numbers for previous years, likely because in 2013 tours began departing from downtown rather than the Wauwinet Gatehouse. When access to the refuge is limited during shorebird nesting, TTOR's tours visit other parts of the peninsula. Ridership to NNWR itself is likely around 600 to 800 riders per season.

Because the tours are interpretive and feature only a limited amount of unprogrammed time at the refuge, they primarily appeal to island visitors who would otherwise not be able to visit the refuge. The price for these users is relatively high: $60 for adults and $20 for children. Adult fares were $40 when trips left from the gatehouse, but users often had to pay for a taxi to the departure area; taxi fare is around $45 for a round-trip ride. The price and limited flexibility may make the current TTOR service less appealing to families and large groups, for which a rental vehicle or a privately-booked tour (see below) may be economical.

TTOR reports that tours are currently running at around 54 percent capacity, although this varies by month and season. It is possible that demand may rise now that the tour originates from downtown, and there may be a need for additional capacity during August and September. TTOR use to run fishing tours that were less popular due to variability in tides and competition from chartered boats. Many anglers may also be short-term or long-term island residents, who are more likely to have access to a private automobile or boat capable of traveling to the refuge, and who may not want to be constrained by a scheduled tour.

Alternative transportation to other Nantucket destinations

Visitors and residents on Nantucket use alternative transportation to access several outdoor recreational destinations on the island, including beaches and lighthouses, such as:

- Children's Beach,
- Jetties Beach,
- Surfide Beach,
- Siasconset Beach, and
- Brant Point Lighthouse.

Scheduled and Chartered Tours

As described in Chapter 1, multiple private transportation operators provide scheduled and chartered tours to these and other Nantucket destinations. A few providers also offer service to NNWR. Table 3 lists a partial selection of these tours, including their destinations, capacity, length, vehicle type, and price, based on publicly available information in 2013 and 2014. Many tours combine transportation to a specific destination with a tour that provides interpretation or other entertainment.

Van and SUV tours are less expensive and focus on lighthouses or general island history, sometimes including traveling to Siasconset village on the somewhat more remote eastern side of the island. The highest per-adult price for a non-TTOR tour is $40, and general island tours cost between $12 and $25 per person. There are fewer scheduled options for boat tours, and those that do offer scheduled services cost around $100 per person and reserve the right to cancel or modify trips based on water conditions. A number of providers offer fishing charters, which are also priced at around $100 per passenger for a four-hour tour.

To access wilder, more remote destinations such as the NNWR, Tuckernuck Island, or Muskeget Island, Nantucket visitors typically have to pay more to travel on a boat. Only two of the land operators below, including TTOR, provide access to NNWR, and the expense is greater than other lighthouse or general island tours.

Figure 15: The Nantucket Town Pier. Boat tours that serve downtown Nantucket pick up passengers at this dock or one of the others near the town center.

Table 3: Partial list of private land and water tours; service to or near NNWR marked with *.

Operator	Schedule/ Charter	Vehicle	Type/Duration	Cost
Ara's Tours*	Scheduled & Charter	Van (8 -13 passenger)	• General Tour (1.5 hrs) • Lighthouse Tour, including Great Point (3 hrs)	• $12 per person • Lighthouses: $40 per person or $300 for 8-passenger charter
Gail's Tours	Scheduled	Van (14 passenger)	General History Tour (1.75 hrs)	$25 per adult, children free
Nantucket Island Tours	Scheduled	Bus	General Tour (1.25 hrs)	$20 per adult, $7 per child
Val's Tours of Nantucket	Charter	Van (6 passenger)	Lighthouse / Island Tour (1 - 2 hrs)	$30 per person
Barrett's Tours	Scheduled	Bus	General Tour (1.25 hrs)	$25 per adult
Trustees of Reservations*	Scheduled and Chartered	Van (8 passenger)	• Natural History (3 hrs) • Sunset Tour (2 hrs) • Birding (4 hrs)	• Adult (member): $40 • Adult (non-member): $60 • Child: $20 • Charter: $350 per van
Endeavor Sailing Excursions	Schedule & Charter	Boat	Maritime history (1.5 hrs)	$40 to $50 per person
Shearwater Excursions*	Schedule & Charter	Boat	• Great Point Seals Watch (2 hrs, does not land) • Whale Watch (6 hrs) • Harbor Coffee (1 hr) • Harbor Cocktail (3 hrs) • Sunset: (1.5 hrs)	• Seals: Adult $95, Child $75 • Whales: $165 per person • Harbor: $35 per person • Charter: $450 to $1,500
Cap'n Tobey's Native Water Taxi*	Charter	Boat (6 passenger)	• Great Point (2.5 hrs) • Upper Harbor, Coskata Pond Coatue (2 hrs) • Tuckernuck (2.5 hrs) • Muskeget Seal Colony (3 hrs) • Harbor Tour (1 hr)	• Great Point, Upper Harbor, Tuckernuck: $275 • Muskeget Seal Colony: $375 • Harbor Tour: $140 (For charter of whole boat, max. 6 persons)
Nantucket Adventures, Inc.	Scheduled & Charter	Boat (10 passenger)	• Seal Tour (3 hrs) • Sunset (1.5 hrs) • Fishing (3 hours)	• Per Person: $100 • Private Charter: $500 for first 6 passengers
Absolute Nantucket Sport Fishing	Charter	Boat (6 to 8 passenger)	Fishing (2.5 to 8 hrs)	$575 per 2.5 hours for up to 6 people
Albacore Charters	Charter	Boat	Fishing (2.5 - 12 hrs)	$475 to $1,900
Capt. Tom's Charters	Charter	Boat (4 to 6 passenger)	Fishing (4 hrs)	$450 to $675
***Just Do It Too* Charter**	Charter	Boat (16 passenger)	Fishing (2.5 hrs)	$95 per person, price decreases with volume

Public Transportation and Cycling

A number of the major natural and lighthouse destinations on Nantucket are accessible via transit or bicycle. The Nantucket Regional Transit Authority (NRTA) provides transit service to Jetties Beach and Surfside Beach during the summer season. In 2013, there were 28,862 trips on these two routes. According to NRTA, almost all of the trips on these lines are end-to-end, starting from downtown Nantucket and ending at the beach. Based on this assumption, there are approximately 14,000 seasonal round trip transit journeys to these two beaches. Multiple NRTA routes serve the Siasconset area, although ridership figures are less useful for this study as they serve many other destinations besides the beach.

However, the total alternative transportation mode-share to these sites is likely even higher when walking and cycling are included. Jetties Beach and Brant Point are a 20-minute and 15-minute walk from downtown Nantucket, respectively. Surfside and Siasconset are served by off-road bicycle paths; Surfside is an approximately 15-minute ride while a ride to Siasconset takes around 40 minutes. Table 4 shows alternative transportation travel time to these destinations as well as transit costs, when available.

Table 4: Nantucket outdoor recreation sites accessible via alternative transportation

Destination	Alternative Transportation Access from Downtown (approx.)	Seasonal Alternative Transportation Users	Round-Trip Transit Service Cost
Children's Beach	Site is within downtown	Unavailable	Unavailable
Jetties Beach	20-minute walk, 6-minute bicycle, 15-minute bus ride	6,386 round trip bus rides	$2
Surfside Beach	17-minute cycle, 20-minute bus ride	8,046 round trip bus rides	$4
Siasconset Beach	40-minute cycle, 40-minute bus ride	Unavailable	$4
Brant Point Lighthouse	20-minute walk, 5-minute bicycle	Unavailable	Unavailable

Analysis

A large number of Nantucket visitors are already using alternative transportation to visit waterfront destinations around the island from downtown. While these sites are more easily accessible, the refuge provides experiences, such as isolation and wildlife observation, that other destinations do not. Any future transit or tour service should seek to capture Island visitors that lack an automobile and are drawn to the refuge's unique characteristics. The logistical difficulty of using a car on Nantucket, the expense and challenge of driving on over-sand roads, and the existing culture of transit use for recreation sites suggest that FWS and its partners could successfully bring more visitors to the refuge through alternative transportation. However, many island visitors may not be familiar with the unique character of Great Point and its wildlife, and there are a large number of tours to other parts of the island that compete for visitors' attention. To attract visitors to future refuge alternative transportation, the marketing, price, and format of the service must build on and communicate the attributes that make the refuge a site of national significance.

Despite the rough, sandy routes that limit private vehicle access to the refuge, it is difficult to predict whether expanded alternative transportation will attract long-term and seasonal Nantucket residents, many of whom currently drive to Great Point. In order for a resident to use alternative transportation,

the service would have to offer some advantage over traveling in a personal vehicle. While there may be some residents without four-wheel drive vehicles who would like to use alternative transportation, the most likely reason a resident would use the service is if it could provide some access to the refuge during the plover nesting restrictions. A service that could be used as a transit-style shuttle rather than a guided tour may also be more appealing to Nantucket residents or seasoned refuge visitors. However, any service that leaves users at the refuge without an immediately available return ride would need to be developed with visitor safety in mind.

Chapter 5 uses this principle to provide rough estimates of demand for the most feasible routes and models for operating enhanced service. The estimates operate by assuming that new alternative transportation service can capture varying percentages of the groups described above: existing visitors and those who might otherwise visit other Nantucket sites.

Marketing

As mentioned above, marketing will be an important component for success of any future alternative transportation service. Island residents are familiar with Great Point and the kinds of activities they can pursue on or around the refuge. Many residents and other experienced users already visit the refuge using private vehicles. Marketing for these potential users should focus on the convenience, schedule, and capacity (e.g. for fishing supplies) of the transit provided.

Nantucket visitors, many of whom already walk, cycle, or ride transit to destinations around the island, need to be informed about the availability of the service, as well as about the refuge itself. They may not be familiar with Great Point or understand how it differs from Island beaches that require less time and money to visit. Any marketing campaign should include information about wildlife observation, the historic lighthouse, and the general isolation of the refuge site.

Chapter 3: Alternative Transportation System Scenarios

Nantucket National Wildlife Refuge
Alternative Transportation Access Study

Overview of Scenarios

This chapter presents several alternative transportation scenarios for improving visitor access to NNWR. It also provides an initial evaluation of the feasibility of these scenarios based on conditions at and around the refuge, including land and water-based constraints such as wind and wave activity and regulatory restrictions that protect nesting shorebirds.

In developing alternative transportation scenarios, the project team considered land-based solutions that operate from downtown, the Gatehouse, and at the start of the Galls, as well as water-based solutions that operate from downtown. The primary objective of the scenarios is to bring visitors to Great Point throughout the high season, including two scenarios that attempt to provide access during the resource-based route closures that typically occur in June and July. FWS is particularly interested in exploring solutions that allow visitors to access the refuge during the closures.

The scenarios are based on the following assumptions:

1. The final destination is Great Point.
2. Passengers may have up to one vehicle transfer in each travel direction – any more than that would be too time consuming and inconvenient.
3. Parking restrictions in downtown Nantucket and at the Gatehouse are not limiting factors.

The analysis of water conditions in this chapter suggests that scenarios requiring boat travel are not feasible for regularly scheduled access to the refuge. However, as discussed later in this study, boat service may be appropriate for special interpretive events. Chapter 5 further analyzes the cost and logistics of the remaining options for over-land travel, including the frequency of service and type of operation (i.e. guided tour, transit service, or a hybrid approach). Chapter 6 addresses parking availability and other implementation considerations that span across the proposed scenarios.

Scenario Descriptions

This section introduces and describes the scenarios considered in this analysis. Chapter 4 discusses vehicle options in greater detail. Table 5 provides an overview of the scenarios, with travel distances and estimated travel times, and Figure 16 illustrates the scenarios.

Scenario 1: Vehicle from Downtown to Refuge

In Scenario 1, the vehicle collects passengers from a central location in downtown such as the Maria Mitchell Association aquarium and then drives over town-owned paved roads to the Wauwinet gatehouse. At the gatehouse, the vehicle deflates tires and may pick up additional passengers. The same vehicle then proceeds on over-sand roads to the refuge. The vehicle will need to re-inflate tires at the gatehouse on the return trip. This route is similar to the one that TTOR tours currently take.

Scenario 1a: Vehicle from Downtown to the Galls, new vehicle from Galls to Refuge (during resource restrictions only)

Scenario 1a is the same as Scenario 1, except that, during shorebird-related resource restrictions, visitors will depart the first vehicle at the beginning of the resource restriction, walk along the restricted area, and then board a second vehicle on the other side of the closure. The second vehicle is stationed on the other side of the Galls to shuttle visitors between the Galls and the refuge during the resource nesting period.

On the return trip, visitors take the shuttle back from the refuge to the Galls, walk across the restricted area, and then board the first vehicle on the other side of the Galls to return to downtown. It would need to re-inflate tires at the gatehouse on the return trip.

Depending on where exactly the nesting takes place, this scenario may not be feasible every year. It will need to be assessed each season to determine exact locations and dates.

Scenario 2: Vehicle from Gatehouse to Refuge

In Scenario 2, the vehicle operates from the Wauwinet gatehouse area rather than downtown Nantucket. The vehicle picks up passengers only at the gatehouse area and then proceeds on over-sand roads to the refuge. On the return trip, passengers are dropped off at the gatehouse. No adjustment of tire inflation is necessary. This scenario most closely resembles the service that TTOR provided prior to the summer of 2013.

Scenario 3: Vehicle from downtown to Gatehouse, over-sand vehicle (OSV) to Refuge

In Scenario 3, a vehicle picks up passengers from a central location in downtown and drives over town paved roads to the Wauwinet gatehouse. At the gatehouse, passengers change vehicles to a second vehicle equipped for over-sand travel (with its tires already at the appropriate pressure level). The second vehicle proceeds on over-sand roads to the refuge. On the return trip, the in-town vehicle picks up passengers at the gatehouse to bring them back downtown. The same driver would likely operate both vehicles, although a high-frequency service could employ a second driver for the over-sand portion while the initial driver returns to downtown to pick up more visitors.

Scenario 4: Galls Closure Shuttle (during resource restrictions only)

In Scenario 4, visitors travel in personal vehicles to the beginning of the restricted area at the Galls. As when visiting when the Galls are not closed for vehicles, drivers must still obtain permits from TTOR, deflate tires at the gatehouse, and use a vehicle capable of traveling over sand. Visitors would park in a designated area near the closure, walk along the restricted area, and board a vehicle stationed on the other side of the Galls to shuttle visitors between the Galls and the refuge during the resource nesting period. On the return trip, visitors ride the vehicle from the refuge to the Galls, walk along the restricted area, and then use their own vehicles to depart. Depending on where exactly the nesting takes place, this scenario may not be feasible every year. It will need to be assessed each season to determine exact locations and dates.

Scenario 5: Boat from downtown to Refuge

In Scenario 5, regular boat service directly to the refuge operates from a central location in downtown such as the Boat Basin docks or Town docks. The boat operates at no-wake speeds until the breakwater at the edge of Nantucket Harbor. The boat then operates in open waters to the refuge. The boat beaches at the refuge to let visitors off, and then anchors offshore during the visit. On the return trip, the boat returns to the shore to pick up visitors and bring them back downtown.

Scenario 6: Boat from downtown to Head of Harbor, OSV to refuge

In Scenario 6, regular boat service to the refuge operates from a central location in downtown such as the Boat Basin docks or Town docks. The boat operates through Nantucket Harbor to the Head of Harbor location. At the Head of Harbor, visitors disembark the boat and board a van equipped for over-sand travel. This vehicle proceeds on over-sand roads to the refuge. On the return trip, the van brings visitors back to Head of Harbor, where they board the boat for the trip back to downtown.

Table 5: Scenario overview. All distances in miles. Travel time includes deflating tires, changing vehicles, etc.

Scenario		Land Distance	Water Distance	One-way Travel Time	Number of Vehicles
1	Van service from downtown to refuge	13.50		65	1
1a	Van service from downtown to Galls, shuttle through Galls	13.50		100	2
2	Van service from gatehouse to refuge	5.20		35	1
3	Van service from downtown to gatehouse, OSV to refuge	13.50		60	2
4	Galls Shuttle (standalone)	2.25		50	1
5	Boat service from downtown to refuge		8.00	45	1
6	Boat service from downtown to Head of Harbor, OSV to refuge	4.16	10.23	65	2

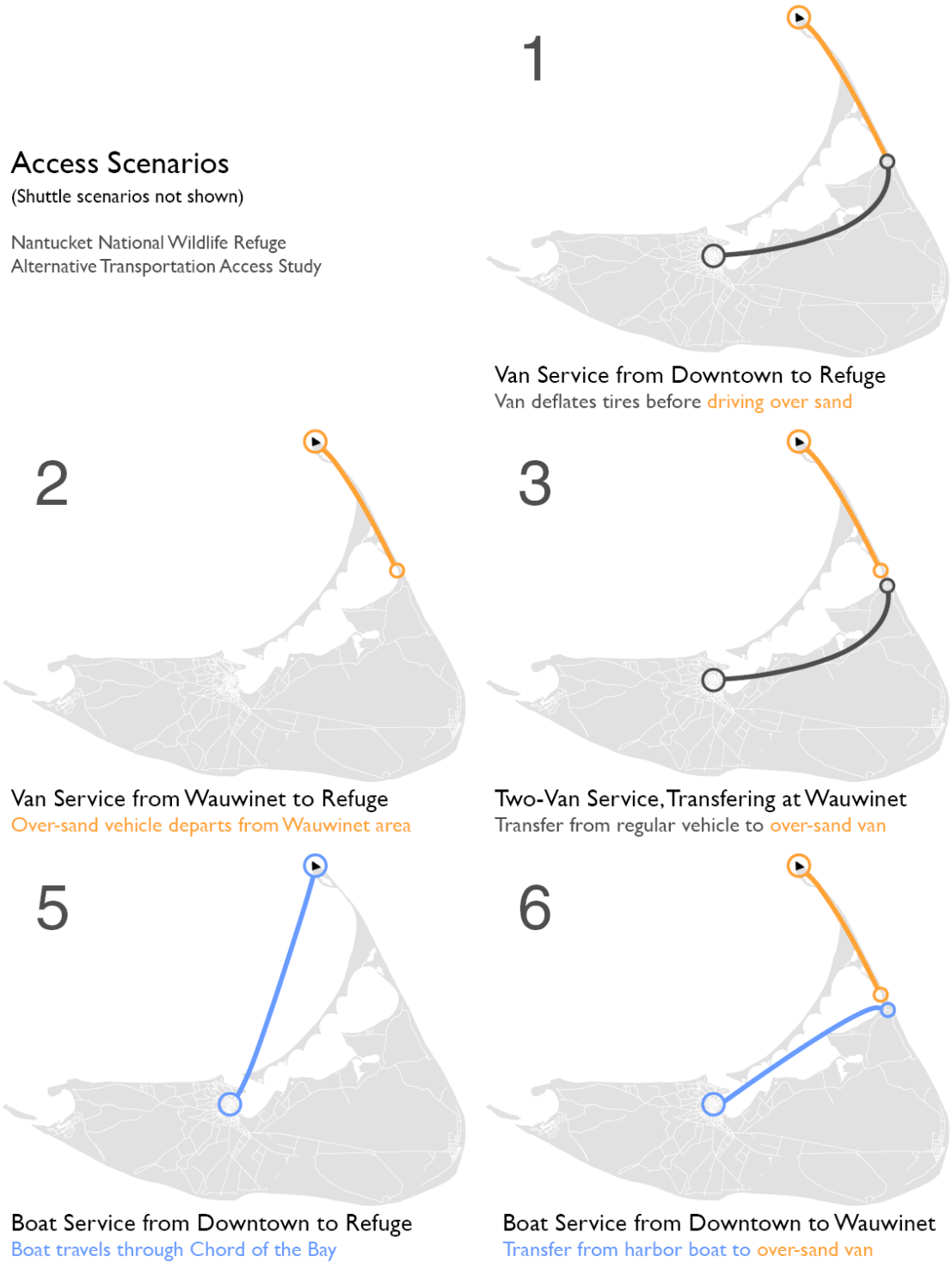
Access during Galls Restrictions

In addition to the larger challenges of accessing the refuge without a personal vehicle, there are further complications in June and July when the area around the Galls is typically closed to vehicular traffic due to plover nesting and fledging. The project team considered both water-based and land-based options to reach the refuge during the restricted period.

Water-Based Transportation Feasibility

Visiting the refuge by boat is appealing, given the interest of many Nantucket visitors in boat recreation on the island, and the possibility of bypassing summer traffic congestion. However, water access raises additional challenges, particularly related to the effects of adverse wind and weather conditions. Prior to conducting a more thorough assessment of costs and implementation issues, the project team explored the feasibility of regular boat access to the refuge.

Figure 16: Non-shuttle access scenario summary



The exposed location of Great Point makes boat service dependent on wind and wave conditions, which impact both ride comfort and safety, particularly when disembarking at the refuge. Medium-sized waves can make the boat ride uncomfortable for passengers and make it difficult to land safely on the beach; larger waves can make the boat ride unstable enough to be unsafe. Based on projected demand and cost, this study assumes that the boat providing service to Great Point would be small, with a capacity of approximately 20 passengers.

To estimate the number of days that boat service could operate safely, the project team analyzed daily wind conditions for 2010-2012, using hourly wind data to calculate average daily wind speeds. The average daily wind speeds were then divided by their respective Beaufort numbers to estimate average wave heights for each day.[22] Days with waves too large for the estimated boat size can be disqualified. Table 6 provides additional information about operating wind and wave conditions for small boats.

Table 6: Small boat operations in waves

Beaufort Number	Wind Speed[23]	Approximate Wave Height	Boat Operation Safe?	Description
0	< 1 knot	0 feet	Yes	Comfortable ride; safe to land and disembark.
1	1 – 3 knots	0 – 1 feet	Yes	Comfortable ride; safe to land and disembark.
2	4 – 6 knots	1 – 2 feet	Yes	Ride begins to be affected by waves; safe landings slightly more difficult.
3	7 – 10 knots	2 – 3.5 feet	No	Ride uncomfortable; landings difficult and should be reserved for emergencies.
4 and above	11 knots +	3.5 feet +	No	Not safe for passenger craft of this size.

Based on the scale in Table 6, any day on which the wind leads to a Beaufort Number 3 or above is not considered suitable for water-based transportation to Great Point.

In addition to wind criteria, the project team gathered precipitation data to estimate additional days on which there would be little or no passenger demand.[24] Any day with hourly rainfall greater than 0.01 inches for one hour between the hours of 8AM and 6PM was disqualified. Table 7 shows the results for disqualified days for 2010, 2011, and 2012.

[22] Beaufort numbers come from the Beaufort scale, an empirical measuring system that relates wind speeds to sea conditions.
[23] Source: NOAA National Data Buoy Center
[24] Source: NOAA National Climatic Data Center

Table 7: Disqualified operational days 2010-2012

	Number of Days Disqualified for Wind Conditions*	Number of Days Disqualified for Rain Conditions**	Total Number of Days Disqualified***	Total Days in Each Month	% of Days Disqualified
2010					
May-10	17	1	18	31	**58.1%**
Jun-10	13	4	15	30	**50.0%**
Jul-10	11	3	13	31	**41.9%**
Aug-10	10	3	10	31	**32.3%**
Sep-10	19	2	19	30	**63.3%**
2010 TOTAL:	**70**	**13**	**75**	**153**	**49.0%**
2011					
May-11	20	5	22	31	**71.0%**
Jun-11	12	3	13	30	**43.3%**
Jul-11	8	1	9	31	**29.0%**
Aug-11	9	3	10	31	**32.3%**
Sep-11	12	3	13	30	**43.3%**
2011 TOTAL:	**61**	**15**	**67**	**153**	**43.8%**
2012					
May-12	15	5	15	31	**48.4%**
Jun-12	13	4	15	30	**50.0%**
Jul-12	11	4	12	31	**38.7%**
Aug-12	7	5	11	31	**35.5%**
Sep-12	15	5	17	30	**56.7%**
2012 TOTAL:	**61**	**23**	**70**	**153**	**45.8%**

** Average Wind Speed rates a "3" or greater on the Beaufort Scale [6.5 kts or greater]*
***Hourly Rainfall is > 0.01" for one hour between 8am and 6pm*
**** Wind or Rain. Can be less than the sum of days disqualified for wind and days disqualified for rain, since some days disqualified for wind are also disqualified for rain*

Based on the rain and wind data above, between 2010 and 2012, almost one half of the days in the peak season would not have been suitable for water-based service to Great Point.

In addition to calculating wind and rain conditions, the project team met with leisure and professional boaters on Nantucket to take advance of local knowledge of boat operations to Great Point. Those interviewed indicated serious concerns about the exposed waters, risks associated with dropping passengers off onto the beach, passenger injuries, insurance requirements, and service reliability. One operator specifically noted that although Nantucket Sound might be calm enough to take a boat out toward NNWR, the direction of the wave swells at Great Point itself might make it impossible to land the boat safely. Unfortunately, it might not be possible to predict the on-site wave conditions before the boat arrives at Great Point. Based on these calculations and discussions, the project team decided not to pursue boat service directly to Great Point (Scenario 5).

Another option for water-based transportation would be to operate boat service from downtown Nantucket to Head of Harbor, at which point passengers would transfer to an OSV to continue on to the refuge (Scenario 6). Because Head of Harbor is in waters protected from the open ocean, this service is likely to be highly reliable, as waves and swells are of less concern if only operating within Nantucket Harbor. However, the primary reason for pursuing water-based transportation is to be able to bypass the access restrictions at the Galls. Bringing the boat to Head of Harbor does not bypass the resource closures at the Galls during plover nesting, limiting the benefit of this scenario over land-based scenarios.

Also, water-based transportation will have higher capital and operating costs than land-based transportation. Initial capital costs for the boat can be as much as five times the cost of a van with the same passenger capacity, boats are typically less fuel efficient than vans, the boat will require annual U.S. Coast Guard (USCG) inspections, the captain of the boat will have to be USCG licensed, and any boat operation carrying more than six passengers is required to have a deck mate onboard as well. For these reasons, the project team chose not to pursue the water-based transportation scenarios further.

Use of an Amphibious Vehicle

Amphibious passenger vehicles are transport vehicles which operate both on land and in water. The best example of an amphibious passenger vehicle is a DUKW, also known as a “duck boat.” DUKWs are military amphibious all-wheel-drive vehicles which were used in World War II. Many DUKWs have been converted to passenger use for land and water tours and interpretation (see Figure 17).

Figure 17: Duck Boat tour in Boston. Source: John Tolva via Flickr

In theory, using an amphibious vehicle for water-based transportation from downtown Nantucket to Great Point could eliminate the concerns of battling waves and swells while passengers disembark. When the DUKW reached Great Point, it could be driven onto the beach to drop off passengers. However, the USCG will not certify a DUKW for use on the route to Great Point.[25] DUKWs are restricted to operate in protected waters, which are sheltered waters presenting no special hazards, such as most rivers and harbors. Because the route to Great Point includes both partially protected and exposed waters, a DUKW cannot pass the USCG stability requirements for operating in the harsher environment of Nantucket Sound. Therefore, the project team chose not to pursue use of amphibious vehicles.

Land-Based Access during the Galls Restrictions

As discussed in Chapter 1, a portion of the refuge access road, near the Galls area of the Coskata-Coatue Peninsula, typically must be closed to non-essential vehicles in June and July to protect nesting shorebirds. Vehicles impede foraging and can accidentally crush plover eggs and chicks. The discussion below about plover protection requirements is designed to inform implementation of alternative transportation service; the text links to further resources and guidance where appropriate.

Plover Protection Requirements

Federal and state guidelines indicate that plover nesting habitat should be identified and delineated with posts, warning signs, or symbolic fencing on or before April 1 each year. All vehicular access into or through posted nesting habitat should be prohibited. However, prior to hatching, vehicles may operate

[25] USCG NVIC 1-01, http://www.uscg.mil/hq/cg5/nvic/pdf/2001/n1-01.pdf

through designated vehicle corridors established along the outside edge of plover nesting habitat. Once chicks hatch, vehicles should be restricted in those corridors until chicks have fledged.[26]

State and Federal regulations require delineating a minimum 50-meter radius around nests in locations where pedestrians, joggers, sun-bathers, picnickers, fishermen, boaters, or other recreational users are present.[27] A buffer of 1000 meters on either side of the nesting area further limits automobiles, unless portions of the protected area are inaccessible to chicks due to natural obstacles such as topography or vegetation. There may be instances in which a smaller buffer area would be appropriate given observed chick behavior; such a case would require the FWS or appropriate State agency to develop an agreement under Section 6 of the Endangered Species Act to develop an ongoing monitoring plan.[28]

Only "essential vehicles" may travel on sections of beaches where unfledged plover chicks are present if such travel is absolutely necessary, and no other reasonable travel routes are available. For transportation access, FWS and its partners would need to justify how refuge visitation for wildlife-dependent recreation is essential and also follow additional guidelines for vehicles:

1. Essential vehicles should travel through chick habitat areas only during daylight hours, and should be guided by a qualified monitor who has first determined the location of all unfledged plover chicks.
2. Speed of vehicles should not exceed five miles per hour.
3. Use of open 4-wheel motorized all-terrain vehicles is recommended when possible because of the improved visibility afforded operators.
4. Beach managers should maintain logs of vehicle activity through areas where unfledged chicks are present, as well as the numbers and locations of unfledged plover chicks. Drivers of essential vehicles should review the log each day to determine the most recent number and location of unfledged chicks.[5]

Land-Based Travel Options

This study considers the possibility of stationing a shuttle vehicle on the other side of the restricted area. Visitors would use a combination of over-sand vehicle travel and walking past the restricted area to reach the shuttle vehicle, which would transport them the remaining distance to Great Point.

The width of the Galls area appears to decrease from approximately 660 feet (183 meters) at its opening and widest point, to approximately 165 feet (50.3 meters) at the narrowest point. At mile marker 3, which is near where the restriction typically begins, the width is approximately 405 feet (123 meters). These widths suggest that it might be possible to establish the necessary 50-meter radius around the fledging plover and allow pedestrian access, but there would not be sufficient width to allow for driving non-essential vehicles, even under the special case of a 100-200 meter buffer (see Figure 18).

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[26] Plover chicks are considered fledged at 35 days of age or whenever in sustained flight for at least 15 meters, whichever occurs first.

[27] http://www.massaudubon.org/PDF/cwp/piping_plover_landowners.pdf

[28] The buffer could not be smaller than 100 meters. Nantucket National Wildlife Refuge Comprehensive Conservation Plan, Appendix I: Federal and State Piping Plover Recovery Guidelines.
http://www.fws.gov/northeast/planning/nantucket/pdf/FinalCCP/16w_Appendix_I_Piping_Plover_Recovery_Guidelines%28999KB%29.pdf

Figure 18: Satellite image of the Galls showing a typical nesting site with required 50m pedestrian buffer and 1000m vehicle buffer

The extent of the restricted area on the Galls varies depending on where the birds have nested; it typically can range up to 1.5, once the 1000 meter buffer is included. During the restricted period, some visitors park near the fencing and hike the remaining roughly 2.2 miles to Great Point, some park and then fish or picnic near the closure point, and others visit other destinations on TTOR and NCF land. The restrictions are one of the reasons that FWS is interested in an alternative way to access to the refuge.

This study considers two options for shuttle service during the access restrictions:

- Connect to Scenario 1 (Scenario 1a) – Visitors would board the vehicle in downtown Nantucket and travel to the beginning of the restricted Galls area. The visitors and driver would disembark and walk together along the shoreline, on a designated path away from the nests and birds. Once past the restricted area, the visitors and driver would all board the waiting vehicle and travel the remaining distance to Great Point. This scenario would require two vehicles – one to go from downtown to the restricted area, and one to travel the remaining distance. It would likely make two round trips per day.
- Standalone shuttle service (Scenario 4) – visitors would travel to the beginning of the restricted area individually, either hiking (a distance of approximately three miles) or with personal vehicles that are equipped for over-sand travel. They would park their vehicles in a designated area prior to the restricted area, and then walk along the shoreline, on a designated path away from the nests and birds. Once past the restricted area, the waiting vehicle would travel back and forth to Great Point on a fixed schedule.

This service would operate only when the area around the Galls is restricted, and exact dates and ability to operate might vary from year to year, depending on when and exactly where the birds have nested. These options are included in the financial analysis and further discussions of implementation and feasibility.

Conclusions

Any solution for increasing alternative transportation access to the refuge must address the challenges posed by its remote and sensitive location. While boats can access the refuge on tranquil days, bypassing Nantucket traffic and peak-season resource closures, water conditions make scheduled boat service an impractical option for bringing visitors to the refuge without the use of a private automobile.

Shorebird nesting closures also pose a challenge for van service. It may be possible to use multiple vehicles and station one past the closure, though such a strategy would have significant challenges of its own in order to be implemented appropriately. This is discussed in Chapter 6 along with other overall considerations for implementing enhanced alternative transportation service. FWS may end up finding that it is most appropriate to pursue alternative transportation options that do not provide physical access during the shorebird nesting restrictions. This report addresses these along with other cost and implementation considerations in the subsequent chapters.

Chapter 4: Vehicle Options

Nantucket National Wildlife Refuge
Alternative Transportation Access Study

One critical element of analyzing transportation service options is to identify a range of appropriate vehicles and costs. The vehicle should be appropriately sized for anticipated passenger demand, and also meet several physical and regulatory requirements.

Vehicle Criteria

Any vehicle providing alternative transportation access to the refuge will need to be able to operate in the over-sand environment along the peninsula, as well as provide access for people with disabilities. These constraints, which are addressed in this section, help to define the universe of vehicles available and appropriate for such a transportation service.

Physical Constraints

TTOR requires any vehicle used for over-sand travel on TTOR land to be equipped with four-wheel drive.[29] Several of the over-sand access paths are also quite narrow, which may cause difficulties for wider vehicles. There are sharp ridges in the sand that may cause vehicles with longer wheelbases to bottom out at the peaks, and small valleys in the sand that may cause vehicles with longer overhangs to dig in to the sand. Vehicles will have to be street legal in order to pick up passengers downtown, refuel at in-town gas stations, and access maintenance facilities as needed.

There are two vehicle dealerships located on Nantucket Island that are capable of performing maintenance and warranty work – Ford and Chrysler/Jeep/Dodge/Ram. Given the logistical complications and expense of transporting a vehicle to and from Nantucket Island, the project team recommends using a vehicle that can be serviced by one of these two dealerships. The Chrysler/Jeep/Dodge/Ram vehicle lineup does not include any vans or buses with a four-wheel-drive conversion option; therefore, the project team recommends pursuing Ford-based vehicles.

Regulatory Constraints

In addition to the physical constraints on the vehicles, there are Federal and State laws with which any transit vehicle must comply. Federal laws require all vehicles used in a transportation system operated by FWS to be wheelchair accessible per the technical requirements set forth in the Americans with Disabilities Act (ADA) Accessibility Guidelines for Transportation Vehicles. If the service is operated by a third party, there has to be a vehicle available that meets the ADA technical requirements to provide equivalent service. Accessibility regulatory requirements are described in more detail in Appendix II.

Massachusetts law requires that drivers operating a vehicle designed to transport 16 or more persons (including the operator) hold a Commercial Driver's License (CDL).[30] Given the additional expense and complication of requiring a CDL and anticipated ridership demand, the project team recommends that vehicle options be limited to those with one operator and no more than 14 passengers. If, as time goes on, FWS and partners identify significantly higher visitor demand, it may be appropriate to consider larger vehicles and hire operators with the CDL.

Over-sand Vehicles

The project team conducted a thorough search for vehicles meeting the above criteria using the GSA Motor Vehicle Management Alternative Fuel Vehicle Acquisition Tool[31] and internet searches. Examples of several vehicle options are presented below to describe a range of options and for use in the cost estimation model. It should be noted that manufacturers change product lines over time and depending on if or when FWS is ready to pursue alternative transportation service, these specific vehicles may not

[29] http://www.thetrustees.org/places-to-visit/before-you-visit/before-setting-out.html
[30] http://www.massrmv.com/rmv/cdlmanual/Introduction.pdf
[31] http://www.gsa.gov/portal/content/104211

be available. However, even if these specific options are not available, there will likely be other similar options at a comparable price.

Enclosed Vans

Ford paratransit vans are available from several conversion companies. Paratransit vans are based on full-size vans but have been modified to allow for wheelchair access. The modifications increase the roof height of the van, install an electric-powered folding wheelchair lift, and reconfigure the seating inside the van to allow for a wheelchair space. Paratransit vans are typically two-wheel drive, but four-wheel drive conversion packages are available. Figure 19 shows a wheelchair van that has not been converted to include four-wheel drive capability.

Figure 19: Ford Wheelchair Van Without Four-Wheel Drive Conversion. Source: MobilityWorks

Enclosed Buses

Several manufacturers build Ford-powered mini-buses. Most of the buses have the option of an integrated wheelchair lift from the manufacturer, and many can also accept a four-wheel drive conversion. The mini-buses are longer and wider than a van, which may impact maneuverability on the over-sand paths to the refuge, but the larger size will also increase per-trip passenger capacity. Figure 20 shows an enclosed bus without the four-wheel drive conversion.

Figure 20: Champion Challenger Without Four-Wheel Drive Conversion. Source: Champion Bus

Open-Air Shuttles

Several styles of Ford-powered open air shuttles are available, but most do not fit the criteria required to operate to NNWR. Many of the tram-type vehicles have had chassis modifications, preventing a four-wheel drive system from being installed, and many are also speed-limited, which would prevent them from operating on public roadways. Only one option was found which can accept a four-wheel drive conversion, the Classic American Tram. This vehicle is open-air, with options for rain curtains and ADA accessibility packages. A non-four-wheel drive version of this vehicle provides the shuttle service at Back Bay National Wildlife Refuge. Figure 21 shows a tram with four-wheel drive conversion.

Figure 21: Classic American Tram with Four-Wheel Drive Conversion. Source: Specialty Vehicles

OSV Costs and Capacity Options

The purchase price and passenger capacity of each style of vehicle will depend on the specific model purchased and the seating configuration used. The total cost for each vehicle consists of the base purchase price, the cost to install a four-wheel drive system, and an estimated price for additional vehicle options, such as a public address announcing system. The passenger capacities will depend on whether there are only able-bodied (AB) persons on board the vehicle, or if the seating configuration is adjusted to allow for a wheelchair (WC) passenger.

The estimated costs and passenger capacities for each of the over-sand vehicle options are shown below in Table 8.

Table 8: OSV Options

Style	Example Model	Base Cost	4WD Conv. Cost	Option Cost (Est.)	Total Cost (Est.)	Capacity w/o WC Passenger	Capacity w/ WC Passenger	Width
Van	Mobility Works E350 Rear Lift	$38,536	$12,295	$5,000	$55,831	1 Operator 9 AB	1 Operator 7 AB 1 WC	79.5”
Mini-Bus	Champion Challenger	$60,285	$12,495	$10,000	$78,780	1 Operator 14 AB	1 Operator 13 AB 1 WC	96”
Tram	Classic American Tram	$87,750 +10%*	$12,495	$10,000	$119,020	1 Operator 14 AB	1 Operator 13 AB 1 WC	96”

* When purchasing non-standard vehicles through GSA, a 10% fee is added.

In-Town Vehicle

Scenario 3 includes an additional vehicle to transport passengers from Downtown to the Wauwinet Gatehouse. As this vehicle will only be operating on paved roads, it will not be required to have four-wheel drive, and vehicle width will be less of a concern. The vehicle would still have to have a wheelchair lift and would still be limited to one operator and 14 passengers or require that the operator hold a CDL.

Purchasing an In-Town Vehicle

The estimated costs and passenger capacities for each of the in-town vehicle options are shown below in Table 9. These are the same vehicles as could be used for over-sand, but without the additional capital cost of the four-wheel drive conversion (differences in operations and maintenance costs are discussed in Chapter 5).

Table 9: In-Town Vehicle Purchase Options

Style	Model	Base Cost	Option Cost (Est.)	Total Cost (Est.)	Capacity w/o WC Passenger	Capacity w/ WC Passenger
Van	Mobility Works E350 Rear Lift	$38,536	$5,000	$43,536	1 Operator 9 AB	1 Operator 7 AB 1 WC
Mini-Bus	Champion Challenger	$60,285	$10,000	$70,285	1 Operator 14 AB	1 Operator 13 AB 1 WC
Tram	Classic American Tram	$87,750 +10% GSA Fee	$10,000	$106,525	1 Operator 14 AB	1 Operator 13 AB 1 WC

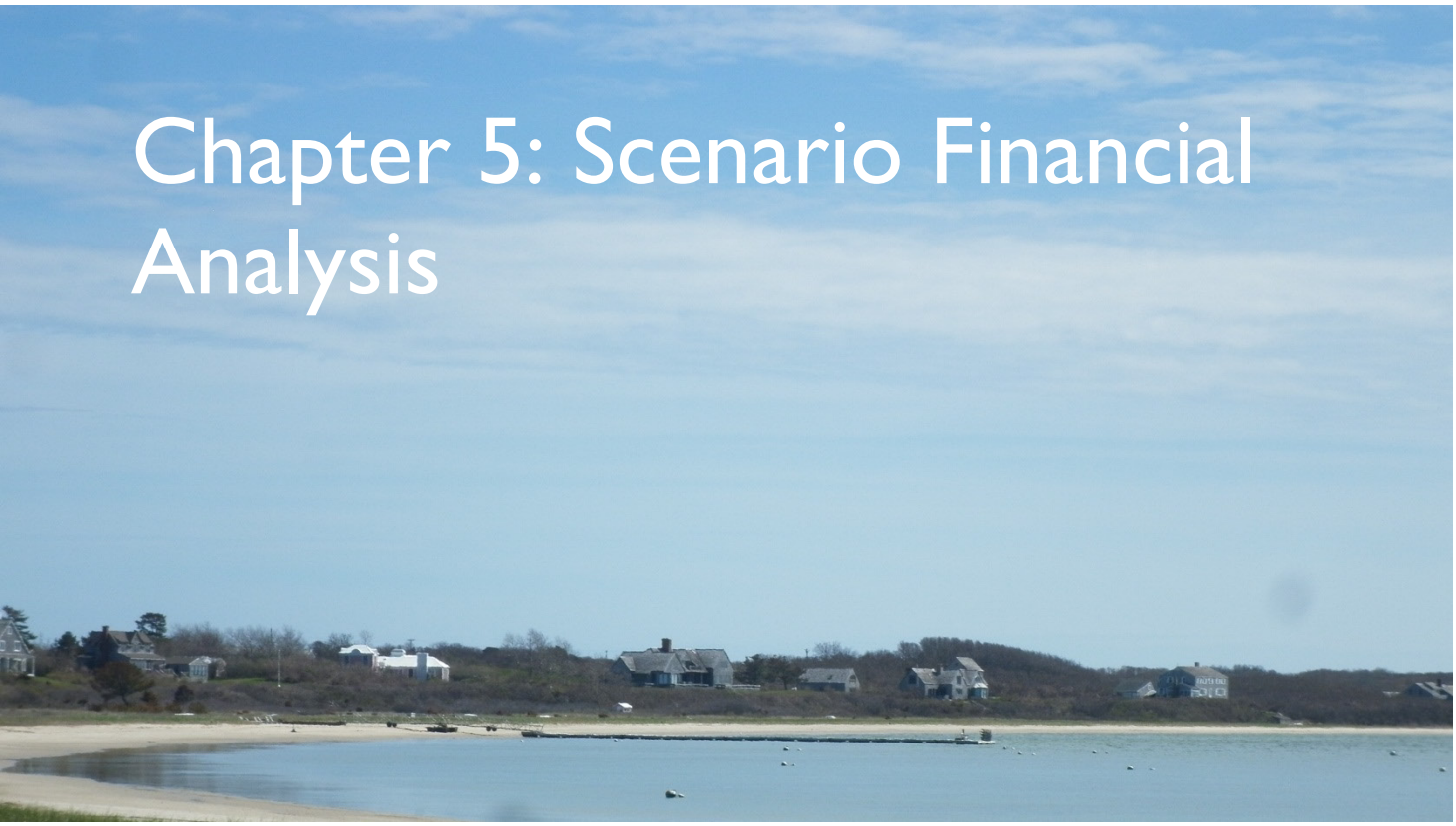
Vehicles Used in Cost Analysis

The cost estimation analysis discussed in Chapter 5 uses two vehicle options: the Mobility Works E350 Rear Lift with four-wheel drive conversion and the Classic American Tram with four-wheel drive conversion. These options were chosen based on the cost, size restrictions, and passenger experience. The van can carry nine able-bodied persons or seven able-bodied persons and one wheelchair. The van is the least expensive option and will be the easiest to maneuver on the sand access paths to Great Point. The tram can carry 14 able-bodied persons or 13 able-bodied persons and one wheelchair. While the tram is the most expensive option and the size makes it less maneuverable, it can carry the most passengers per trip, and the open-air experience of the tram may be appealing for visitors.

Leasing an In-Town Vehicle

Depending on the service scenario FWS decides to pursue, it may be possible to consider leasing a vehicle. Leasing provides more flexibility for NNWR to pilot test service to Great Point without having to make the commitment of the capital cost of a vehicle. It is unlikely that FWS would be able to lease a vehicle and then perform the four-wheel drive conversion and still maintain the terms of the lease; leasing options will likely be limited to the in-town portion of Scenario 3. There should be available wheelchair vans or mini-buses that FWS or its partners could consider leasing. Leases could go through private providers, or if FWS will be operating the vehicle, it may be able to lease vehicle through GSA. If leasing, FWS or the operating partner will need to account for the additional logistics required to manage the lease.

Chapter 5: Scenario Financial Analysis



Nantucket National Wildlife Refuge
Alternative Transportation Access Study

As discussed in Chapter 3, the project team developed several broad scenarios for enhancing access to the refuge, including boat service, land-vehicle service, and options that combine both. The team analyzed logistical barriers such as weather to conclude that the options that use a van or other land-based vehicle are the most practical options for enhancing access to the Nantucket NWR. This chapter analyzes the costs and implementation options of the remaining four scenarios in more detail and then examines how ridership and demand would affect feasibility based on the demand analysis in Chapter 2.

This chapter focuses on the following scenarios, which are described in greater detail in Chapter 3:

Do Not Operate During Resource Closures

- Scenario 1: Van from Downtown to Refuge
- Scenario 2: Van from Gatehouse to Refuge
- Scenario 3: Van from downtown to Gatehouse with an over-sand vehicle (OSV) to refuge

Operate During Resource Closure

- Scenario 1a: same as Scenario 1 with additional shuttle vehicle stationed on the other side of the restricted area in June and July
- Scenario 4: Shuttle service during Galls closures that serves visitors driving to the closure point

This section begins with a description of different operating strategies for the land-based scenarios. It then describes the financial model and presents figures and tables comparing the scenarios' estimated operating and implementation costs. The section ends by using the demand analysis from Chapter 2 to estimate ridership levels necessary to sustain each scenario.

Service Operating Models

For any scenario, there are multiple operating models for providing alternative transportation service to the refuge. Each operating model poses different opportunities and challenges related to issues such as cost, safety, and service frequency. The project team discussed and evaluated three operational models: transit, drop-off and wait, and guided tour.

Transit

Similar to a conventional transit service, the vehicle in this operating model takes passengers to the refuge and then returns with any departing visitors to its origin downtown or at the Wauwinet Gatehouse. There is no associated onsite programming for passengers. The trips run on a regular schedule; passengers need not necessarily return on the same trip on which they depart.

This model is time efficient because the driver and vehicle can make multiple trips during the day. However, many visitors that arrive at the refuge throughout the day may want to leave during a relatively small period of time at the end of the day. This could create more demand for return trips than can be accommodated, especially given the relatively small vehicle sizes required by the over-sand access route.

While it is possible to manage capacity to accommodate daily "peaking" of demand, the possibility of inclement weather poses a related but more significant challenge. Should an unexpected weather event threaten visitor safety, the service operator would need to bring all on-site visitors back from the Refuge immediately. This would strain service capacity and, unlike an expected end-of-day peak, would be difficult to plan for.

Finally, the open-ended nature of the transit trip may reduce the number of passengers the service can accommodate compared to a drop-off-and-wait service making the same number of trips. This

likelihood is based on the assumption that few passengers would make use of the first return trip, since it occurs immediately after the first arrival trip unloads, or the last arrival trip, since there would be no service to bring visitors back later the in the day. Thus, while the transit implementation of Scenario 1, for example, provides more daily trips, its overall capacity is likely the same as the drop-off-and-wait service under the same scenario.

Drop-off and wait

The vehicle brings passengers to the refuge, lingers for a period of time, and returns with all passengers to its origin. Visitors determine their own activities on-site during the period of time that they are there. This is the simplest model and avoids the time-of-day and weather-related peaks that are possible in the transit model. However, the need for the driver to be present on the refuge at all times means that he or she cannot make additional trips while passengers are at the refuge.

In addition, the scheduled length of stay for each group could limit the activities available to visitors, which could reduce demand among those who would like to spend the entire day at Great Point or who seek to experience the relative isolation of the refuge's wilderness. The period of time of the trip must be considered carefully.

Guided tour

This model is operationally similar to the drop-off and wait model, except that a driver and/or tour guide provides narration about the site's heritage and natural resources during the trip and guides visitors around the refuge. Visitors would not be required to stay on the vehicle the entire time; the driver/tour guide could disembark with the visitors at different locations for various amounts of time.

While it does not affect the cost predictions below, a guided tour may attract different types of users than other types of transportation service.

Vehicle Types

The project team identified two types of land vehicles most suitable for access to the refuge. Both can be modified to allow for over-sand travel and to accommodate passengers in wheelchairs. Each has certain advantages and disadvantages, which are explored in greater detail in Chapter 4.

- **Passenger vans**: Compact, less expensive vehicles; provide limited views of the surrounding landscape.
- **Open-air tram:** Provide views and exposure to surrounding scenery, but are larger in size, more expensive, and may offer limited protection from insects or inclement weather.

While the capital and operating cost of tram service is higher than for passenger vans, for the purposes of the financial operating model, the marginal increase in total annual operating cost is relatively minor. For simplicity, each cost model uses passenger vans.

Cost Model Assumptions

To analyze different access scenarios and operating decisions, the project team created a series of financial and operational projections based on the Bus Lifecycle Cost Model that the Volpe Center

developed for the Department of the Interior in 2011.[32] The projections in this analysis draw from cost assumptions included in this model as well as other sources described below.

Vehicle capital cost

The project team conducted a thorough analysis of potential vehicles, which is described in greater detail in Chapter 4.

Based on the vehicle recommendations, the operations models use the Ford E350 4x4 10-Passenger Vans for conventional van service or 15-passenger Classic American Trams for open-air tram service. The cost of these vehicles is adjusted to include accessibility features and, when required, 4-wheel-drive conversion for over-sand travel. Table 10 lists the costs of the vehicle options and the specific adjustments used to calculate these costs.

Table 10: Purchasing cost of vehicle costs used in model. See Chapter 4 for more detail.

Style	OSV	Example Model	Base Cost	4WD Conv. Cost	Option Cost (Est.)	Total Cost (Est.)	Expected Life (years)
Van	Yes	Mobility Works E350 Rear Lift	$38,536	$12,295	$5,000	**$55,831**	**5**
	No	Mobility Works E350 Rear Lift	$38,536	-	$5,000	**$43,536**	**10**
Tram	Yes	Classic American Tram	$87,750 +10% GSA Fee	$12,495	$10,000	**$119,020**	**5**
	No	Classic American Tram	$87,750 +10% GSA Fee	-	$10,000	**$106,525**	**10**

The cost model output as presented in this chapter includes only operating costs, and excludes the capital cost of obtaining vehicles. This reflects the study recommendation for FWS to pursue grant funding for any service's initial capital costs, and provides a better picture of potential cost per rider should FWS or its partners obtain a capital grant.

The project team also ran the model with vehicle costs included and annualized—divided across each year of the vehicle's life. Annualizing the vehicle cost does not include the cost of financing but does provide a general sense of the vehicle's contribution to the overall cost of providing the service. The expected operating life of the vehicles is based on discussions with refuge and partner agency staff. Vehicles that routinely operate over sand typically wear out much more quickly than those that only travel on paved roads. The model also assumes purchase of a backup vehicle for emergencies and breakdowns.

[32] US Department of Transportation Volpe Center / US Department of the Interior, *Bus and Ferry Lifecycle Cost Modeling*, December 2011. http://www.volpe.dot.gov/transportation-planning/public-lands/department-interior-bus-and-ferry-lifecycle-cost-modeling

Table 11: Initial capital costs for each scenario

Scenario	OSVs	Non-OSVs	Shuttle Vehicles	Vehicle Cost (Van)	Vehicle Cost (Tram)
Scenario 1	2			$111,662	$200,490
Scenario 2	2			$111,662	$200,490
Scenario 3	2	1		$155,198	$288,240
Scenario 1a	2		1	$167,493	$300,735
Scenario 4	1		1	$111,662	$200,490

Table 11 lists the total initial capital cost for each scenario. These costs, when annualized, comprise 36 to 58 percent of the annual cost of running enhanced transit service. Thus, a capital grant for acquiring vehicles significantly reduces the cost of providing alternative transportation service to the refuge.

Vehicle operations and maintenance

The Bus Lifecycle Cost Model provides maintenance and fuel usage estimates for a variety of alternative transportation vehicles, including passenger vans and larger cutaway vans that are similar to open-air tram options studied. The project team used the operating cost estimates in the Bus Lifecycle Model as a base and adjusted them according to the particular conditions on and around the NNWR.

In particular, as the Bus Lifecycle Cost Model does not calculate maintenance and fuel costs for over-sand service, the project team adjusted the financial models to make conservative assumptions about over-sand fuel economy and deterioration. These adjustments account for increased wear and tear on the vehicle, reduced momentum for the vehicle, and the related need for fuel-consuming all-wheel-drive features. The estimates also consider that under most scenarios land vehicles are operating on both sand routes and paved town roads. Table 12 lists and details the assumptions behind the per-mile costs for multiple vehicle configurations on different road types.

Table 12: Operations and capacity assumptions used in the cost model

ASSUMPTION	VALUE	NOTES
OPERATIONS COST		
Maintenance cost per road mile (OSV)	$0.90	For "Fair" road condition in bus lifecycle model, with 20% upward adjustment
Maintenance cost per road mile (non-OSV)	$0.72	For "Good" road condition in bus lifecycle model, with 20% upward adjustment
Maintenance cost per sand mile	$1.44	For "Bad" road condition in bus lifecycle model, with 20% upward adjustment
MPG per road mile (OSV)	10.08	Adjusted from RWD van model based on 10% lower fuel economy for AWD
MPG per road mile (non-OSV)	11.2	For "Fair" road condition in bus lifecycle model
MPG per sand mile	3.5	For "Bad" road condition in bus lifecycle model, less 50% for over-sand
Fuel cost per gallon	$4.50	Reflects July 2013 costs on Nantucket
Driver Hourly Wage	$25.00	
CAPACITY		
Capacity per Trip	9 (van) ; 13 (tram)*	
Shuttle Operating Days	60	
Non-Shuttle Operating Days	120	
Total Operating Days	180	

*note that the conversions for 4-wheel-drive and wheelchair accessibility reduce internal passenger capacity

Labor costs are a large component of the cost of operating a transit service. As shown in Table 12, the financial cost model assumes a driver labor cost of $25 per hour, which is consistent with the higher cost of living on Nantucket reflected in Census data (See Chapter 1) and information from FWS partners on the island.

Cost Model Analysis – Non-Resource Closure Scenarios

The project team used the model to compare the land-based scenarios for their financial and operational feasibility. However, as discussed below, the choice of operating tour service or conventional pick-up, drop-off transit service—and also the frequency of any transit service—is important to consider when assessing the potential cost of alternative transportation service to the refuge. Table 13 provides characteristics and costs for each scenario and service option based on model estimates; the following section describes relative advantages and disadvantages of each in more detail.

Table 13: Overview of Scenario Costs and Characteristics

	Non-Resource Closure Scenarios			During Resource Closure	
	Scenario 1	Scenario 2	Scenario 3	Scenario 1a	Scenario 4
Drop-off-and-wait / Guided Tour					
Fuel and Maintenance Cost	$12,168	$6,803	$11,273	$20,050	N/A – This scenario is transit only.
% of Annual Cost	*30%*	*24%*	*29%*	*30%*	
Labor Cost	$28,000	$22,000	$27,000	$46,750	
% of Annual Cost	*70%*	*76%*	*71%*	*70%*	
TOTAL ANNUAL COST	**$40,168**	**$28,803**	**$38,273**	**$66,800**	
Cost per Day	$335	$240	$319	$371	
Frequency of Service	4.5 hours	3.6 hours	4.5 hours	5 hours	
Travel Time (round trip)	130 min	70 mins	120 mins	180 mins	
Number of Trips	2	2	2	2	
Length of Operating Day	9.3 hours	7.3 hours	9 hours	12.5 hours	
Operating Days	120	120	120	180	
Seasonal Capacity (round trips)	2,160	2,160	2,160	3,240	
Transit					
Fuel and Maintenance Cost	$18,251	$10,205	$16,909	$27,377	$7,196
% of Annual Cost	*45%*	*27%*	*45%*	*42%*	*32%*
Labor Cost	$22,500	$27,000	$21,000	$37,500	$15,000
% of Annual Cost	*55%*	*73%*	*55%*	*58%*	*68%*
TOTAL ANNUAL COST	**$40,751**	**$37,205**	**$37,909**	**$64,877**	**$22,196**
Cost per Day	$340	$310	$316	$360	$370
Frequency of Service	3 hours	3 hours	3 hours	3.3 hours	1 hour
Travel Time (round trip)	130 min	70 mins	120 mins	180 mins	40 mins
Number of Trips	3	3	3	3	8
Length of Operating Day	9 hours	9 hours	9 hours	10 hours	10 hours
Operating Days	120	120	120	180	60
Seasonal Capacity (round trips)	2,160	2,160	2,160	3,240	4,320

Scenario 1: Vehicle from Downtown to Refuge

Single-vehicle service from downtown to the refuge offers a relatively affordable and simple option for providing enhanced access to Great Point. Detailed cost estimates are provided in Table 14.

Table 14: Scenario 1 Cost Overview

	Drop-off-and-wait/Guided tour	Transit
Fuel and Maintenance Cost	$12,168	$18,251
Labor Cost	$28,000	$22,500
TOTAL ANNUAL COST	**$40,168**	**$40,751**
Cost per Day	$335	$340
Frequency of Service	4.5 hours	3 hours
Travel Time (round trip)	130 min	130 min
Number of Trips	2	3
Length of Operating Day	9.3 hours	9 hours
Operating Days	120	120
Seasonal Capacity (round trips)	2,160	2,160

Advantages

This scenario most closely matches the guided tours that TTOR currently provides in the peak season. Implementing this option requires only one vehicle for the entire trip from downtown to the refuge, which may streamline maintenance and logistics. Passengers are not burdened by the inconvenience of transferring between vehicles.

Disadvantages

Using a modified over-sand vehicle for the entire journey across sand as well as paved town roads will likely consume more fuel per mile than other options. In addition, although passengers will not have to transfer vehicles, they must wait as the operator inflates or deflates the vehicle tires when transitioning between over-sand and on-road portions of the route.

The simplicity of this scenario in terms of operations, infrastructure needs, and costs make it an attractive option for a pilot of expanded service. And while, like most other access options, it does not provide access to the refuge during seasonal closure of the Galls, a shuttle addition could be included to provide that access (see Scenario 1a).

Scenario 2: Van from Gatehouse to Refuge

Single-vehicle service from the Wauwinet Gatehouse to Great Point is the most limited option, in that it does not provide access to downtown. It is most similar to the tour service TTOR provided before the 2013 season. Detailed cost estimates are provided in Table 15.

Table 15: Scenario 2 Cost Overview

	Drop-off-and-wait/Guided tour	Transit
Fuel and Maintenance Cost	$6,803	$10,205
Labor Cost	$22,000	$27,000
TOTAL ANNUAL COST	**$28,803**	**$37,205**
Cost per Day	$240	$310
Frequency of Service	3.6 hours	3 hours
Travel Time (round trip)	70 mins	70 mins
Number of Trips	2	3
Length of Operating Day	7.3 hours	9 hours
Operating Days	120	120
Seasonal Capacity (round trips)	2,160	2,160

Advantages

The vehicle in this scenario travels the shortest distance as it does not travel over paved roads to downtown Nantucket. It is therefore the most affordable scenario. Also, because of the gatehouse, there is already a logical staging area for visitors to embark and disembark the shuttle. This scenario saves some time because the vehicle is always on sand and can therefore keep the tires deflated.

Disadvantages

This option does not connect the refuge to the many visitor amenities and transportation hubs around downtown Nantucket. Given the past need for many visitors to drive their own automobiles or use expensive taxi service to reach the Wauwinet gatehouse, continuing or even enhancing this limited service route may not provide a sufficiently attractive alternative to visiting other Nantucket beaches or visiting the refuge in a private automobile.

However, Scenario 2 may become more attractive in the future if other projects, such as bicycle trails or enhanced NRTA service, make it easier for potential visitors to travel from downtown to the Gatehouse.

Scenario 3: Van from downtown to Gatehouse, over-sand vehicle (OSV) to refuge

This access scenario travels over a similar route to Scenario 1. However, it uses two vehicles to reach the refuge: one intended for on-road travel and the other modified for over-sand routes. Detailed cost estimates are provided in Table 16.

Table 16: Scenario 3 Cost Overview

	Drop-off-and-wait/Guided tour	Transit
Fuel and Maintenance Cost	$11,273	$16,909
Labor Cost	$27,000	$21,000
TOTAL ANNUAL COST	**$38,273**	**$37,909**
Cost per Day	$319	$316
Frequency of Service	4.5 hours	3 hours
Travel Time (round trip)	120 mins	120 mins
Number of Trips	2	3
Length of Operating Day	9 hours	9 hours
Operating Days	120	120
Seasonal Capacity (round trips)	2,160	2,160

Advantages

While requiring a greater initial investment than Scenario 1 due to the second vehicle purchase, the overall operating cost is only slightly higher due to some small savings in fuel and maintenance from using standard road vehicles rather than OSVs where possible during the route. There is no need for the driver to deflate or inflate vehicle tires at the Wauwinet Gatehouse, slightly reducing the travel time to the refuge.

Disadvantages

Operation and logistics are slightly more complex than Scenarios 1 or 2 as passengers will need to transfer vehicles at the Gatehouse. In addition, the operator would need to arrange a location where a vehicle could be parked throughout the day while the other vehicle moves passengers. This could be at the Gatehouse or a nearby location.

The addition of shuttle service during closure of the Galls would require yet another transfer and a third concurrently operating vehicle. However, Scenario 3 could be operated when the Galls are open for vehicle traffic and Scenario 1a with shuttle service used during closures.

Cost Model Analysis – During Resource Closure

The following scenarios address the option of accessing the refuge when the Galls are closed for shorebird nesting. Both involve variations on a shuttle service that would station a vehicle on the other side of the restricted area, from which it would shuttle passengers. This would likely require the use of an additional vehicle stationed long-term on TTOR land accessing the refuge or on the refuge itself. These scenarios could be implemented in coordination with any of the above scenarios as an option available only when the Galls are closed.

This section discusses primarily the cost issues associated with these two individual scenarios. Chapter 6 has a more detailed discussion about the shuttle concept in general, including consideration of its implementation feasibility.

Scenario 1a: Same as Scenario 1, with additional vehicle stationed on the other side of the restricted area in June and July

Because of its full access to downtown and operation simplicity, Scenario 1 is the most useful service model to adapt to provide access through the closed Galls for transit or tour users. This service would operate for the approximately 60 days annually when resource closures prevent non-essential vehicular access to the refuge. Detailed cost estimates are provided in Table 17.

Table 17: Scenario 1a Cost Overview. Costs include operating Scenario 1 alongside this service.

	Drop-off-and-wait/Guided tour	Transit
Fuel and Maintenance Cost	$20,050	$27,377
Labor Cost	$46,750	$37,500
TOTAL ANNUAL COST	**$66,800**	**$64,877**
Cost per Day	$371	$360
Frequency of Service	5 hours	3.3 hours
Travel Time (round trip)	180 mins	180 mins
Number of Trips	2	3
Length of Operating Day	12.5 hours	10 hours
Operating Days	180	180
Seasonal Capacity (round trips)	3,240	3,240

Advantages

This option would allow alternative transportation travel to the refuge during a part of the season when currently very few can access the refuge due to restrictions on vehicle traffic. This option would also create new opportunities for visitor interpretation during Nantucket's summer peak visitation season and may attract and expose visitors who may not otherwise consider using alternative transportation to the shuttle service.

Disadvantages

The need for visitors to walk along a resource-restricted area increases travel time and may be challenging for many users, even with a temporary stable surface placed along the walking route. Also, a vehicle stationed for 60 days on the refuge would be exposed to substantial wear and tear, and any maintenance, including refueling, would be significantly more complicated. The following section explores the feasibility of attracting riders.

Scenario 4: Shuttle service during Galls closures that serves visitors driving to the closure point

The project team also analyzed stand-alone shuttle transit service that would bring visitors in private vehicles the remaining distance from the end of the seasonal Galls closure to the refuge. Detailed cost estimates are provided in Table 18.

Table 18: Scenario 4 Cost Overview. Costs do not include service when the Galls are not closed.

	Transit (Scenario 4 is transit only)
Fuel and Maintenance Cost	$7,196
Labor Cost	$15,000
TOTAL ANNUAL COST	**$22,196**
Cost per Day	$370
Frequency of Service	1 hour
Travel Time (round trip)	40 mins
Number of Trips	8
Length of Operating Day	10 hours
Operating Days	60
Seasonal Capacity (round trips)	4,320

Advantages

Implementing this scenario may be less risky, as it serves the existing, established user group of people who drive to the refuge. This service would likely be attractive to this group given the very limited alternatives for accessing Great Point during resource closures, and the typical timing of the closures during Nantucket's peak tourism season.

Disadvantages

Because the shuttle would only serve drivers, its audience would be largely limited to existing visitors with suitable private vehicles. Combined with the need to adhere to the shuttle's limited schedule, this could dampen the appeal of stand-alone shuttle service, even during the summer high season. Further, this scenario does not enhance alternative transportation the refuge. The need for shuttle users to park near the resource closures may pose additional environmental concerns.

Demand and Cost per Rider

In addition to the overall cost of providing alternative transportation service, the financial feasibility of enhanced access also depends on how many riders will use the service. Each scenario depends on sufficient user demand to fund the long term operating and maintenance costs. If there are opportunities for grant funding to support a portion of the operations during a pilot phase or for FWS or other partners to support some of the operating and maintenance costs, those could alleviate some of the pressure of achieving a specific ridership level. The scenarios and service models vary in their likely attractiveness to different members of the public. Although a scenario may have a larger overall cost, high ridership could make it more feasible than a scenario that is less costly in absolute terms but would attract fewer riders.

Estimating Potential Demand

The project team developed the ridership estimates in Table 19 for the scenarios based on capturing a percentage of users that are already using alternative transportation to visit waterfront destinations and

a smaller percentage of existing refuge visitors. These estimates assume that any new expanded service would also incorporate the current scheduled service provided by TTOR. While the estimates are based on current available data and not a thorough market forecast, these rough, conservative figures help guide the sensitivity analysis below, and provide insight into the feasibility of a transportation service covering its long term costs through fare recovery.

Based on the analysis in Chapter 2, the project team adjusted estimates to reflect the assumption that there may be 15 percent less demand for a tour-style service given the prevalence of other lighthouse and water-based tours available to island visitors as well as a lack of options for accessing isolated, wilderness areas on a less programmed basis. Table 19 provides ridership estimates for each scenario.

Table 19: Estimated demand for enhanced access scenarios based on anticipated capture of current offerings

Scenario	Current Refuge Tour Ridership (does not include closure ridership)		Current Jetties/Surfside Ridership		Current non-Transit Refuge Visitation		ESTIMATED DEMAND
Base Numbers	*700*		*14,000*		*19,000*		
	% Captured	# Captured	%	#	%	#	
Scenario 1	100%	700	5%	700	1%	190	1,590
Tour (85%)							*1,352*
Scenario 2	100%	700	1%	140	1%	190	1,030
Tour (85%)							*876*
Scenario 3	100%	700	5%	700	1%	190	1,590
Tour (85%)							*1,352*
Scenario 1a	150%	1,050	5%	700	6%	1,140	2,890
Tour (85%)							*2,457*
Scenario 4	0	-	0	-	15%	2,850	2,850

Using these demand estimates as a base for initial service, FWS and its alternative transportation partners can adjust the type and frequency of service based on actual usage and observed demand. It may be appropriate to structure an operating arrangement that includes flexibility to pilot service and make changes as needed to ensure that increased transit access to the refuge is sustainable over a longer time period.

Ridership and Feasibility

Given the rough nature of the above estimates, the project team also conducted two sensitivity analyses that show the ridership required to "break even" on each of the scenarios across a number of per-ride prices charged to visitors. Table 20 shows the results of this analysis for drop-off-and-wait and guided tour service, along with the estimated demand from above. Table 21 does the same for transit service.

Table 20: Riders needed for each scenario to achieve a given price point (Drop-off-and-wait service)

Cost / rider	Scenario			
	1	2	3	1a*
$10	*3,894*	*2,820*	*3,717*	*6,482*
$20	1,947	1,410	1,859	*3,241*
$30	1,298	940	1,239	2,161
$40	973	705	929	1,621
$50	779	564	743	1,296
$60	649	470	620	1,080
Estimated Demand	**1,352**	**876**	**1,352**	**2,457**

Above service capacity, which is maximum capacity for one vehicle

* Operates during resource closures for a total of 180 days. All other services operate for 120 days.

Table 21: Riders needed for each scenario to achieve a given price point (Transit service)

Cost / rider	Scenario				
	1	2	3	1a*	4*
$10	*3,895*	*3,630*	*3,629*	*6,218*	*2,155*
$20	1,947	1,815	1,814	3,109	1,077
$30	1,298	1,210	1,210	2,073	718
$40	974	908	907	1,555	539
$50	779	726	726	1,244	431
$60	649	605	605	1,036	359
Estimated Demand	**1,590**	**1,030**	**1,590**	**2,890**	**2,850**

Above service capacity, which is maximum capacity for one vehicle except for scenario 2, which features 3 trips per day.

* Scenario 1a operators for 180 days, Scenario 4 for 60. All other services operate for 120 days.

The lowest price points require a number of riders that would be difficult to obtain, based on discussions with FWS and partner staff and the demand analysis in Chapter 2. Also, the number of riders required to provide trips at the $10 per ride is beyond the capacity of a service that can be offered using one primary vehicle. Scaling up is expensive, as the over-sand route prevents the use of larger transit buses. The alternative is to add additional vehicles and drivers, but this dramatically increases operating costs and hence per-user prices. However, the analysis does show that, with reasonable ridership, it is possible to support the operation of alternative transportation at prices comparable to other Nantucket travel options.

High-frequency Transit Service

The project team also created cost models for the study scenarios that ran two transit vehicles at once instead of one. This increases the frequency of service to just above once per hour for most scenarios, but also significantly increases costs and would hence require many more riders to be financially sustainable. Based on the Chapter 2 demand analysis and current tour ridership in particular, obtaining this increased ridership could be difficult.

However, the more frequent a transit service, the greater its appeal compared to using a personal vehicle. This effect, along with concerted marketing, could make a high-frequency service feasible. Further, funding for a pilot of enhanced Nantucket NWR service from the Federal Lands Access Program or the Federal Lands Transportation Program (See Chapters 7 and 8) could provide a low risk environment for FWS and its partners to test the practicality of higher-frequency transit.

Table 22 shows the ridership required for each access scenario with high-frequency transit operations. The proposed Galls shuttle (scenario 4) is not included, as its one-vehicle option already operates at one trip per hour frequency.

Table 22: Riders needed for each scenario if under a two vehicle, high-frequency operation

Cost / rider	Scenario				
	1	2	3	1a*	4*
$10	9,375	5,609	8,713	14,147	-
$20	4,687	2,805	4,355	7,074	-
$30	3,125	1,870	2,905	4,715	-
$40	2,345	1,402	2,179	3,536	-
$50	1,875	1,121	1,744	2,830	-
$60	1,563	935	1,451	2,358	-
Estimated Demand	**1,590**	**1,030**	**1,590**	**2,890**	**2,850**
Above service capacity, which is maximum capacity for two vehicles except for scenario 2, which features 9 trips per day (one per hour).					

* Scenario 1a operators for 180 days, Scenario 4 for 60. All other services operate for 120 days.

Conclusions

Cost is just one of the considerations that FWS and any potential partners must take into account when considering the feasibility of expanding alternative transportation service to Nantucket. The remote

conditions that make the refuge a unique place also present challenges that increase the cost of transporting even a small number of passengers from other parts of Nantucket.

However, as shown in Chapter 2, many Nantucket visitors are willing to pay prices similar to those needed to support this service to experience unique parts of the island. With coordinated outreach, alternative transportation service could likely be implemented with minimal FWS contributions to annual costs. Because vehicle purchases are a large portion of these annual costs, a grant to purchase new vehicles would help make alternative transportation service feasible and potentially enable low prices for visitors. The next chapter addresses feasibility considerations beyond cost that are also crucial to successfully implementing alternative transportation to the Nantucket NWR.

Chapter 6: Implementation Considerations

Nantucket National Wildlife Refuge
Alternative Transportation Access Study

Prior to implementing any sort of alternative transportation system for Nantucket National Wildlife Refuge, FWS must consider multiple issues related to vehicle storage, maintenance, and overall system logistics, some of which will be uniquely challenging given the context of the refuge. Many or all of these issues could be addressed through partnerships and other creative solutions.

General Considerations

Any new transportation system on Nantucket, regardless of the operating model, must address the following considerations.

Boarding Location

The TTOR tour currently boards in a parking lot across the street from the Maria Mitchell aquarium. This site is the future location of the Maria Mitchell Science Center, which is expected to be constructed by 2015. When construction on the new facility begins, the parking lot will no longer be available for use as a pickup location. Any transportation service bringing passengers to and from downtown will require a new permanent boarding location. Figure 22 shows the current departure location.

There are several opportunities for partnerships in Nantucket for a boarding location for the transportation service:

- Town of Nantucket parking lots – the town owns several lots, including in front of Straight Wharf (near the Hy-line ferry terminal) and the public lot adjacent to the Maria Mitchell aquarium;
- Town Visitor Center – several other tours use the spaces in front as a boarding location;
- Nantucket Regional Transit Authority – there may be capacity at the Greenhound bus terminal during times when NRTA buses are not loading and unloading.

Figure 22: The future Maria Mitchell Science Center, from which tours to the refuge currently depart

Each of these options would require partnerships and discussion with the parking lot owners. If FWS elects to move forward with one of the operational scenarios that brings passengers to and from downtown, FWS should initiate discussions as soon as possible to identify an appropriate boarding location. Once a location is identified, FWS can work with the owner to figure out where exactly to board passengers and how to provide signage or other information to clearly delineate to visitors where they need to be.

Vehicle Storage

The vehicle(s) will need an overnight parking location during the operating season and a permanent storage location during the off-season. It may be possible to partner with another agency to identify an overnight parking location (e.g., the town DPW maintenance facility, the NRTA bus storage facility, or the TTOR office). If FWS pursues any additional land acquisition on Nantucket Island in the near future, it may be appropriate to identify a location to house the vehicle(s) on a new site. Some of the storage considerations include:

- Is there an indoor storage location available? Keeping the vehicle indoors could help extend its useful life by reducing exposure to the elements.
- Is it possible for any routine maintenance to be performed at the storage location? If FWS is able to partner with the town or the NRTA to store the vehicle at one of their sites, it may be possible to negotiate some routine maintenance, which could reduce expense of using the local dealership (see discussion below).
- Where should be vehicle stay during the off-season? Is there a location for it on Nantucket, or a better location elsewhere within FWS? The additional expense associated with transporting the vehicle to and from Nantucket may be justified by less costly off-island storage.
- Is there any use for the vehicle during the off-season, whether on Nantucket or with another refuge? Such a need could dictate the most appropriate location; if the vehicle(s) would be used by another refuge, there may be an opportunity for some cost sharing to cover ongoing maintenance.

Vehicle Maintenance

Exposure to the harsh outdoor environment of the refuge (i.e., sand and salt) takes a heavy toll on vehicles and may shorten their useful lives. Performing routine preventative maintenance on the vehicles is one way to extend the useful life. For example, at Back Bay National Wildlife Refuge, maintenance staff washes the tram daily to remove all of the sand and salt water from the vehicle. The Back Bay vehicle also receives a full detail service on a quarterly basis, to help preserve the interior and exterior of the vehicle.

FWS will need to consider where maintenance will take place and by whom. Given that there is no FWS permanent facility or staff on Nantucket at this time, the project team assumes that all maintenance will be performed either by a partner or at the vehicle dealership on the island. FWS may be able to incorporate routine or preventive maintenance into a partnership arrangement to help reduce dealership costs.

Vehicle Flexibility

In deciding which type of vehicle to pursue, FWS should consider whether the vehicle would be used exclusively for the transportation service, or if there may be other uses beyond the transportation service, either during the summer or the off-season. For example, FWS may wish to have the vehicle

available for staff to use when visiting the island in the off-season. In this case, a van may be more versatile than a larger tram or bus.

Accessibility

The boarding areas must be accessible to and usable by individuals with disabilities, including individuals who use wheelchairs. Though it would be structurally and environmentally impracticable to build a fixed boarding area on the refuge, temporary matting could provide the necessary stable surface.

FWS must be mindful of accessibility requirements associated with any alterations to circulation paths, parking facilities, toilet facilities, or bathing facilities at the refuge, which could require new beach access routes (see Appendix II for further discussion of Accessibility requirements). There are several companies that manufacture portable rollout or panel systems, which are regularly used in beach contexts (see Appendix III for examples). Figure 23 shows an example of beachgoers using temporary matting at Crane Beach in Massachusetts.

Figure 23: Temporary matting at Crane Beach in Ipswich, Massachusetts

The temporary matting would be deployed at the start of each season and removed at the end of the season. The matting may also need to be removed in the event of a large storm system. FWS or its partner will need to develop an approach for deploying and removing the temporary matting. Depending on the quantity and locations, it may require multiple trips and/or a separate truck to bring the necessary amount of matting.

Along with accessibility of boarding locations, FWS may wish to consider other services on the refuge. There is currently a portable toilet on the refuge during the summer (owned by TTOR), which is not ADA-accessible. In order to comply with accessibility requirements on a Federal facility, the portable toilet may need to be replaced with an accessible unit, or an additional ADA-accessible unit may need to be brought out to the refuge.

Detailed accessibility requirements are described in Appendix II.

Interpretation

There is no regular interpretation available at the refuge; there are no staff onsite to provide interpretation, and no information kiosks or other printed materials. Any FWS plan to bring additional visitors to the refuge should consider appropriate interpretation and be consistent with visitor services needs identified in the CCP.

The lighthouse is generally closed to the public, though the TTOR tour to Great Point includes an opportunity to go inside the lighthouse. Given the public interest in visiting the Great Point lighthouse, FWS could consider establishing an agreement with the U.S. Coast Guard (and possibly TTOR) to allow visitors using the transportation service to access the lighthouse.

In the drop-off and wait and guided tour operating models, the vehicle driver would be able to provide interpretation at Great Point and tours of the lighthouse. However, in a transit service operating model, providing onsite interpretation would require an additional FWS staff member or volunteer throughout the day.

Any onsite interpretation, whether of the lighthouse or the refuge more generally, must include an option that is accessible to people with disabilities. For example, because the lighthouse is not physically accessible to people with disabilities, the tour could incorporate alternative methods, such as using audio-visual materials and devices to depict the portions of the property that visitors with disabilities would not be able to reach. For more discussion of accessibility requirements, see Appendix II.

Outreach, Marketing

Based on discussions with stakeholders as well as the demand analysis conducted in Chapter 2, the study team observed that many Nantucket visitors may not be aware that there is a National Wildlife Refuge on the island or about their options for visiting the refuge. A comprehensive marketing and outreach effort should thus accompany any enhanced alternative transportation service to the refuge.

The outreach program should have three goals:

- Promote awareness of the Nantucket National Wildlife Refuge's unique characteristics
- Describe alternative transportation options to the refuge
- Highlight the role of FWS as one of the partners helping to manage habitat on Nantucket

Marketing could also describe alternative transportation access options beyond the enhanced van/tram service, such as water taxi, canoeing, and hiking. Potential visitors may not be aware that they can access Great Point through these means, or may not know that this access is permissible when the Galls are closed for shorebird nesting.

There are many existing tour services and natural destinations on Nantucket that compete with Great Point for the attention of island visitors. Future marketing should distinguish itself by building from FWS's national reputation and emphasizing the remote wildness of Great Point, which is dissimilar from most other Nantucket destinations. There is also an extensive infrastructure of existing visitor centers, hotels, and websites that are logical outlets for the outreach effort. Potential strategies include:

- Featuring transportation options on FWS and partner websites
- Printed brochures and materials for visitor information centers and kiosks
- Meetings with staff at the Nantucket Visitors Services Center and other organizations that interact directly with island visitors

Considerations Specific to a Transit-Service Operating Model

In addition to the general considerations for any new alternative transportation system, there are specific considerations for a system based on the transit-service operating model.

Capacity

In a transit service, the trips run on a regular schedule; passengers need not necessarily return on the same trip on which they have gone out. Running an effective transit system may require additional staffing to manage capacity to limit ridership on the outgoing trips later in the day, in order to ensure that there is enough room for return passengers. Such limits may be necessary so that the scheduled return trips are able to accommodate all visitors returning in from the refuge; otherwise it might be necessary to make additional unscheduled trips to bring all of the visitors off the refuge. Who takes the lead in managing the capacity will depend in part on the operational arrangements and partnerships, as discussed in Chapter 7.

Communications

The remote location of the refuge makes it difficult for a rescue vehicle to arrive quickly in an emergency. If the transit vehicle is en route to the refuge or on the way back to town, the response time would be quicker than an emergency vehicle coming from further away. The transit vehicles should have a phone or radio back to a dispatcher or the Gatehouse so that if passengers call, the vehicle can turn around in the event of an emergency.

Visitor Materials

All visitors should be provided with a map of the refuge, a schedule of return trips, and a list of emergency phone numbers. FWS and partners should also make these materials available at pick-up and drop-off locations.

Considerations Specific to Galls Closure Shuttles

Chapter 3 discusses the concept of a shuttle between the Galls and Great Point that would bring visitors to the refuge when the Galls are closed for shorebird nesting. All visitors would need to walk along the resource closure area to access the shuttle, which would be stationed on the opposite side of the closure throughout the nesting period. While this option would facilitate access to the refuge during resource closures, such a shuttle service also presents several implementation challenges.

Available Right of Way

During the nesting period there must be a buffer of 2000 meters for non-essential vehicle use and 50 meters for pedestrian use. While there is no portion of the Galls wide enough to support the vehicle buffer, there may be sufficient right of way (ROW) to allow for a pedestrian buffer. The availability of the ROW will vary depending on where exactly the plovers have nested; there may be some years when it is not possible to designate a walking path during the nesting period, and FWS and its partners would be unable to provide the shuttle service in those years.

This study assumes that visitors would walk along the shoreline of the ocean side of the Galls area to get past the nesting area. FWS and TTOR will need to analyze more fully where exactly it would be most appropriate for visitors to walk and provide some signage or other information to direct them accordingly. This analysis will need to happen every year, as the exact nesting locations will vary.

Storage and Maintenance

FWS and its partners would need to identify a location past the restricted area, either on TTOR or FWS property, to store the shuttle vehicle during the approximately two-month operations period. Because the exact location of the nesting area varies from year to year, it is not possible to designate one specific

place as the storage location; it may be more appropriate to develop criteria and survey the general area each spring to identify several candidate locations. To protect the vehicle and the surrounding environment, FWS and partners would likely want to identify locations that are:

- relatively flat,
- distanced away from the shore, and
- offer some shelter, if possible.

While there are no permanent structures in that area, it might be possible for FWS and partners to erect a temporary structure to provide shelter or storage for either the vehicle or for supplies. FWS and TTOR will need to review environmental regulations and policies to determine whether they allow a temporary structure.

The operator of the shuttle will need to consider vehicle maintenance and fuel storage during the time that the vehicle is stationed past the Galls. FWS or its partner can estimate the fuel that will be necessary to operate the shuttle during the restricted period, and then determine whether it would be most appropriate to bring in fuel in advance and store it outdoors (or in a temporary structure), or have a staff member periodically carry in fuel. Given the sensitive nature of the area and proximity to the shore and the plover, outdoor storage may be precluded or require considerable safeguard measures.

The stationed vehicle will likely be exposed to the elements during its time in service beyond the restricted area, which may add to maintenance costs or reduce the lifespan of the vehicle. For the cost model used in the Chapter 5, the project team assumed a 3-year lifespan for any vehicle used during the Galls closure. FWS and its partners would also need to consider the logistics of how to provide any urgent service to the vehicle while it is stationed beyond the restricted area. Unless a FWS partner has its own vehicle maintenance staff, the operator would need to contract with a local repair shop or dealership to provide low-level on-site maintenance in the event that it is necessary and cannot wait until after the period of the resource restriction is over. Any more significant maintenance that might require additional parts or have environmental implications (such as draining fluids, etc.) would likely have to wait until after the vehicle could be moved back to the mainland. Such maintenance needs could require halting the shuttle service.

Evacuation Contingency

Given that the vehicle would be stationed past the Galls area, FWS would need to develop a contingency plan in case of an extreme weather event or emergency. This would include delineating the circumstances under which it would be acceptable to guide the vehicle through the restricted area and back to the mainland, or other ways to secure and protect it during extreme weather.

Accessibility

In order to allow visitors to walk along the restricted area, FWS or its partners would need to provide a path that would be accessible to visitors with disabilities consistent with the Access Board requirements (see Appendix II). This could include installing a temporary walkway or mat that creates a firm surface and facilitates safe passage.

Conclusions

Operating and maintaining an alternative transportation service to a refuge involves many components and is complicated by the remote nature of NNWR and limited FWS property and staffing presence on Nantucket. Many of the general considerations may be able to be addressed through arrangements with local government and nonprofit partners. Implementing a transit-based service is somewhat more complicated in the logistics, but those concerns could be addressed through careful planning and

communication. Implementing a shuttle service during the Galls closure will require further discussion and consideration as to its feasibility. The next chapter discusses funding opportunities and transportation service ownership and operational models.

Chapter 7: Funding and Operating Arrangements

Nantucket National Wildlife Refuge
Alternative Transportation Access Study

To implement enhanced alternative transportation service to Nantucket NWR, FWS should determine the best organizational structure for providing the service and an appropriate funding arrangement. This chapter describes potential approaches to owning, operating, and maintaining the transportation service options described in this study. It then describes the authorizations under which FWS can collect the fares that provide the bulk of funding for the proposed service, and other resources that could fund vehicle purchases or support a pilot service.

Operating Arrangements

FWS may choose among several ownership and operation models for delivering enhanced alternative transportation service to the refuge. Each option has several associated considerations for FWS. This section draws from past research into alternative transportation business models at FLMA units and discussions with FWS staff.[33]

The broad options for ownership and operation models are:

- FWS owns and maintains the vehicles and operates the service
- FWS administers a concession or service contract with a private organization or local government to own and operate the service
- FWS partners with a private non-profit organization or local government to operate a transportation service. FWS may or may not own the vehicles.

FWS Owned and Operated

Under the owner-operator model, FWS would be entirely responsible for providing and paying for the transportation service. FWS would provide the capital investment for vehicles, infrastructure, and related equipment, and operate, fuel, maintain and manage the service. FWS could use the Federal Lands Transportation Program or other funds to cover capital costs and some operating expenses, as described below.

Assessment: The owner-operator model gives FWS the most direct control over the visitor experience and the most flexibility in tailoring the service to fulfill the mission of the refuge and to meet individual needs of unique user groups.

However, FWS does not currently have the staff capacity or other necessary infrastructure on the island to own and operate the service. This scenario would likely require creating new staff or volunteer positions on Nantucket to administer the service, drive vehicles, promote it to visitors, and handle reservations, and also require capacity to store and maintain the vehicles.

Concession

FWS may put a concession out for bid, in which a private operator would operate transportation service under contract with the refuge, providing at least five percent of gross receipts to FWS.[34] In this case, the concessionaire would be responsible for all procurement, maintenance, and operation of transportation vehicles and service. Although requirements could be integrated into the concession

[33] See Paul S. Sarbanes Transit in Parks Technical Assistance Center, "Alternative Transportation Systems Business Models Evaluation," September 2012: http://www.triptac.org/Documents/RepositoryDocuments/ATS_Business_Models_Eval_Final.pdf

[34] Fish and Wildlife Service, "Director's Order No. 139: Concession Contracts," November 7, 2001. http://www.fws.gov/policy/do139.html

contract, FWS would likely have less input into the operation of the transportation service once the concession agreement is signed.

Assessment: A concession agreement could be a good opportunity to use a private company to provide high quality transportation service to the refuge, freeing up FWS resources for conservation-related activities. A concession could also provide revenue to FWS, much of which could be reinvested into improving visitor experience.

However, the refuge's location and the relatively untested demand for different types of transportation service may complicate a concession arrangement for Nantucket NWR. Because operating arrangements and expected financial returns to FWS are written into the contract, it could be challenging to pilot different operational models, and potential concessionaires may be unwilling to pursue a service without an already proven market. A concession contract with a for-profit transportation operator could also prove challenging for FWS's relationship with its non-profit conservation partners on Nantucket, which own most of the other land on the Coskata-Coatue Peninsula. Finally, while FWS would not be responsible for providing the transportation service, managing concession agreements typically require substantial FWS staff time and effort, and are therefore unattractive to many units.

Partnership Agreement

A partnership agreement is a flexible alternative to FWS operations or a concession contract, and given the current conditions, may be most appropriate. Under this option, FWS would develop an agreement that establishes permission for a public, private, or non-profit operator to access the refuge as an appropriate special use reflecting the partners' shared vision for the refuge. In this case, enhanced alternative transportation would be a special use or a commercial use that "directly support[s] a priority general public use" and FWS could make the appropriateness finding as it does for any other refuge use.[35] Unlike a concession contract, a partnership agreement with an existing operator stipulates permission to operate the service on FWS land and could be jointly funded and managed. It does not necessarily need to set out specific operating requirements in advance or require complex administration, although it could include some parameters related to number of trips per day, routes, and appropriate fare prices. A flexible agreement would allow for different types of operating arrangements that could be adjusted based on experience. A partnership would still require choices about what roles FWS and its partners would play in specific activities. This section describes some of the possibilities.

Vehicle acquisition and ownership

Depending on the partnership arrangement and available funding, the vehicle owner does not necessarily need to be the same entity that is responsible for operations and maintenance. It may be possible to have some combination of FWS, another local public entity, or a partnering nonprofit organization own and operating the service vehicles.

If FWS uses its own funds to purchase vehicles, it may choose to maintain ownership. It could still enter into agreements or contracts for operating, maintaining, and storing the vehicles, which would likely be necessary given the limited FWS facilities on the island. Alternately, FWS could use its funds to purchase vehicles and then transfer ownership of them to the operating partner as part of the operating agreement.

FWS could also expand its relationship with the Town of Nantucket or the Nantucket Regional Transit Authority (NRTA) to coordinate on vehicle acquisition. The local government agency could then partner

[35] Fish and Wildlife Service, "Appropriate Refuge Uses," July 26, 2006. http://www.fws.gov/policy/603fw1.html

with FWS and/or another entity to operate and maintain the service. For example, the Federal Lands Access Program (FLAP), discussed below, is designed to facilitate access from communities to Federal Lands units. Local and state governments are the only eligible recipients for FLAP funds; the grant application must be developed in partnership with a local government and the local government must be the funding recipient. The local government partner could assume responsibility for vehicle operation, maintenance, and storage, or could work with FWS and a private partner to perform these duties.

Finally, an NGO partner or other service operator could acquire and own vehicles. This is the most logistically simple option if federal funds are not used to purchase vehicles. If federal funds are used, FWS and partners would need to review any requirements or restrictions associated with transferring direct ownership of the vehicle to an NGO partner.

Maintenance and storage

Given the rugged conditions along the route to the refuge, proper maintenance of vehicles is critical to ensuring reliability and adequate service life. The simplest option may be for the partner that is operating the vehicles to be responsible for their maintenance; internalizing the costs of upkeep incentivizes proper operating care. However, a full maintenance facility on the island could be difficult for an operator to fund or build, especially given the small associated vehicle fleet. FWS and other entities on the island could help address this need by sharing existing or new maintenance facilities.

In Chapter 4 of this study, the project team recommends that FWS and its partners purchase vehicles from automakers with a dealership on Nantucket. This simplifies tune-ups and other regular maintenance and avoids the costs associated with a bringing a large vehicle to the mainland. Day-to-day care and cleaning is also critical to adequately maintaining vehicles. For example, Back Bay NWR in Virginia washes its trams daily to avoid corrosion from sea and sand exposure. FWS continues to explore opportunities to purchase and protect additional land on the island. If such an acquisition occurs, FWS may be able to consider dedicating a small area for vehicle maintenance and/or storage. Even providing simple facilities such as a washing station and enclosed parking could help extend the life of the vehicles and provide reliable service. If FWS were able to build such a facility, it could negotiate an agreement for another party to provide the maintenance service.

Both NRTA and the Town of Nantucket operate and service heavy-duty vehicles. FWS and its partners may be able to negotiate an agreement that would allow refuge-serving vehicles to park or even receive basic care in town or NRTA facilities.

Reservations, marketing, and fee handling

Handling reservations and fees directly would provide FWS the most control over visitor experience and marketing of the service. However, FWS has no staff stationed on Nantucket to perform these duties. In addition, FWS would need to invest in adequate IT infrastructure to handle online reservations, and could require dispatch support if implementing more of a transit-style service.

FWS's operating partner could also take responsibility for logistics, as they have more staff based on Nantucket than FWS. Regardless, FWS should have a key voice in setting the tone of marketing and also ensure its own website and resources describe where and how to ride the service.

Assessment: The study ream recommends that FWS to enter into a partnership with one or more existing local non-profit and/or local government entities to operate the transportation service and maintain the vehicles. Such an arrangement would provide the most flexibility to try different service options to best serve the FWS mission and interpret the refuge, and also provide the most opportunity to leverage existing relationships and resources.

Funding Sources

On-Site Funding and Fares

This study anticipates that the long-term funding for enhanced transportation service will come from fares visitors pay to access the refuge through the service. Chapter 5 describes anticipated service costs and discusses the degree to which these would be covered by different fare levels.

FWS is authorized to collect fares directly from users, or it may instead receive a portion of fares collected by its operating partner. FWS may also allow the partner to provide on-site refuge management or other services rather than direct payments. The value of FWS's payment from an operating partner or concessionaire should reflect the anticipated gross profit of transportation service at the chosen fare rate.

FLREA

The Federal Lands Recreation Enhancement Act of 2004 (FLREA) authorizes FWS and other federal land management agencies to collect three types of fees: passes, entrance fees, and expanded amenity fees. Of the three, expanded amenity fees, which are charged when a visitor uses a specific or specialized facility, equipment, or service, would apply to an alternative transportation service at NNWR. Eighty percent of FLREA fees remain at the unit at which they are collected.

Concession: Franchise fees

FWS units may collect franchise fees from private operators under concessions contracts. The franchise fee must be agreed upon by both FWS and the private operator. Franchise fees are paid from the fares private operators charge visitors.

Federal Programs

If the service is funded entirely through fares collected, it may not be able to provide service at a price that is attractive for many potential refuge visitors (See Chapter 5). FWS may lower the operating cost—and hence price—of the service by procuring vehicles using federal funds. FWS could also apply grant funds to an initial pilot program, which would help cover a portion of the operating costs and give FWS and partners some time to test the feasibility of different service types and frequencies.

The programs below are the key relevant sources of federal funds for enhanced transportation services:

FLAP

The Federal Lands Access Program (FLAP, or Access Program) supports transportation that accesses federal lands but is owned and operated by state and local governments. Funds may be used for public roads, pedestrian and cyclist infrastructure, transit systems (capital and operations), and other uses. FLAP funds are allocated among states based on the amount of total federal land in the state, and a committee programs projects based on the merits of the proposals submitted. The FY14 total funding for FLAP in Massachusetts was $374,523.

FWS and its partners could use FLAP to fund vehicle procurement as well as operations for a pilot service to Nantucket NWR, as both are eligible expenses. FLAP applicants must be a state or local government, and must provide a 20 percent match for the FLAP funds.[36] Because a local government must apply for and receive the funds, pursuing this funding option would require extensive coordination with the Town of Nantucket or NRTA to develop an application and use the funds if the proposal is successful.

[36] However, the next transportation reauthorization may lower this requirement, and FWS may contribute Federal Lands Transportation Program (FLTP) or other funds to cover all or part of this match.

FLTP

The Federal Lands Transportation Program provides funding for FWS and other FLMAs to operate and maintain their own transportation assets. These include roads and parking lots as well as capital and operations costs for transit service. Each FWS region develops multiyear programs for its FLTP funds.

FLTP funds are appropriated directly to FWS; vehicle purchases and operations funding would not need to be coordinated with the Town of Nantucket. However, whereas applying for FLAP funds allows FWS and its partners to compete for discretionary funding it might not otherwise receive, FWS receives a set annual FLTP allocation. Hence, these funds are applied over a five-year program at the regional level to meet FWS's large maintenance needs on refuge roads and other existing transportation facilities.

Other FWS

FWS may also choose to use its own funds instead of or in combination with the above programs. To help prepare for funding opportunities that may arise in the future to support visitor experience and access, it may be useful for the refuge to prepare a prioritized list of funding needs. Staff could use this as a basis to develop a funding proposal or application.

Partner sources

Non-profit organizations, local government agencies, and private companies can contribute money or in-kind support (e.g., staff labor, marketing support, IT infrastructure for handling reservations/ payment, vehicle maintenance services, etc.) toward the transportation service. These types of overhead costs are not accounted for in the service cost estimates in Chapter 5, but they can be crucial in creating a positive visitor experience.

Chapter 8: Recommendations

The analyses in the preceding chapters suggest that enhanced transit or tour-style alternative transportation service to the Nantucket National Wildlife Refuge is feasible. This chapter describes the project team's specific recommendations about the types of enhancements that would be most successful and appropriate for the refuge, as well as next steps that FWS can take to implement alternative transportation improvements.

Recommended Approach

The project team recommends that FWS supplement and improves upon the existing tour service to the refuge, in coordination with local partners, rather than develop an entirely new concession or service. Two separate operations to the refuge would probably compete for same pool of riders and would increase the risk of unsustainable ridership for both services. However, FWS can help facilitate a service that provides expanded options to riders and is accessible to all users in compliance with federal rules.

Service Characteristics

This section provides recommendations on specific components of the transportation service, including service model, vehicle type, and scheduling.

Service Model: Hybrid Tour/Transit Model

The project team recommends that enhanced alternative transportation service consider a hybrid tour/transit model, in which visitors can opt to spend more time independently on the refuge. One example of how such a hybrid model would work is that visitors could be given the option to purchase a ticket with a return trip on the same vehicle, or another type of ticket where with a reserved space on a later return. Offering such an option may require additional trips during the day or a vehicle with a larger capacity in order to allow for more visitors to return on the later trip.

The project team suggests that FWS pilot expanded service if possible. The pilot would test and refine the recommendations of this study, particularly the balance between the tour and transit approaches. Both the Federal Lands Transportation Program and the Federal Lands Access Program can be used to fund transit operations and could support a pilot. However, any pilot should focus on operating scenarios that would be financially sustainable after the pilot period ends.

A one or two-year pilot would allow FWS and its partners to test service changes with less financial risk. For example, a pilot could demonstrate whether a hybrid tour/transit model is effective. It could also test the demand for larger service changes such as a Galls shuttle during resource closures or even very frequent transit service (with hourly departures) as described at the end of Chapter 5.

Vehicle Type: Basic Vans or Open-Air Trams

Open-air trams provide an enhanced visitor experience, but are more costly to purchase and operate than smaller vans, and the added size may make them more challenging to service and store. While some visitors may prefer the open-air experience, others may be sensitive to wind, sand, or insects. There may be opportunities to explore screens for the windows, at an additional cost. For some of these reasons, TTOR service uses vans for its existing tour service.

Given that capital purchases may covered through a grant program and that maintenance constitutes only a small share of operating costs, the project team suggests that FWS continue to consider both open-air trams and basic vans until implementation details become more clear. Final vehicle selection may also depend on partnership arrangement and the preferences of the operator.

Any tour or transit service to the refuge requires a vehicle that is accessible for people with disabilities (either some or all of the time, depending on the operator. See Appendix II for more detailed information). The current TTOR van service does not provide such an option, but the vehicles identified in Chapter 4 would meet these requirements. The project team recommends that FWS work with partners to identify and procure an appropriate accessible vehicle as soon as possible.

Scheduling: Coordination to Match Visitor Arrival Schedules

Based on conversations with visitor information stakeholders in downtown Nantucket, the project team identified an opportunity for Nantucket NWR alternative transportation to be better coordinated with the ferry arrival schedules. Many visitors taking day trips to Nantucket may be interested in taking a tour of the refuge, but arrive too late in the day to take advantage of the current tour schedule. The project team recommends exploring adjustments to the current schedule, or adding a third, mid-day departure.

Resource Closure Options: Potential for Galls Shuttle Service

Positioning a shuttle vehicle on the other side of the restricted Galls area during shorebird nesting resource closures would require extensive coordination between FWS, TTOR, NCF, any other operating partners, and state environmental regulators. It would also require visitors to walk a considerable distance, approximately one mile, along the shoreline before meeting the vehicle. While this may be a feasible option for allowing access during the entire summer, the project team believes the logistical barriers and environmental risks are likely to outweigh the benefits.

Water-Based Transportation: Boat Tours

While high costs and often-unfavorable wave conditions make regularly scheduled boat service infeasible, FWS may be able to partner with one of Nantucket's boat tour operators to participate in occasional tours or special events that bring passengers out around Great Point, but do not land on the refuge. For example, a FWS ranger could provide interpretation on the vessel, and the agency could share revenues through an agreement with the operator. Flexible scheduling in response to weather events would be critical, although waves may present less of a challenge to a craft that is not actually landing on the refuge.

FWS Role and Actions

Given the lack of full-time, on-site refuge staff, FWS needs to have a limited role in operating and managing alternative transportation. However, as described below, the agency can and should play a key role in enabling, promoting, and coordinating enhanced alternative transportation. In particular, the project team recommends the following actions for FWS:

- Procure accessible vehicle(s) that the operator would use to access the Nantucket NWR
- Provide explicit permission for tour/transit service to the refuge
    - This may include revisiting the current compatibility determination that allows for two trips per day to the refuge, if new service would expand the current offerings.
- Provide space for vehicle storage facilities if new FWS land on Nantucket becomes available (if appropriate given the conservation needs of such property)
- Market and provide information about the refuge and transportation options through refuge literature and on the refuge website
- Coordinate with and advise partners on operations and logistics (e.g. pickup locations, time tables, marketing, etc.)
- Provide appropriate interpretive information to be used during tours or transit service – this could be through a script if FWS staff is not present on the tours.

The sections below elaborate on a number of these actions.

Partnerships

To develop and operate enhanced alternative transportation service, FWS should continue to collaborate with transportation and conservation partners on the island.

New Agreement with TTOR

Given their current successful operation of Natural History Tours to the refuge, ownership of adjacent land, and the refuge management activities they currently provide to FWS, TTOR is a potential partner for FWS to work with on future transportation. The project team notes that FWS's current memorandum of understanding with TTOR has expired. The two organizations could include provisions for operating and managing expanded, accessible transportation service as part of the new agreement.

Local Nantucket Partnerships

The project team recommends that FWS and its partners work with the Town of Nantucket and the Nantucket Regional Transportation Authority (NRTA) to:

- Identify convenient in-town locations for passenger boarding and disembarking
- Explore potential co-location of vehicle storage and maintenance facilities
- Discuss feasibility of maintenance agreements between the local agencies and FWS or its operating partner

Local coordination may be especially valuable in maintaining open-air trams, which are larger and may require specialized parts, making them more difficult to service and store.

The Maria Mitchell Association (MMA) is another important conservation partner for FWS, and may be a good partner for expanded transportation service. MMA has provided an in-town pick up/drop off site for the TTOR tour in recent years, and may be able to continue providing space for refuge access loading as their new building effort proceeds. There may be opportunities to further coordinate interpretation and education, e.g., through refuge-related exhibits or films at the MMA site or coordinated refuge tour and museum admission ticketing. The project team recommends that FWS continue to discuss such options with MMA.

Interpretation and Marketing

In its site visits and discussions with stakeholders, the project team noted that many Nantucket visitors seem to be unaware of the Nantucket NWR and of their transportation options for visiting. Communication about refuge visitation is vital to the success of any future transit or tour service. In particular, the project team recommends that FWS develop an outreach strategy to communicate:

- The unique character of the Nantucket NWR
- FWS's role in land conservation nationally, as well as on the island
- Transportation options to the refuge

Additional interpretive materials about the refuge would help enhance any outreach strategy to promote the Nantucket NWR and alternative transportation options.

Audience

The project team recommends that any outreach effort target Nantucket visitors in particular, as long-term and seasonal island residents may already be familiar with the refuge. However, service options

such as the transit or hybrid transit/tour model could appeal to residents, and FWS and its partners should ensure that they inform residents of additional refuge access options. Also, many residents appear to not be aware of various access options, especially during Galls closures. For example, visitors may generally continue to hike and use personal boats to access Great Point even when shorebird nesting requires closure to vehicles.

Outreach Actions

FWS may take a number of actions to spread awareness about the refuge and its transportation options, both with a transportation partner and independently. The project team identified the following actions that FWS can take independently:

- Develop a Nantucket NWR brochure and interpretive materials
- Enhance content on the refuge's website to include interpretive and transportation information
- Consider longer term development of on-site interpretation (e.g. signs, placards, etc.) and/or visitor materials (e.g. mobile app, interpretive guide, etc.)

The following actions, likely performed in coordination with any operating partner, would also be helpful for communicating about the refuge and its transportation options:

- Develop a joint marketing and information campaign about the enhanced alternative transportation service
- Create materials that describe the various options for accessing the refuge throughout the year (i.e. driving/permits, hiking, boat access, transit/tour service)

A coordinated outreach strategy will be key to attracting users to enhanced alternative transportation and for communicating the unique value of the Nantucket NWR to island visitors and residents.

Appendix I: Meetings and Stakeholders

During the course of this study, the FWS/Volpe project team conducted three site visits to the Nantucket NWR. During these visits, the team met with refuge stakeholders, listed below, to solicit their input and discuss initial findings. The team consulted with some of these stakeholders less formally through email and phone conversations between formal site visits.

Initial Stakeholder Meeting and Site Visit: May 7 - 8, 2013

- Linda Loring Nature Foundation
- Maria Mitchell Association
- Nantucket Conservation Foudnation
- Nantucket Planning & Economic Development Commission
- Nantucket Regional Transit Authority
- The Trustees of Reservations
- Town of Nantucket

Site Visit 2: August 27 – 28, 2013

- Nantucket Conservation Foundation
- Nantucket Planning & Economic Development Commission
- Nantucket Visitors Center
- Town of Nantucket
- Nantucket Anglers Club

Site Visit 3: June 23 – 25, 2014

- Maria Mitchell Association
- Nantucket Conservation Foundation
- Nantucket Planning & Economic Development Commission
- Nantucket Regional Transit Authority
- The Trustees of Reservations
- Town of Nantucket

Appendix II: Accessibility Requirements

The U.S. Fish and Wildlife Service follows and enforces Federal civil rights laws to ensure that all persons are offered equal access to programs and activities, without regard to disability status. These laws apply to programs that are conducted by FWS or by any recipient of Federal financial assistance.[37] Accommodations for persons with disabilities can include modification of equipment or structures to allow for disabled access or providing information about programs and activities in alternative formats.

Accessibility-related laws

There are several Federal laws that apply to FWS with regard to providing access to and within refuges. Applicable portions of the accessibility laws and how they affect access to and on NNWR are discussed below.

Rehabilitation Act of 1973, Section 504, As Amended

Section 504 of the Rehabilitation Act of 1973,[38] as amended by Section 119 of the Rehabilitation, Comprehensive Services, and Developmental Disabilities Amendments of 1978,[39] prevents any program or activity conducted by Federal Agencies or by any recipient of Federal financial assistance from discriminating against or excluding participation of persons with disabilities. 49 Code of Federal Regulations, Part 17 implements these laws for programs operated or assisted by the Department of Interior.

Lighthouse and Interpretation

The Great Point Lighthouse is located on a one-acre inholding to NNWR that is owned by the U.S. Coast Guard. TTOR maintains the lighthouse through a management agreement with the Coast Guard. The lighthouse, as constructed, is not accessible to persons with disabilities. Because it is located on Federal property, any tours of the lighthouse must be operated in a non-discriminatory manner and be accessible to people with disabilities. Because the lighthouse is not physically accessible to handicapped persons, accommodations for persons with disabilities must be provided using alternative methods, such as using audio-visual materials and devices to depict the inaccessible portions of the property.

Architectural Barriers Act (ABA) Accessibility Standards for Outdoor Developed Areas

The ABA Accessibility Standards for Outdoor Developed Areas, released in 2013, address access to trails and beach access routes of outdoor developed areas on Federal sites.[40] The requirements apply to facilities that are built, altered, or leased with Federal funds, including non-Federal entities that construct or alter recreation facilities on Federal land on behalf of the Federal agencies.

ABA defines trails as pedestrian routes developed primarily for outdoor recreational purposes. Beach access routes link trail routes to the high-tide line of the beach. There are currently no designated trails or beach access routes on NNWR. New beach access routes would be required if there are any alterations to circulation paths, parking facilities, toilet facilities, or bathing facilities. ABA standards require one beach access route for each ½ mile of beach shoreline. Beach access routes may be

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[37] http://www.gpo.gov/fdsys/pkg/CFR-2012-title43-vol1/pdf/CFR-2012-title43-vol1-part17.pdf

[38] http://www.dol.gov/oasam/regs/statutes/sec504.htm

[39] http://www.eeoc.gov/eeoc/history/35th/thelaw/rehab_amendments_1978.html

[40] http://www.access-board.gov/guidelines-and-standards/recreation-facilities/outdoor-developed-areas/final-guidelines-for-outdoor-developed-areas/single-file-version-of-rule

developed using removable materials; there commercial products for portable rollout or panel systems, which are regularly used in beach contexts. See Appendix III for examples.

The standards do provide conditions for exceptions from compliance with the technical requirements for trails and beach access routes. These exceptions include:

- Compliance is not practicable due to terrain.
- Compliance would fundamentally alter the function or purpose of the facility or the setting.
- Compliance is limited or precluded by any of the following laws, or by decisions or opinions issued or agreements executed pursuant to any of the following laws: Endangered Species Act; National Environmental Policy Act; National Historic Preservation Act; Wilderness Act; or other Federal, State, or local law the purpose of which is to preserve threatened or endangered species; the environment; or archaeological, cultural, historical, or other significant natural features.

The ABA accessibility standards for outdoor developed areas are described in 36 Code of Federal Regulations, Part 1191.

Americans with Disabilities Act of 1990 (ADA)

Under the ADA, the U.S. Department of Transportation issues and enforces accessibility standards for transportation vehicles.[41] The accessibility standards are described in the ADA Accessibility Guidelines for Transportation Vehicles, and apply to new or remanufactured vehicles, including buses, vans, and trams. The ADA standards also address transportation services and facilities. 36 Code of Federal Regulations, Part 1192 describes the ADA accessibility standards for transportation vehicles, and 49 Code of Federal Regulations, Part 37 implements the transportation and related provisions of the ADA.

Vehicles

Any transit vehicle for use by individuals with disabilities shall follow the technical requirements set in the ADA Accessibility Guidelines for Transportation Vehicles. These guidelines describe the required layout and construction of accessible vehicles, including the clear-space requirements for wheelchairs and design loads for lifts.

Service Operated by FWS

Any public entity operating a fixed route system purchasing or leasing a new bus or other new vehicle for use on the system shall ensure that the vehicle is readily accessible to and useable by individuals with disabilities, including individuals who use wheelchairs.

Service Operated by Third Party

Any private entity, not primarily engaged in the business of transporting people, who is purchasing or leasing a vehicle with a seating capacity of 16 or fewer passengers (including the driver) shall ensure that the vehicle is readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs. There is flexibility if the system, when viewed in its entirety, meets the standard for equivalent service.

The Equivalent Service Standard allows a private operator to use vehicles which are not accessible by individuals with disabilities, as long as the operator provides an equivalent service to individuals with disabilities, including individuals who use wheelchairs, in the most integrated setting appropriate to the

[41] http://www.gpo.gov/fdsys/pkg/CFR-2012-title49-vol1/pdf/CFR-2012-title49-vol1-part37.pdf

needs of the individual. This allows an operator to use non-ADA accessible vehicles when no individuals with disabilities are present, and then use an accessible vehicle when required.

Transportation Facilities

Any new facility to be used in providing designated public transportation services, such as new (built after January 1992) bus boarding areas, shall be accessible to and usable by individuals with disabilities, including individuals who use wheelchairs. Accessible transportation facilities require bus boarding areas with firm, stable surfaces. However, if the agency can demonstrate that it is structurally impracticable to meet the requirements, such as if the characteristics of terrain prevent the incorporation of accessibility features (such as on the refuge), full compliance may not be required.

Implications for NNWR

FWS and its partners must consider the Federal accessibility requirements with regard to transportation service to NNWR. Any alternative transportation system that brings visitors to the refuge, whether operated by FWS or by a private partner, must be usable by individuals with disabilities.

First, there must be a vehicle available that follows the technical requirements established in the ADA Accessibility Guidelines for Transportation Vehicles. If the transportation system is operated by FWS, all vehicles used must be accessible. If the system is operated by a third party, per the equivalent service standard, there must be an accessible vehicle available upon request by prior arrangement for visitors requiring accessible accommodation.

Second, the boarding areas must be accessible to and usable by individuals with disabilities, including individuals who use wheelchairs. All boarding areas, including in the town, at the gatehouse, and on NNWR, shall have a firm, stable surface for boarding of wheelchairs. Because it would be structurally and environmentally impracticable to build a fixed boarding area on the refuge, the use of temporary matting is recommended.

Third, a tour including a visit to the lighthouse must include a way to provide an alternative experience for visitors who are unable to climb the lighthouse. This may be accomplished through alternate media such as photographs and recordings.

Appendix III: Temporary Beach Access Matting

Federal accessibility laws require that beach access routes and bus boarding areas be accessible to and usable by individuals with disabilities, including individuals who use wheelchairs. Because it would be structurally and environmentally impracticable to build walkways and a fixed boarding area on the refuge, one option may be to use temporary access systems. Mobi-Mat, a portable rollout access mat, and DuraDeck, a portable panel system, are both examples of products which can be used to create a temporary surface accessible to persons with disabilities.

Mobi-Mat

Mobi-Mat RecPath is a portable rollout ADA-compliant beach access mat for pedestrians and wheelchairs. The rollout mats are available in widths up to 6.5 feet and lengths up to 82 feet. To install, the rolls are stretched out and anchored into the sand. To create longer sections, the rolls can be connected end-to-end with special connectors. A 5 foot wide by 50 foot long section weighs 72 pounds and can be handled by two people. The cost for a 5 foot by 50 foot section is approximately $3,500; the cost for 500 linear feet of matting is approximately $35,000.

Figure 24: Mobi-Mat RecPath. Source: City of New York

DuraDeck

DuraDeck is a portable plastic panel system which can be used to create ADA-compliant beach access routes. The panels are each eight feet long and four feet wide and each weigh 86 pounds, and can be connected together to create larger surface areas or longer walkways. To create paths, the sections are laid end-to-end and linked using connection holes. Each panel costs approximately $160; the cost for 500 linear feet of matting is approximately $10,000. DuraDeck mats are less expensive than MobiMat

and may even be able to withstand the weight of vehicle traffic, but the increased square footage and weight would make them more challenging to store and install.

Figure 25: DuraDeck for beach access. Source: AccessRec

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