



Assabet River National Wildlife Refuge Transportation Study

Preliminary Candidate Alternatives Report

Submitted to
Eastern Federal Lands Highway Division
21400 Ridgetop Circle
Sterling, VA 20166-6511

Submitted by
 *Vanasse Hangen Brustlin, Inc.*





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Prepared For: Federal Highway Administration
Eastern Federal Lands Highway Division

U.S. Fish and Wildlife Service
Northeast Region

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Introduction

The Assabet River National Wildlife Refuge (ARNWR) is one of eight refuges comprising the Eastern Massachusetts National Wildlife Complex and is located in the communities of Hudson, Stow, Maynard and Sudbury, Massachusetts. Established in 2000, the refuge opened to public use in 2005. The property was previously under the control of the U.S. Army and used for a variety of training and research purposes until it was transferred to the U.S. Fish & Wildlife Service (FWS) under the Base Closure and Realignment Act of 1990. A location map and a site map of ARNWR are presented as **Figure 1.1** and **Figure 1.2**.

The purpose of the ARNWR Transportation Study is to develop a plan of prioritized projects to improve access to, and mobility within, the refuge. This *Preliminary Candidate Alternatives Report* presents the initial screening of conceptual project alternatives identified during the evaluation of existing conditions¹ and through the project's public outreach process, including consultation with refuge staff. The purpose of the initial screening is to determine candidate project alternatives to be advanced for further, detailed evaluation, and to document those conceptual alternatives that were dismissed from further consideration. The evaluation of the candidate project alternatives and recommendations for preferred projects will be presented in the subsequent *Transportation Improvement Plan* report.

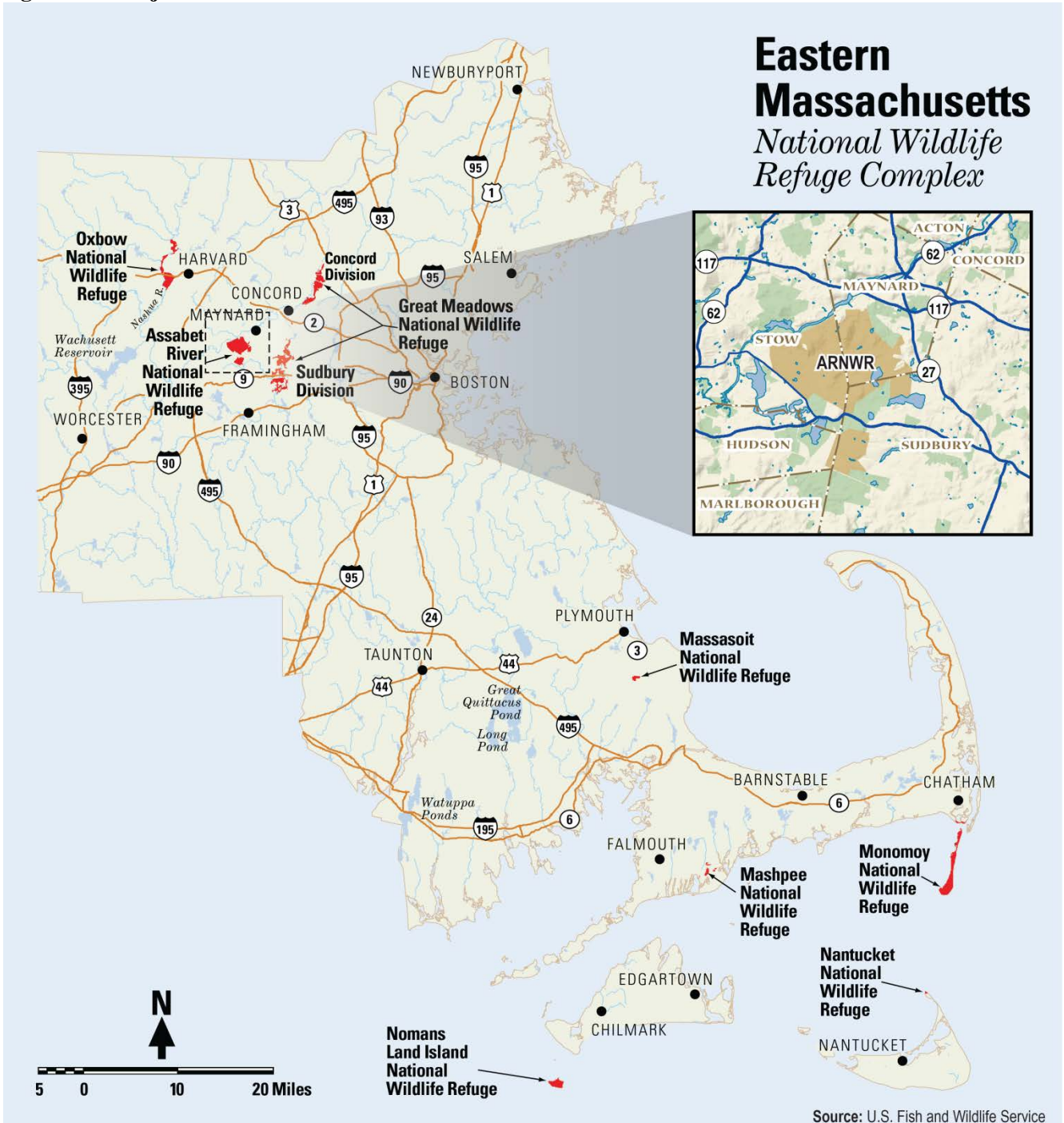
The findings of this report are presented in the following two chapters.

- The Preliminary Conceptual Alternatives chapter presents the list of conceptual alternatives, the initial screening of those projects, and documents those dismissed from further consideration and those retained for further evaluation as candidate alternatives.
- The Candidate Alternatives chapter summarizes the projects advanced as candidate alternatives, including the No-Action alternative.

¹ Assabet River National Wildlife Refuge Transportation Study Existing Conditions Report, April 2012.



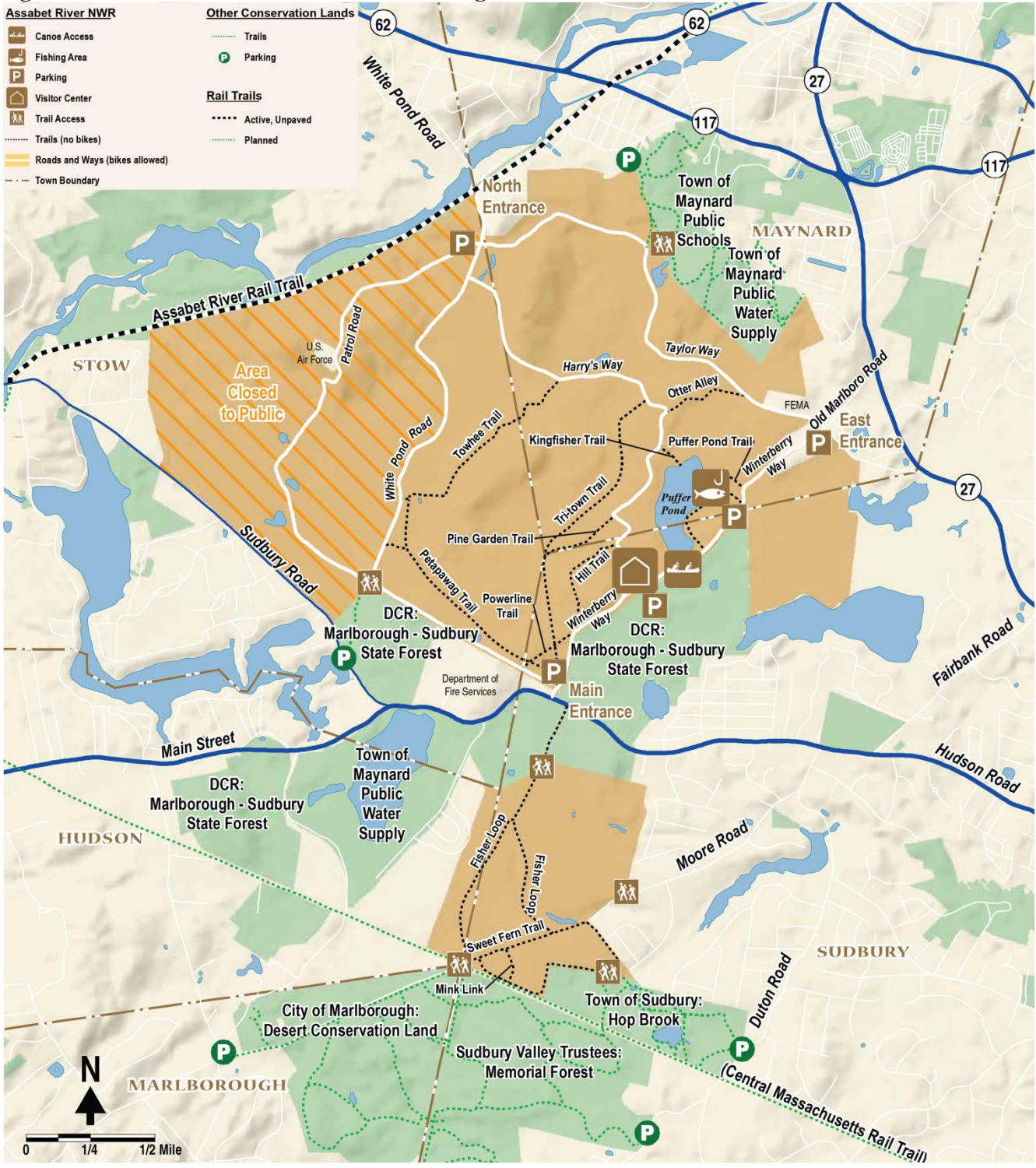
Figure 1.1: Project Location





Assabet River National Wildlife Refuge –
 TRANSPORTATION PLANNING STUDY –
 PRELIMINARY CANDIDATE ALTERNATIVES REPORT

Figure 1.2: Assabet River National Wildlife Refuge





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Preliminary Conceptual Alternatives

This chapter presents the initial screening of potential projects identified during the evaluation of existing conditions and through the project’s public outreach process, including consultation with refuge staff. The purpose of the initial screening is to determine the conceptual project alternatives to be advanced for further, detailed evaluation, and to document those potential projects that were dismissed from further consideration.

2.1 Screening Criteria

General and comparative screening criteria were used for determining which of the conceptual project alternatives are to be advanced for further evaluation as candidate alternatives. The general criteria include consistency with the mission and policies of the National Wildlife Refuge System and the Assabet River National Wildlife Refuge. Criteria used to screen preliminary project concepts that addressed similar purpose and need include comparative factors such as the transportation benefits provided by the project, environmental and cultural impacts, constructability, cost, and the overall feasibility for implementing the project. In addition, all conceptual projects are screened for readily apparent design or operational “fatal flaws”, although some of these may not become evident until a more detailed evaluation is done.

- All projects advanced as candidate alternatives are consistent with the mission of the National Wildlife Refuge System to conserve, protect, and enhance fish, wildlife, plants, and their habitats for the continuing benefit of the American people. This includes supporting the six wildlife-dependent recreational uses defined as priority public uses of refuge lands – hunting, fishing, environmental education, environmental interpretation, wildlife observation, and wildlife photography.² Policies set forth in the refuge’s Comprehensive Conservation Plan and other planning documents set some

² National Wildlife Refuge System Improvement Act of 1997.



parameters for the types of transportation projects that are considered for further evaluation. For example, the refuge’s system of roads, trails and ways has been carefully developed and no new or relocated roads, trails or ways are to be considered except for connectivity purposes.

- Some of the conceptual projects are “competing” projects that are alternative ways of addressing the same transportation issues. In some cases the advantages of one project over the other becomes readily apparent and the less-desirable project can be dismissed from further consideration. In many instances, however, both project options are advanced for further evaluation because only through the second-stage, detailed evaluation can the preferred project version be determined. Among the factors considered in the comparative screening are the following.
 - **Transportation Benefits provided by the project** — Which project alternative best achieves the identified needs for access to, and mobility within, the refuge.
 - **Environmental and Cultural Impacts** — Which project alternative is best for protecting and enhancing wetlands, wildlife habitat, and historic elements.
 - **Constructability** — For projects with similar benefits, which project alternative is most likely to be effectively implemented. This takes into account not only the physical constraints of the project location, but also the complexity of required permitting, number of partnerships, and the likely time frame for implementation.
 - **Cost** — Which project is the most cost-effective. For the purposes of this initial screening, a project’s general scale of construction costs are categorized as Low, Moderate and High. Cost estimates will be developed later for those projects advanced as candidate alternatives.

2.2 Preliminary Conceptual Alternatives

This section discusses the preliminary conceptual alternatives identified through the existing conditions data gathering process, stakeholder input, and public outreach process. The potential projects are listed among three general categories — External Access, Internal Infrastructure, and Internal Circulation and Mobility. It is noted that often an issue can overlap with two of the main areas.

Each conceptual project is summarized as to its purpose and key work elements, the potential length of time for implementation, the general scale of cost, and what partnerships may be involved. The categories for the potential time for implementation are short-range (up to five years), mid-range (5 to 10 years), and long-range (10 to 20 years). The cost categories are low cost (less than \$50,000), moderate cost (\$50,000 - \$250,000), and high cost (over \$250,000).

Projects or project alternatives that are dismissed from further consideration are noted. All others are advanced as candidate alternatives. Those that are dismissed from further consideration were found to have “fatal flaws” in design elements of the concept or were more complex or costly than a similar project that addressed the same issue.



2.2.1 External Access

Based on a review of existing and projected future conditions, the following external access improvements were considered for the refuge study area.

Vehicular wayfinding signage to the refuge. There has never been any wayfinding signage external to the refuge. The installation of appropriate wayfinding signs will provide better guidance for first-time visitors, as well as market the refuge to passing drivers. Most of the signage would be on arterial and collector roads and would lead visitors to the main entrance and the visitor center. Additional signs would be on the local roads that lead to the north entrance and to the east entrance. The wayfinding signage project is short-range and low cost. It involves coordination of efforts with the communities in which signs would be installed — Stow, Maynard, Sudbury, and Hudson.³

Improve visibility of Hudson Road crosswalk. This crosswalk is used by visitors walking or bicycling to the refuge from Sudbury via the sidewalk path along the south side of Hudson Road, and by visitors traveling between the refuge’s north and south tracts. The project is to trim vegetation near the crosswalk to make persons waiting to cross more visible to approaching drivers. In addition, an in-street pedestrian crossing sign (shown at right) could be used on busy days, as is done by the Town of Sudbury at crosswalks farther east on Hudson Road near Haskell Field. The project is short-range, low cost, and would include coordination with the Town of Sudbury.



Encourage use of existing state forest parking. Making better use of parking on adjacent conservation and recreation lands by visitors to the refuge would provide an alternative to constructing additional parking in the refuge. The best opportunity for doing so is with the state forest parking lot on Sudbury Road. The parking lot can accommodate about a dozen cars and a short walk from the lot through the state forest property leads to the interior of the refuge at the intersection of Patrol Road and White Pond Road. The parking lot is well used during hunting season, but it is rarely used other times of the year. The parking and the trail connection to the refuge can be highlighted on park mapping and parking information. Although no improvements would need to be made to the parking area, a few small directional signs would be needed at the parking lot and along the trail connection through the state forest. Most significantly, the trail itself would need to be maintained, likely by refuge staff or volunteers. The project is short range, low cost and would involve the Massachusetts Department of Conservation and Recreation.

Additional parking at the main entrance. The nine-space parking lot at the main entrance is a popular location for visitors who are walking or biking on the trail networks. The parking lot is usually full at some point during busy days. Several options for creating additional parking were identified.

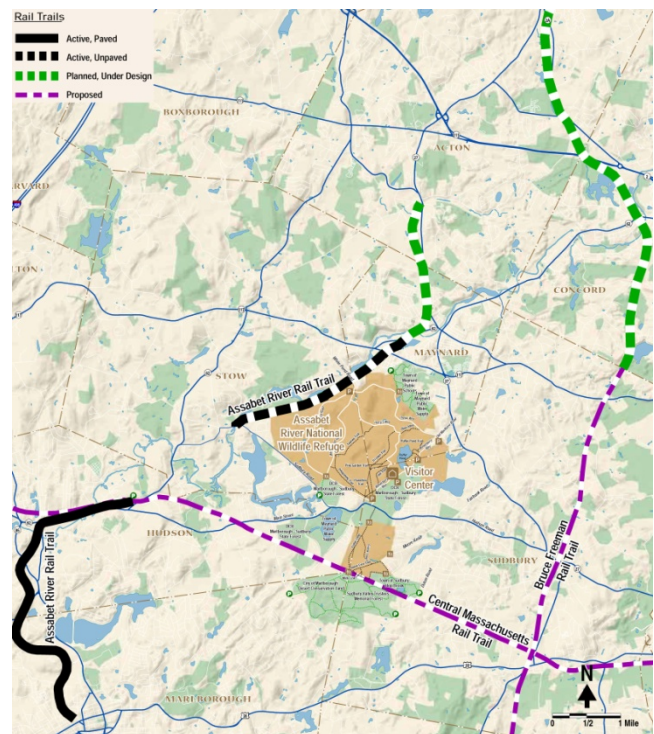
³ See Technical Memorandum #1 for details of wayfinding plan.



1. One option is to expand the existing parking area by 10 parking spaces by adding a second row of parking. This is a low-cost, short range option located wholly on refuge land.
2. Another option is to create a new parking area on the adjacent gravel parking area owned by the Massachusetts Department of Fire Services. This alternative is dismissed from further consideration since the Department of Fire Services now plans to use the parking area to accommodate continued growth in training activity, and has developed plans to re-grade and pave the parking area.
3. A third option is to create a new parking area on the state forest land adjacent to the entrance drive, where the sign and flagpole are located. This project could provide up to about 35 parking spaces. The land would have to be obtained from the Massachusetts Department of Conservation and Recreation, and this would require action not only by the agencies involved, but also by the state legislature. This alternative is dismissed from further consideration due to the comparative advantages of the first option. The first option can be implemented without land acquisition, at a lesser cost, and provides for a better visual entrance to the refuge than would a large parking area remote from the visitor center. Although the first option provides only 10 additional parking spaces, they would be sufficient on most days and additional parking capacity for the few busiest days each year is available at the visitor center.

Support rail trail connections. Facilitating non-motorized access to the refuge is a high priority of the refuge and is consistent with the FWS efforts to reduce its carbon footprint. There are three rail trail projects in the refuge’s host communities that provide various levels of opportunities to enhance connectivity. They are the Assabet River Rail Trail, the Central Mass Rail Trail, and the Bruce Freeman Rail Trail.

The support for the rail trail projects involves marketing of the trail access to the refuge and advocacy to support current efforts to move the trail projects through the state planning, design and funding process. For example, the recent Boston MPO FY13-FY16 Transportation Improvement Plan⁴ deferred the construction funding for the northerly section of the Assabet River Rail Trail and instead made it a “first tier” priority project for the MPO should additional funding become available. The refuge could support efforts to restore the previous funding schedule. Some marketing opportunities exist today with the Assabet



Existing and proposed rail trails near ARNWR

⁴ Draft Federal Fiscal Years (FFYs) 2013–16 Transportation Improvement Program (TIP), Boston MPO, May 2012.



River Rail Trail connections and more will exist once the rail trail projects are fully realized. Brochures for the refuge should be provided at rail trail kiosks, and access to the refuge from the rail trails should be highlighted in the refuge's informational materials.

The three rail trail projects and their relationship to enhancing access to the refuge are discussed below.

1. **Assabet River Rail Trail.** A section of Assabet River Rail Trail (ARRT) runs along the northwest boundary of the refuge. A one-mile section between the refuge's north entrance and downtown Maynard is currently unpaved but is maintained and is actively used by bicyclists and walkers. The final design of that section and the design of its extension farther north through Maynard and into Acton is underway. This Maynard section of rail trail travels through the highest density of populations near the refuge and provides the best connectivity to the refuge of the three rail trails.

There is an existing, paved segment of the ARRT in place between Hudson and Marlborough. The trailhead in Hudson is about five miles from the refuge's north entrance and four miles from the main entrance. Connectivity to the north entrance is unlikely since a segment of the old rail line between the Hudson trailhead and the refuge's north entrance is privately owned, but connectivity to the main entrance via the Central Mass Rail Trail alignment may be possible in the long term.

2. **Central Mass Rail Trail.** The proposed Central Mass Rail Trail is promising for its connectivity with Sudbury neighborhoods to the southeast of the refuge, and to the trailhead for the Hudson section of the Assabet River Rail Trail. The segments of Central Mass Rail Trail alignment near the refuge are controlled by the Massachusetts Department of Conservation and Recreation. The design of the rail trail has recently begun; however, there are no funding commitments for construction at this time and any substantial use of the rail trail for accessing the refuge should be considered a long-term potential. It is important to note that the Central Mass Rail Trail is located along the south boundary of the refuge's south parcel and bicycling is not a permitted use in the south tract. To provide access for bicyclists to the visitor center in the north tract, accommodation for bicyclists in the south tract would need to be considered.
3. **Bruce Freeman Rail Trail.** The Bruce Freeman Rail Trail is proposed to follow a 25-mile north-south route from Lowell to Framingham. The northerly section has been constructed and the southerly section is under design. The remaining section, through Sudbury, continues to be advocated for by the Friends of the Bruce Freeman Rail Trail and others, but right-of-way acquisition is incomplete and no design work is underway. Unlike the other two rail trails, the Bruce Freeman Rail Trail would not be adjacent to the refuge. Should the Sudbury segment be constructed, the closest it will be to the refuge is about 3.5 miles via streets with no dedicated bicycle lanes. Nonetheless, the Bruce Freeman Rail Trail does connect with the Central Mass Rail Trail and would thus provide additional connectivity to the refuge for bicyclists.



Signage at main entrance.⁵ Two issues regarding signage at the main entrance were identified through the study process. One is the lack of visibility of the main (Winterberry Way) entrance for drivers approaching on Hudson Road. The other is uncertainty by first-time visitors as to whether they should proceed through the gate on Winterberry Way or park in the adjacent parking lot.

- The issue with uncertainty by first-time visitors when they arrive at the gate is in part due to the visitor center not being visible from the gate and concern as to when the gate will be closed at the end of the day. Project elements to address this issue include more explicit signage directing to the parking and trails at the visitor center, and signs indicating when the gate will close that day.
- Advance signs for the entrance, an entrance sign closer to the road, and removing some vegetation obscuring the existing ARNWR monument sign from westbound drivers are ways to improve visibility of the main entrance. Reflective signs would improve conditions at night for those attending meetings at the visitor center.

This project to improve signage at the main entrance is short-range, low cost, and would involve working with the Town of Stow, the Town of Sudbury, and the Massachusetts Department of Conservation and Recreation.

Improved safety at main entrance. The speed and volume of traffic on, and character of, Hudson Road create some safety concerns at the refuge's main entrance related to eastbound vehicles entering the refuge. The relatively low volume of traffic entering the refuge can result in through-traffic drivers being unprepared for vehicles slowing to turn left into the refuge. There have been no accidents at that location, but the refuge is relatively new and increased visitation is a goal. Four alternatives were identified to address the issues.

- 1. Signage at main entrance.** As noted for the project to improve signage at the main entrance, advance signs for the entrance, an entrance sign closer to the road, and removing some vegetation obscuring the existing ARNWR monument sign from westbound drivers are ways to improve visibility of the main entrance. The signs would be reflective and thus improve conditions at night for those attending meetings at the visitor center.
- 2. Move the entrance road to the east.** This option is to relocate the refuge entrance road about 300 feet to the east onto state forest property, to where the crosswalk on Hudson Road is at present. The new alignment would be on the old rail track corridor now used for the walking path from Hudson Road. The project would include reconfiguration of the crosswalk and the walking path. The land would have to be obtained from the Massachusetts Department of Conservation and Recreation, subject to approval by the state legislature. The project would also involve the Town of Sudbury. This project is mid-range and of moderate cost.

⁵ See Technical Memorandum #1 for specifics of recommended signage enhancements at the main entrance



3. **Move the entrance road to the west.** This option is to relocate the refuge entrance road about 700 feet to the west, near to the Sudbury/Stow town line. The entrance road alignment would use an existing utility corridor through Department of Fire Services land and along Powerline Trail in the refuge. Until closed when the army took over the land in the 1940s, this was the historic alignment of one of the primary roads (Concord Road/Cravan Lane) through what is now the refuge. A sight distance analysis of this location showed that there would be little improvement over the existing location, essentially mitigating issues with the eastbound approach by creating similar issues with the westbound approach. Because the benefits are less than relocating the entrance to the east, and because it is a more costly and complex project, this project is dismissed from further consideration.
4. **Create an eastbound left turn lane pocket.** A left-turn lane would allow through traffic to pass cars waiting to turn into the refuge. The lane could be constructed by widening Hudson Road for about 600 feet to account for the storage area and taper for the lane. The project would involve the Department of Fire Service, the Massachusetts Department of Conservation and Recreation and the Town of Sudbury. The project cost would be moderate. Construction of the project could be mid-range, but implementation is long-range due to the need to meet justification criteria. MassDOT standards for left-turn lanes are generally based on the volume of turning vehicles and the volume of opposing traffic flow and current traffic volumes are not high enough to meet those warrants.⁶

State forest parking on Hudson Road. A potential project was identified to construct a small dirt parking lot on state forest land along Hudson Road near the refuge's main (Winterberry Way) entrance. The parking would be similar to the state forest parking lot on Sudbury Road. The new parking area would not only provide parking and access for the adjacent state forest properties, it would be the closest and most visible parking for the refuge's south tract. Several locations were considered, but all were dismissed from further consideration. Locations on the south side of Hudson Road were preferred since visitors using that parking would not have to cross Hudson Road to access the refuge's south tract. Locations to the west and east of the crosswalk were reviewed. Constructing parking to the east of the crosswalk is not practical due to proximity of a wetland area. There is room to construct parking to the west of the crosswalk but access is an issue. Any driveway for that parking would create similar safety concerns with sight distance and turning vehicles as now exists at the Winterberry Way entrance. Locating parking on the north side of Hudson Road, to the east of the crosswalk, is constrained by wetlands and an easement for a high-pressure natural gas pipeline. Further, parking in this area has few if any advantages over the previously discussed options for creating additional parking at the refuge's main entrance.

Other potential external access projects dismissed from further consideration are links to transit and connections to waterways. Supporting access by means other than private automobiles is an important goal of the National Wildlife Refuge System and ARNWR already achieves considerable access by bicyclists and walkers. Connections to waterways and transit links are also desirable but impractical for ARNWR. There are no public transit systems operating in the host communities and none planned. The Assabet River does not provide any practical water access since the section of river adjacent to the refuge (the Ben Smith dam

⁶ See Technical Memo #3



impoundment) is where kayaks and canoes are put in rather than a destination from other locations along the river.

2.2.2 Internal Infrastructure

Based on a review of existing and projected future conditions, the following internal infrastructure improvements were considered for the refuge study area.

Reconstruct the north entrance access road (White Pond Road). This 1,000-foot long section of roadway extends from the refuge boundary at the end of White Pond Road at the Assabet River Rail Trail, to the newly constructed parking area near the north entrance gate. The 14-foot wide paved roadway is in “poor” condition based on a 2010 roadway inventory conducted by the Federal Highway Administration – Central Federal Lands Division⁷ and has an estimated service life of less than five years. The project would include widening to 18 feet to accommodate the mix of vehicle traffic to the parking lot and those entering the refuge on foot or by bicycle. The roadway is along the Maynard/Stow town line and is close to the Assabet River. The project is mid-range, of moderate cost, and would need to be coordinated with the towns of Stow and Maynard.

Reconstruction of Roads and Ways. The reconstruction and future maintenance of the roads and ways in the refuge is the most challenging of the transportation issues. Except for Winterberry Way none of the trail surfaces have been maintained since long before the refuge was established. Paved surfaces have deteriorated and unpaved surfaces are rutted. The loss of the crowning of the surface profile, as well as the loss of drainage swales, has hastened the damage by water flow.

The proposed projects involve the following four roads and ways.

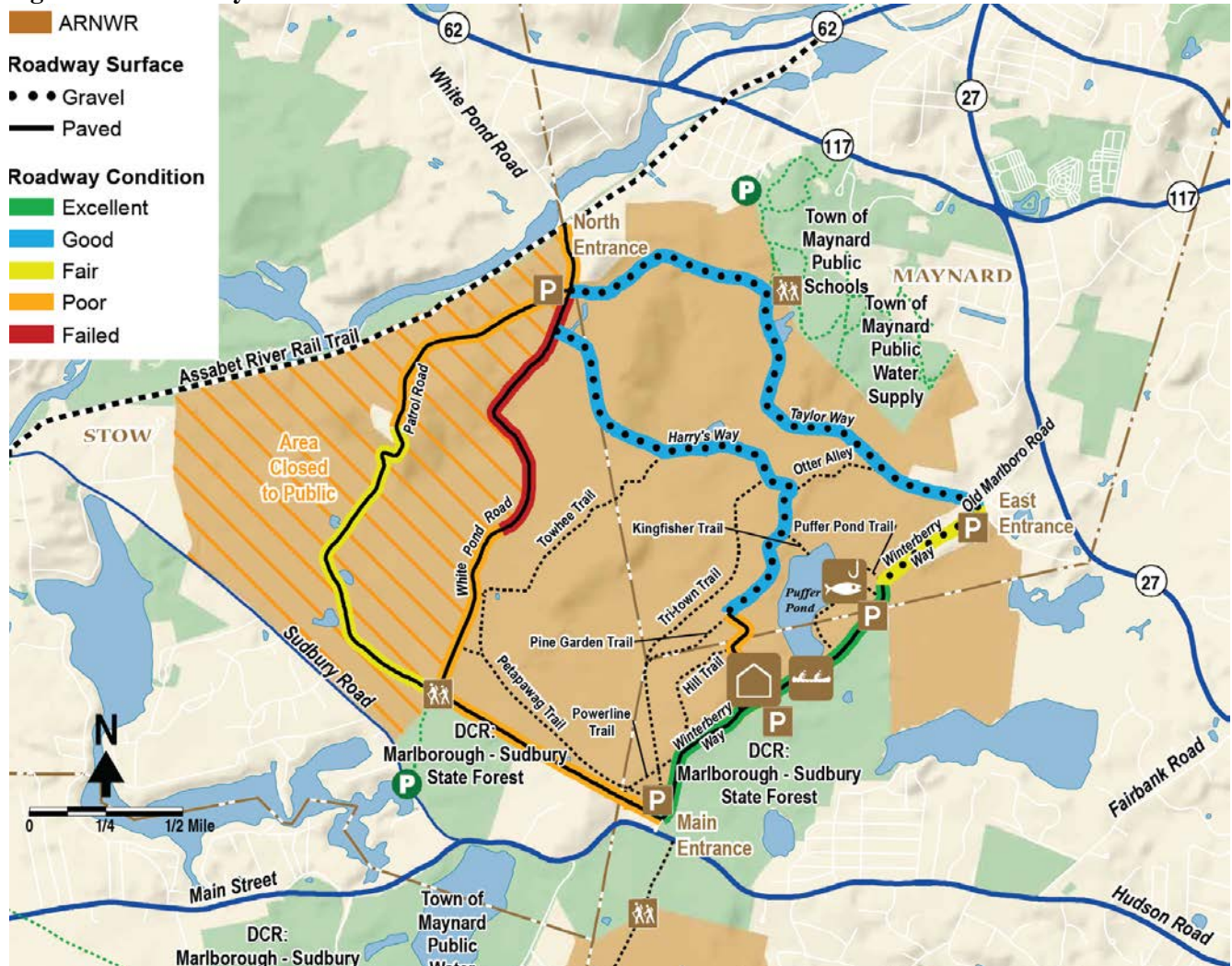
1. **Patrol Road**, between Winterberry Way and White Pond Road. This 0.8-mile section of paved roadway is used not only by bicyclists and walkers, but it also provides primary vehicle access to the Air Force site in the west section of the refuge. The project would reconstruct the paved road at a reduced width.
2. **White Pond Road**. This paved road is 1.7 miles long and used by bicyclists and walkers. The pavement conditions range from “poor” to “failed”. Options for this project include reconstructing the paved roadway or constructing a stabilized gravel path over the roadway base.
3. **Harry’s Way**. This trail is used by bicyclists and walkers. It is 1.9 miles long, of which 1.5 miles is gravel and 0.4 miles is paved. The paved section connects with the visitor center and is handicap accessible. The project would reconstruct the paved and gravel segments separately.
4. **Taylor Way**. This 1.8 mile gravel trail is used by bicyclists and walkers. The project would reconstruct the trail with a gravel surface.

⁷ *The Road Inventory of Assabet River National Wildlife Refuge*, Federal Highway Administration – Central Lands Division, September 2010.



The reconstruction of the four roads and ways are high cost projects and implementation would likely be mid-range. All of the roadway projects involve sections that border wetlands and the projects would involve the towns of Maynard, Stow and Sudbury.

Figure 2.1: Roadway surface and conditions



Note: Roadway surface and condition data are from *The Road Inventory of Assabet River National Wildlife Refuge*, Federal Highway Administration – Central Lands Division, September 2010.



Install a charging station at the visitor center. An electric vehicle charging station is in keeping with the education mission of the refuge and the carbon-footprint reduction goals of the FWS. ARNWR is well suited for an electric vehicle charging station due to the demographics of the gateway communities and the fact that the typical duration of visit to the refuge is about two hours and thus a single charging station might accommodate multiple vehicles each day. The project is short range and low cost. The visitor center is located in the Town of Maynard and partnership opportunities may become available since the town is part of the state’s Green Communities program.

Traffic counters at entrances. Vehicle, pedestrian and bicycle counters at the entrances to the refuge would provide more accurate information on the number of visitors and their pattern of use. This will enable future transportation and program planning to better meet the needs of the visitors and the refuge in a cost-effective way. The count system would be a data-logging system rather than provide real-time information. The count system would also use data recorders that could be moved easily to provide for targeted pedestrian and bicycle counts on trails within the refuge. The project could be implemented short range and at low cost.

Electronic kiosk at visitor center. A park use management software system, including an electronic kiosk at the visitor center, would provide visitors with information when the visitor center is closed, allow the refuge to collect information about visitor characteristics and experiences, and provide a means to manage the fishing and hunting activities at the refuge. Like the traffic counters, the park use management system would provide data to be used for future transportation and program planning. An example of such a system is i-Sportsman. Systems such as i-Sportsman are web-based and provide options for kiosk or smart phone use by visitors. The systems can provide visitors with updated information about the refuge, print maps or informational flyers, collect polling data about visitor activities, and manage the issuance of permits and revenue collection. The project could be implemented short range and at low cost.

Kiosk at the northern end of Winterberry Way. For this project a standard informational kiosk would be installed at the terminus of public vehicle access (paved) section of Winterberry Way. It was observed that when many of the visitors reach that location they are unsure of where they might enjoy going from there. Installation of the kiosk would be short range and low cost.

Maintenance of Sandbank Trail canoe launch. A canoe launch for Puffer’s Pond is located off the Sandbank Trail. There is a short, unimproved path leading from Sandbank Trail down to the water’s edge. The slope down to the water is relatively steep and erosion along the path and at the shoreline is a maintenance issue. An articulating concrete block mat system would stabilize the shoreline and path. The project would be short range and low cost, and would involve coordination with the Town of Sudbury.



Example of block mat system used for a boat launch



Accessible canoe launch. Providing handicap accessibility to the canoe launch is a priority for the refuge. Making the existing canoe launch location handicap accessible was dismissed from further consideration because of grade issues that would require construction of an extensive and intrusive ramping system. There is a drop of about 10 feet to the water and this would require more than 200 feet of ramping for handicap accessibility.

The most practical means of providing an accessible canoe launch is to provide it at the Barron Fishing Access Site located at the end of Carbury's Way. The dock could be expanded slightly to include additional dock platform and an accessible transfer system. The accessible transfer system include a sliding bench, grab bars, and a roller system to launch and land the canoe.



Example of accessible canoe launch

Key issues to be evaluated are options to provide and manage handicap parking for the canoe launch and the impacts of those options on Carbury's Trail. For example, if parking were provided at the shoreline, then Carbury's Trail would need to accommodate occasional use by private vehicles and policies would need to be established to manage that use. The project would be mid-range, of moderate cost, and would involve coordination with the Town of Maynard.

2.3.2 Internal Circulation and Mobility

The conceptual project alternatives addressing internal circulation and mobility reflect the study guideline that since the refuge's system of roads, trails and ways has been carefully developed no new or relocated roads, trails or ways are to be considered except for connectivity purposes. Accordingly, the conceptual projects focus on enhancing mobility among the existing travelways rather than constructing new trails.

Improve handicapped accessibility along Puffer Pond Trail and Carbury's Trail. This is an opportunity to enhance the experience at the refuge for all those who are mobility impaired. Reconstructing Carbury's Trail would provide an accessible trail from the parking at the end of Winterberry Way to the Barron Fishing Access Site. Reconstructing Puffer Pond Trail southerly from Carbury's Trail to Winterberry Way would create an accessible trail along the water, something not now available in the refuge. This project would be mid-range and moderate cost. The project would include coordination with the towns of Maynard and Sudbury.

Procure electric shuttle vehicle. Procuring one or more multi-passenger shuttle vehicles was identified as a means of expanding access to sites in the refuge for visitors who have mobility impairments, transporting school groups to learning sites within the refuge, and providing tours for all visitors. A multi-passenger vehicle could also be used as a parking shuttle to accommodate large meetings and events.



Shuttle service can involve a wide variety of operational scenarios involving service types (scheduled vs. non-scheduled), operational models (contracted versus self-operation), and even vehicle types. The preliminary evaluation of options took into account factors such as environmental benefits, impacts on trails, likely ridership patterns, driver licensing requirements, financial cost, and overall flexibility for accommodating a variety of mobility needs. The preferred vehicle option is an electric shuttle that carries fewer than 16 passengers (due to driver licensing requirements) and provides handicap accessibility.

Circulation and mobility concept alternatives dismissed from further consideration include accommodating unrestricted bicycle access on the south tract and consolidating bicycle routes within the north tract. The refuge has carefully considered both issues in the past and the current policies reflect the findings and recommendations of those analyses. Reducing the number of trails open to bicyclists in the north tract would be contrary to the compatibility determination for bicycle use in the north tract. Reducing the number of trails open to bicyclists would reduce mobility in that large area, would diminish visitor's access to a variety of habitats, and could dissuade non-automobile access to the refuge. Conversely, the south tract is small and easily walkable, it does not provide a unique visitor experience for bicyclists, and bicycle use in the south tract does not facilitate non-automobile access to the refuge.

Undefined future projects

There are two potential, but not certain, events that could significantly affect circulation within the refuge. The first is the construction of the Central Mass Rail Trail. For that project to facilitate non-automobile access to the refuge would require connectivity for bicyclists through the south tract and to the visitor center. The second potential event is the possible transfer of the Air Force easement and buildings to the FWS. If that transfer were to occur, it would change how Patrol Road in the area of the refuge closed to public access might be used and thus affect options for roadway capital and maintenance investments.

There is no guarantee that either event will ever occur and, due to their potentially broad impacts on the refuge, if they were to happen any subsequent planned projects and policy changes would likely first need to be evaluated as part of the refuge's next Comprehensive Conservation Plan (CCP) update. The first CCP for ARNWR was done in 2005 and they are typically updated every 15 years. Regardless of the uncertainty and long-term time frame, the significant changes to circulation that could arise should those events occur make it useful to understand how the existing transportation infrastructure might be maintained in order to not preclude later transportation planning options.

1. **Bicycle connectivity between the Central Mass Rail Trail and visitor center.** The proposed Central Mass Rail Trail would provide additional non-automobile access to the refuge, but since the trail connects to the refuge's south tract there would need to be a bicycle-usable connection through the south tract to the visitor center. Bicycle use in the south tract is not currently allowed and a determination of compatibility would need to be approved if the current policy were to change. The south tract is relatively small, is level and is easily walkable using the existing trail system. It also does not offer habitat significantly different than elsewhere in the refuge and so it is reasonable to assume that any determination of compatibility of bicycle use would focus on the connectivity to the visitor center rather than mobility within the south tract.



The most direct route is along a 1.14 mile stretch of the Fisher Loop trail that includes a segment through the adjacent state forest land. The trail surfaces include native (0.25 mile segment), gravel (0.29 miles), and asphalt (0.6 miles, most of which is within state forest land). Although the asphalt is in poor condition all of the trail surfaces are suitable for their current use as walking trails and no heavy maintenance or reconstruction would be necessary to continue use as a walking trail. On the other hand, if bicycles were to be accommodated then the entire length of the trail would need to be reconstructed as a stabilized gravel path or a paved path. The cost of doing this would exceed half a million dollars.

No infrastructure investment on the Fisher Loop trail is necessary unless the Central Mass Rail Trail is constructed and construction of the trail is uncertain. Preliminary rail trail design has recently been initiated, but there is no funding commitment and there are many other rail trail projects in the state that have been waiting 10 or more years for funding and still have no funding commitment. Nonetheless, it would be appropriate for the refuge to coordinate with the Department of Conservation and Recreation (DCR) about the Fisher Loop trail and the rail trail project planning and design. The DCR not only controls the rail trail right of way, but it owns the state forest land adjacent to the refuge through which part of the Fisher Loop trail traverses.

2. **Public access to the restricted-access section of the north tract.** The section of the north tract west of White Pond Road is closed to public access. The northerly part of Patrol Road bisects the area and there has until recently been an Air Force weather monitoring facility located there. The Air Force has discontinued use of the facility and it is hoped that the land and roadway easements will be transferred to the FWS. However, the time line for any transfer is uncertain, in part due to the buildings on site and the evaluation of options for removal or renovation.

If that transfer were to occur the options for capital investments and maintenance of Patrol Road would vary according to future administrative and public access requirements. Following are some initial findings regarding possible roadway projects.

- A preliminary review of potential circulation options should public access be restored found that most circulation options would not require transportation infrastructure projects of the types applicable to this study. Pedestrian access along Patrol Road does not require reconstructing the road, and reopening of native-surface walking trails, such as old Trail B, would also not require construction work. Accommodating bicycles on Patrol Road would require reconstruction of the roadway, but bicycle access in the now-closed area is not necessary. The primary reason is that White Pond Road is preferred for bicycle travel over the closed section of Patrol Road. White Pond Road is level and provides access to a variety of habitats whereas Patrol Road does not offer access to any new habitats and is hilly. One section, which has a grade of about 12%, would be extremely difficult and potentially unsafe for many bicyclists, particularly the families with small children that are an important part of current visitation.



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- If the area was maintained for administrative use there are many options for using the roadways and they depend on the proposed administrative use. For example, there is a gravel pit off Patrol Road that can be accessed by retaining the southerly section of Patrol Road, or by upgrading old Trail B and accessing the area via White Pond Road instead of Patrol Road. Access to the Air Force parcel could be maintained from either or both direction on Patrol Road. In addition, it may be desirable to retain the northerly section of Patrol Road to provide access to the utility line paralleling the roadway or to provide access to a planned equipment/maintenance facility. In all cases it may be desirable to decommission part of the roadway either passively by installing barriers or actively by removing the pavement and restoring the landscape.



3

Candidate Alternatives

This chapter summarizes the projects advanced as candidate alternatives, including the No-Action alternative. The evaluation of the candidate project alternatives and recommendations of prioritized projects will be presented in the subsequent *Transportation Improvement Plan* report.

3.1 No-Action Alternative

The No-Action alternative is the “status quo” and consists of new capital projects that are already designed and funded. These projects can be assumed to be constructed whether or not any of the other study alternatives are advanced. Some of the No-Action alternative projects are nearing completion. The new parking areas at the refuge’s north entrance and east entrance provide additional parking capacity and handicap-accessible routes around the gates.

There are also two future projects as part of the No-Action alternative, both of which increase connectivity to adjacent communities and facilitate non-motorized access to the refuge.

- The refuge’s east entrance has pedestrian access from the small neighborhood along Old Marlboro Road. Other, larger neighborhoods are located north of the Old Marlboro Road/Route 27 intersection, but there are currently no sidewalk connections. The Town of Maynard is planning to construct 1,200 feet of sidewalk on the east side of Route 27 between Old Marlboro Road and Vose Hill Road during 2013. This project will connect Old Marlboro Road to a sidewalk network stretching into downtown Maynard.
- A one-mile section between the refuge’s north entrance and downtown Maynard is currently unpaved but is maintained and is actively used by bicyclists and walkers. The final design of that section and the design of its extension farther north through Maynard and into Acton is underway. This project will enhance access from a high density residential area to the refuge. The current Boston MPO FY13-FY16



Transportation Improvement Plan has deferred the construction funding but it remains a “First Tier” priority project that the MPO would like to consider first should funding become available”.⁸

3.2 Candidate Alternatives

More than 20 preliminary candidate alternatives remain after the initial screening of the conceptual alternatives. The projects are summarized in **Table 3.1**. The candidate alternatives will be evaluated in the next phase of the study, resulting in a recommended transportation plan of prioritized projects.

⁸ Draft Federal Fiscal Years (FFYs) 2013–16 Transportation Improvement Program (TIP), Boston MPO, May 2012.

TABLE 3.1: CANDIDATE ALTERNATIVES

No.	Conceptual Alternative	Description	Benefits of Implementation	Partners	Project Type			Implementation Timeframe	Capital Cost	Annual O&M	Transportation Issue							
					External Access	Internal Infrastructure	Internal Circulation and Mobility				Visitation Data	Maintenance of Roads and Ways	Parking	Wayfinding	Safety	Handicap Accessibility	Community Connections	Educational Outreach
1	Vehicular wayfinding signage to the refuge	Install directional signs on area roadways	Provide better guidance for first-time visitors Awareness of the Refuge for other drivers	Sudbury, Stow, Hudson, & Maynard	✓			Short-range	Low	Low			✓					
2	Improve visibility of Hudson Road crosswalk	Trim vegetation and use in-street pedestrian sign	Provide a safer environment for pedestrians	Sudbury, Mass Dept of Conservation and Recreation	✓			Short-range	Low	Low				✓		✓		
3	Encourage use of existing state forest parking	Market option in maps. Install guide signs. Trail maintenance.	Quick access to interior of refuge. Lessens need to construct parking.	Mass Dept of Conservation and Recreation	✓			Short-range	Low	Low			✓	✓				
4	Additional parking at Main Entrance - Expand Existing Lot	Add second row of parking to existing lot	Additional parking capacity (10 spaces) in busy area of refuge	Sudbury	✓	✓		Short-range	Low	Low			✓					
5	Support Rail Trail - Assabet River Rail Trail	Advocate for construction of Assabet River Rail Trail in Maynard and Acton	Facilitates non-motorized access. Connectivity with downtown Maynard and South Acton	Acton, Maynard, ARRT friends group	✓			Mid-range	N/A	N/A							✓	
6	Support Rail Trail - Central Mass Rail Trail	Advocate for planning, design and construction of Central Massachusetts Rail Trail in Sudbury	Facilitates non-motorized access. Connectivity with Sudbury neighborhoods to east. Link to ARRT trail head parking in Hudson.	Sudbury, Stow, Hudson, CMRT friends group	✓	✓	✓	Long-range	N/A	N/A							✓	
7	Support Rail Trail - Bruce Freeman Rail Trail	Advocate for planning, design and construction of Bruce Freeman Rail Trail in Sudbury and Framingham	Facilitates non-motorized access. Connectivity with CMRT.	Sudbury, Framingham, BFRT friends group	✓			Long-range	N/A	N/A							✓	
8	Signage at Main Entrance	Install entrance signs at driveway and on approaches. Modify signage at Winterberry Way gate.	Improved safety at entrance. Reduce visitor confusion at gate.	Sudbury, Stow	✓			Short-range	Low	Low			✓	✓				
9A	Improve safety at main entrance - Advance signage	Install entrance signs at driveway and on approaches.	Improved safety at entrance.	Sudbury, Stow	✓			Short-range	Low	Low			✓	✓				
9B	Improve safety at main entrance - Left turn lane	New left turn lane on Hudson Road for eastbound traffic	Allows through traffic to bypass drivers waiting to turn into refuge	Sudbury, Mass Dept of Conservation and Recreation, Dept of Fire Services	✓			Long-range	Moderate	Low				✓				
9C	Improve safety at main entrance - Relocate entrance	Realign or relocate Winterberry Way (main entrance) to the east, where crosswalk is currently	Improved sight distance. Better pedestrian connection between north and south tract.	Sudbury, Mass Dept of Conservation and Recreation	✓	✓		Mid- to Long-range	Moderate	Moderate				✓				
10	Reconstruct north entrance access road	Reconstruct the north gate access road (White Pond Road)	Road provides only access to new parking area	Sudbury, Maynard	✓	✓		Mid-range	Moderate	Moderate		✓	✓				✓	
11	Reconstruction of roads and ways - Patrol Road south of White Pond Road	Reconstruct paved road at reduced width	Maintains usability for bicyclists. Maintains vehicle access to Air Force parcel.	Stow		✓	✓	Mid-range	High	High		✓					✓	
12	Reconstruction of roads and ways - White Pond Road	Reconstruct road, pavement or gravel	Maintains usability for bicyclists	Stow		✓	✓	Mid-range	High	High		✓					✓	
13	Reconstruction of roads and ways - Harry's Way	Reconstruct road, pavement and gravel	Maintains usability for bicyclists	Stow, Maynard, Sudbury		✓	✓	Mid-range	High	High		✓					✓	
14	Reconstruction of roads and ways - Taylor Way	Reconstruct road, gravel	Maintains usability for bicyclists	Maynard		✓	✓	Mid-range	High	High		✓					✓	
15	Install a charging station at the visitor center	Electric charging station for private automobiles	Provide charging stations for visitors who own electric vehicles			✓		Short-range	Low	Moderate								✓
16	Vehicle, bicycle and pedestrian traffic counters	Traffic counters on Winterberry Way and three parking lots. Bicycle and pedestrian counters at entrances.	Provide more accurate information on number of visitors			✓		Short-range	Low	Moderate	✓							
17	Electronic kiosk at visitor center (i-Sportsman)	Install i-Sportsman (or similar) system, including kiosk at visitor center.	Provide information to visitors. Collect visitor activity data. Manage hunting permits.			✓		Short-range	Low	Moderate	✓							✓
18	Kiosk at north end of Winterberry Way	Installation of standard information kiosk near Carbury's Trails	Visitor information at important decision point			✓		Short-range	Low	Low			✓					✓
19	Maintenance of Sandbank Trail canoe launch	Install block mat at shoreline	Erosion control	Sudbury		✓		Short-range	Low	Low								
20	Accessible canoe launch	Construct canoe launch at Barron Fishing Access Site. Reconstruct Carbury's Trail for vehicle access.	Enhance the Refuge experience for visitors who are physically disabled	Maynard		✓	✓	Mid-range	Moderate	Moderate							✓	
21	Improve handicap accessibility along Puffer Pond Trail and Carbury's Trail	Pave or gravel trail along Carbury's Way and Puffer Pond Trail south of Carbury's Way	Provides waterfront access	Maynard		✓	✓	Mid-range	Moderate	High							✓	
22	Procure electric shuttle vehicle	Use of a reduced emissions multi-passenger shuttle service to facilitate movement around the refuge for group tours and mobility impaired visitors	Enhance the Refuge experience for visitors who are physically disabled Transport school groups to learning sites within refuge Provide regular tours for all visitors				✓	Short-range	Low - Moderate	Moderate			✓				✓	✓

LEGEND		
Implementation timeframe	Capital Cost	Annual O&M
Short-range = 0 - 5 years	Low = \$0 - \$50,000	Low = \$0 - \$1,000
Mid-range = 5 - 10 years	Moderate = \$50,000 - \$250,000	Moderate = \$1,000 - \$5,000
Long-range = 10-20 years	High = greater than \$250,000	High = greater than \$5,000

