LAND MANAGEMENT PLAN

4 Braddocks Way | Orleans, MA

February 7, 2022

1 *Revised April 25, 2022*

1. *Page 6 - Additional information on site preparation and sediment barriers.*

2. *Pages 6-8 - Additional information on treatment method of invasive species and removal method.*

3. *Page 8 - Install bird boxes for additional nest opportunities and image detailing cavity nests.*

4. *Pages 14-15, Monitoring included to project timeline.*

2 *Revised July 13, 2022*

1. *Pages 4-5 - Historical Aerial added to show presence of grassland in the past.*

1. *Page 8 - Area Diagram revised with more specific information on proposed plant community cover percentages .*

2. *Pages 14-15 - Additional information for the justification of proposing the scope of warm season grassland/sandplain grassland restoration. Listing of wildlife species that are expected to be using the existing invasive plant species and wildlife that are expected to using the proposed warm season grassland/sandplain grassland.*

Orleans Conservation Trust

WILKINSON ECOLOGICAL DESIGN


Orleans Conservation Trust Land
Henson's Way
HABITAT CONNECTIONS
Orleans Conservation Trust Land
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Newly acquired Orleans Conservation Trust Land
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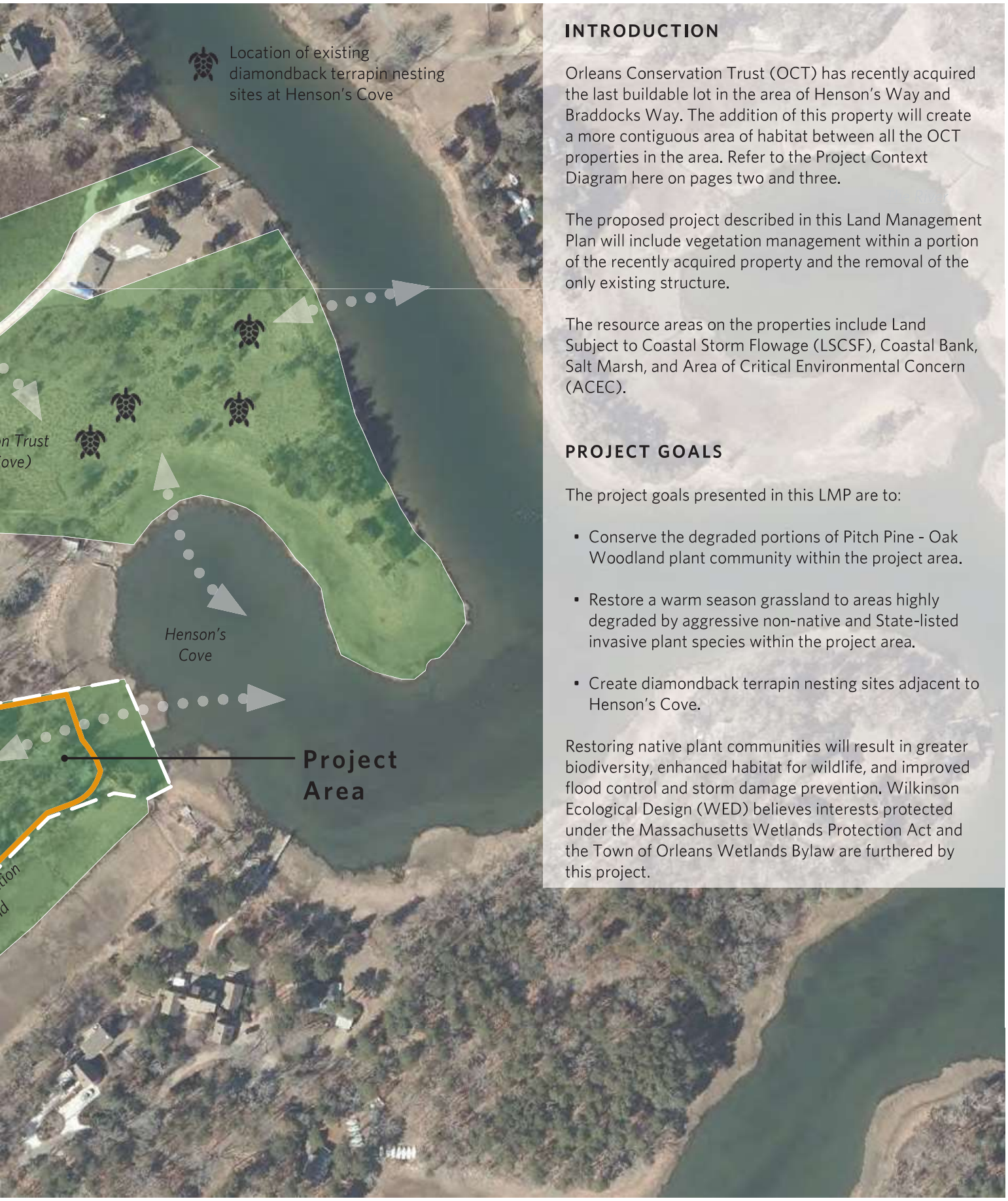


INTRODUCTION

Orleans Conservation Trust (OCT) has recently acquired the last buildable lot in the area of Henson's Way and Braddocks Way. The addition of this property will create a more contiguous area of habitat between all the OCT properties in the area. Refer to the Project Context Diagram here on pages two and three.

The proposed project described in this Land Management Plan will include vegetation management within a portion of the recently acquired property and the removal of the only existing structure.

The resource areas on the properties include Land Subject to Coastal Storm Flowage (LSCSF), Coastal Bank, Salt Marsh, and Area of Critical Environmental Concern (ACEC).

PROJECT GOALS

The project goals presented in this LMP are to:

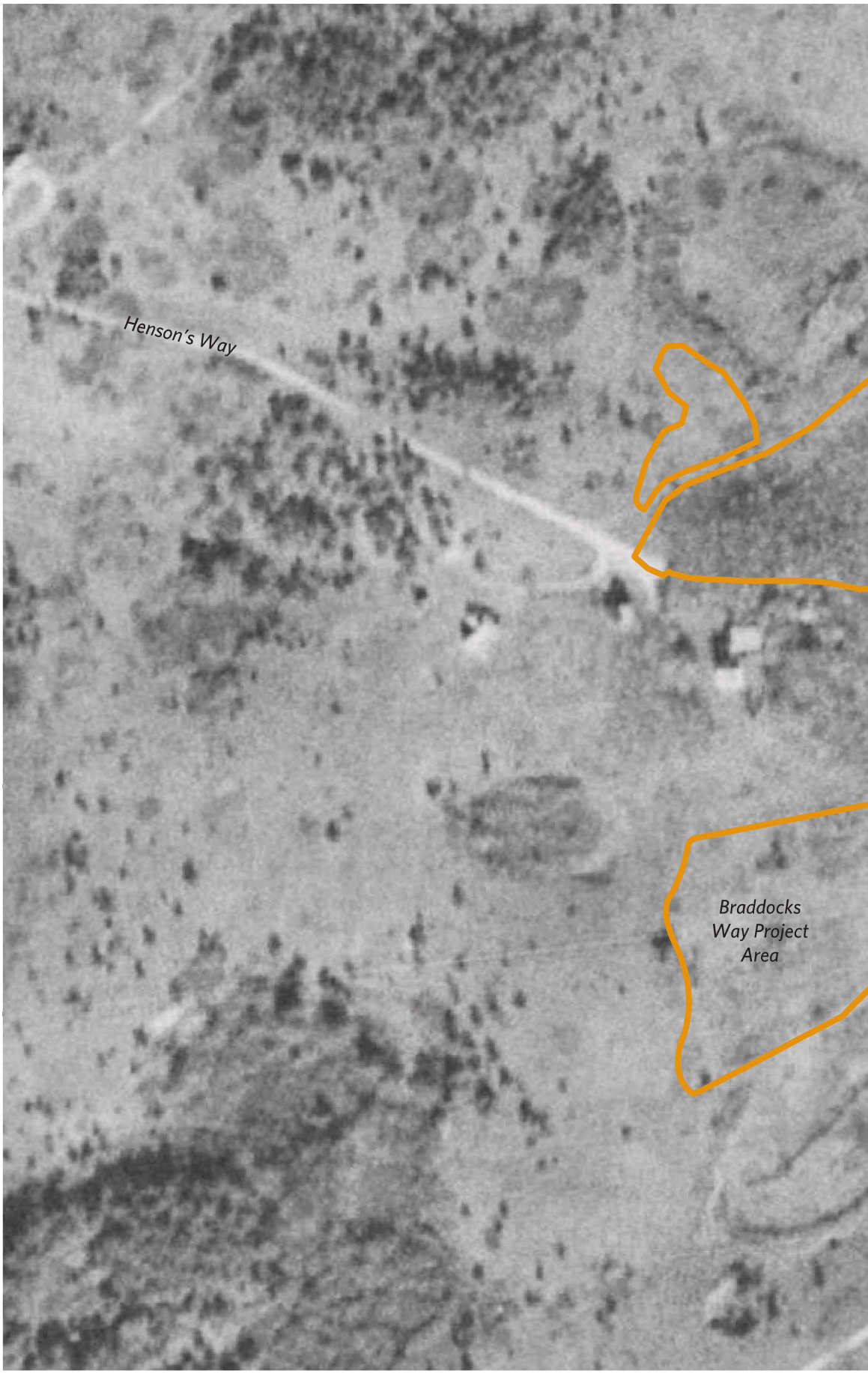
- Conserve the degraded portions of Pitch Pine - Oak Woodland plant community within the project area.
- Restore a warm season grassland to areas highly degraded by aggressive non-native and State-listed invasive plant species within the project area.
- Create diamondback terrapin nesting sites adjacent to Henson's Cove.

Restoring native plant communities will result in greater biodiversity, enhanced habitat for wildlife, and improved flood control and storm damage prevention. Wilkinson Ecological Design (WED) believes interests protected under the Massachusetts Wetlands Protection Act and the Town of Orleans Wetlands Bylaw are furthered by this project.

1938 AERIAL IMAGE

This image shows the historical context of the Braddocks Way project and the surrounding area in 1938. The majority of the area was an open grassland with sparse trees. The areas of vegetation that appear darker are groves of trees that existed in 1938.

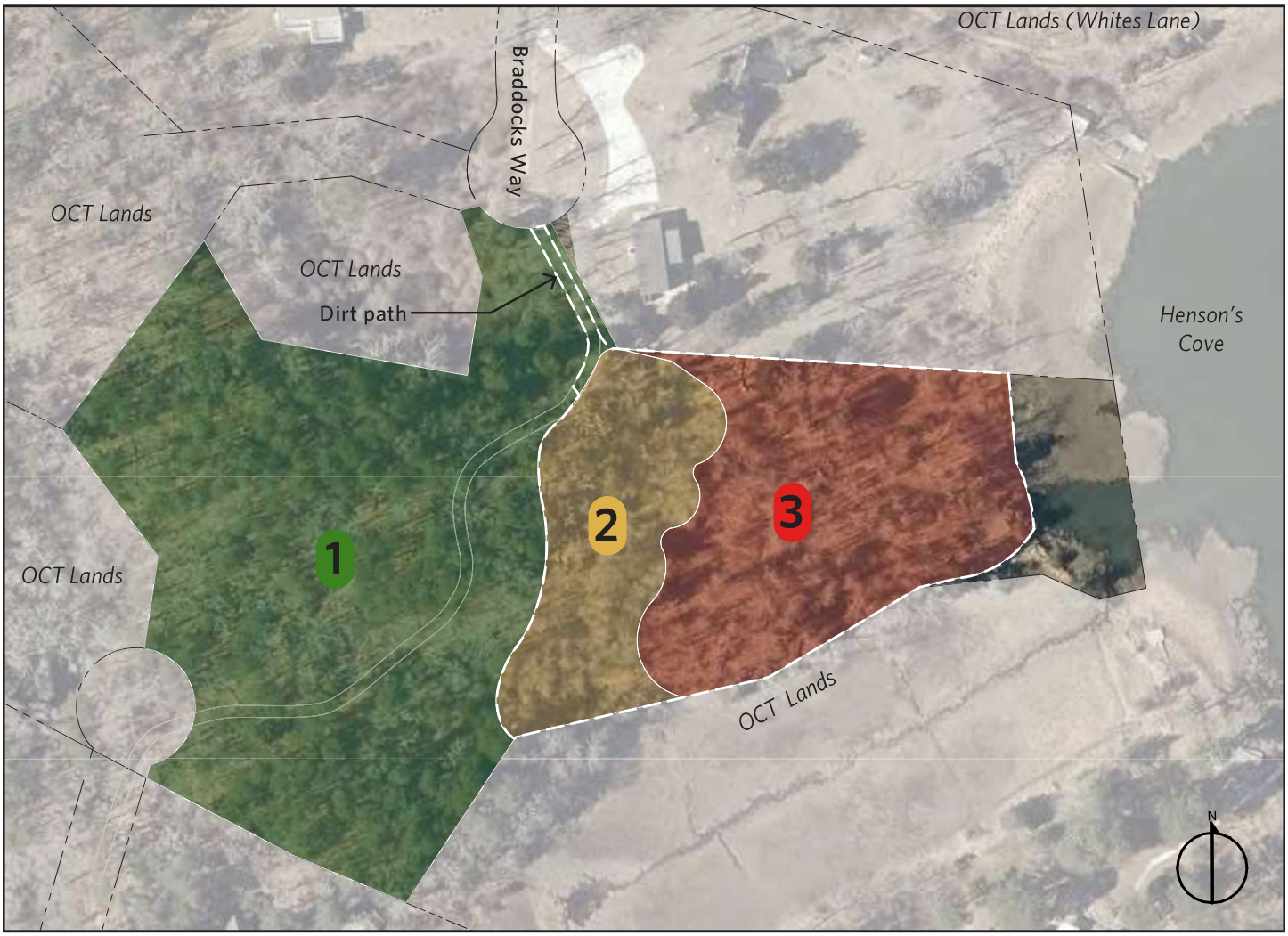
Image from: U.S. Geological Survey. Orleans. 1:24000. Roll 000005 Frame 11. Photo ID AR1F00000050011. Earthexplorer.usgs.gov. 1938




Whites Lane
Restoration Project
Area
Henson's
Cove
Keziahs Lane
Kents Point

EXISTING CONDITIONS

The OCT property for this project is an undeveloped lot located at the end of Braddocks Way. The existing plant communities are described using the color overlays on the Area Diagram below keyed to the written descriptions and photos.



AREA DIAGRAM

The historic vehicle track/dirt path bisects the property into a western and eastern half. The western half of the property is dominated by a Pitch Pine-Oak Woodland with a closed canopy of oak, pitch pine, red maple, and eastern red cedar, with a native understory of sparse shrubs, grasses, and a thick duff layer. Some State-listed invasive plant species were observed along a portion of the vehicle track/dirt path as you enter the property, but quickly transitions to native vegetation under the closed canopy.

The Pitch Pine-Oak Woodland plant community continues across the vehicle track/dirt path to the east, towards Henson's Cove. The canopy of native trees species in this area is less dense and have allowed for some invasive black locust to become established. The understory in this area has also become invaded by multiflora rose, Chinese privet, shrub honeysuckle, and English ivy which can be seen climbing trees in the photo above.

This portion of the property is highly degraded by a dense thicket of State-listed invasive plant species. The thicket is comprised of black locust as the dominate tree species and Norway maple to a lesser extent. The shrub layer of vegetation is a mixture of Chinese privet, shrub honeysuckle, and Asiatic bittersweet. The ground layer under the thicket is also invaded by English ivy and pockets of garlic mustard. Very few native species were found within this thicket of invasive plants. Some mature and heathy cedars were found along the east and south sides of the property, adjacent to Henson's Cove and the marsh to the south.

PROPOSED PROJECT ACTIVITIES

The project goals of conserving the degraded portions of Pitch Pine - Oak Woodland, restoring a Sandplain Grassland, and creating diamondback terrapin nesting sites will be met through the following proposed activities:

1. Manage invasive, non-native, and aggressive species throughout the project area and preserve the existing native vegetation where possible.

2. Implement protocols to preserve tree snags to maintain and provide this habitat feature for birds and insects.

3. Restore a warm season grassland to the highly degraded plant communities.

4. Install and maintain plots for diamondback terrapin nesting sites adjacent to Henson's Cove.

Site Preparation 1

Prior to the start of work a sedimentation barrier will be installed on the western side of Braddock's Way and the dirt track leading into the project area. This will protect the wetland to the west of the access route from possible sedimentation. Black locust tree within the access route will be flush cut and treated. Two black cherry trees that overhang the access route will be flush cut and will then be allowed to grow naturally. Following completion of the project the access route will be brought to pre-implementation conditions within the jurisdictional areas.

Sediment barriers will also be installed around the existing boathouse that is to be removed. Refer to the Restoration Plan for the deconstruction protocol of the boathouse.

Vegetation Management

Vegetation management will target invasive, non-native, and aggressive plant species within the project area including black locust, Asiatic bittersweet, Chinese privet, shrub honeysuckle, English ivy, and all other invasive, non-natives, and aggressive

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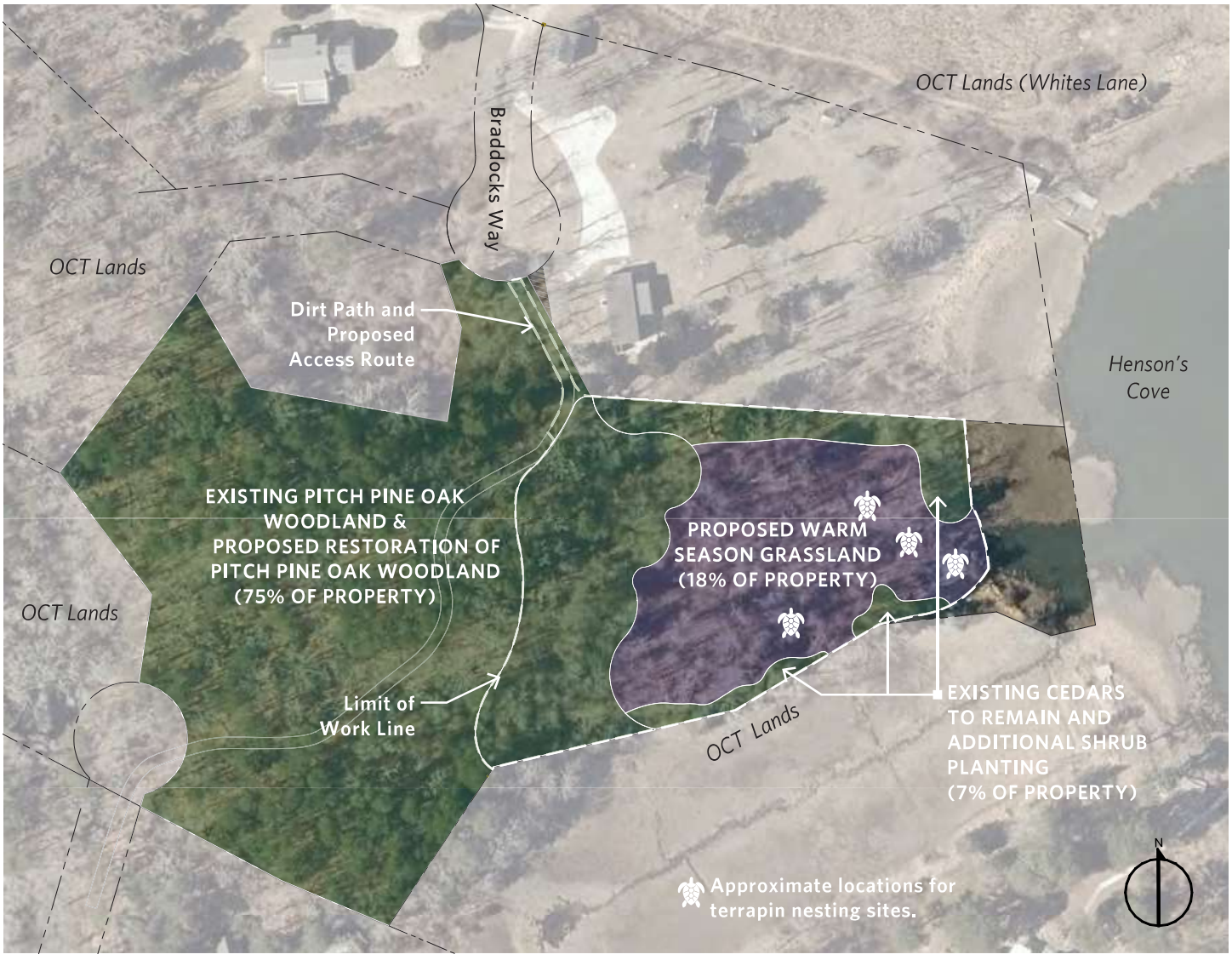


AREA DIAGRAM

native vines approved for management. While the plan does not propose functional eradication of aggressive species like greenbriar, it should be reduced to encourage the health of other native plant species and to allow for establishment of the target native plant communities.

Invasive plant species can cause profound changes to environmental conditions of a site including soil nutrient levels, sun exposure, increased erosion, and the ability to negatively affect resources for wildlife. Three of the most dominant State-listed and non-native species to be managed are black locust, Asiatic bittersweet, and English ivy.

Black locust is a clonal tree species of particular concern as it aggressively out-competes native plants in recently disturbed environments. This tree species can also facilitate and encourage other aggressive non-native plant species to become established due to its nitrogen-fixing abilities. The additional nitrogen is not utilized by most of the native plant species due to their evolution to thrive in nutrient poor soils.

Image of mature cedar at 4 Braddocks Way that has been over-topped and killed by Asiatic bittersweet.

Asiatic bittersweet poses a serious threat to restoration efforts due to its high reproductive rate, long-range dispersal mechanisms, and the ability to root-sucker. Vines of this plant species also have the ability to aggressively wrap around and grow over other vegetation strangling mature trees. Even entire plant communities can be over-topped and shaded out by the vine's rapid growth. An image of bittersweet that has over-topped and killed a mature cedar at 4 Braddocks Way is shown below.

English ivy is an aggressive invader that threatens to overtake multiple vegetation levels, from ground cover to mature trees, as is smothers the plants and limits their ability for photosynthesis. The vines can weigh a tree down making it more susceptible to storm damage. If native plant species are present in English ivy management areas, herbicides will be applied when the native plants are dormant, such as in the winter.

1 For the most effective management of black locust, trees and saplings should be treated with an herbicide using a manually injection technique (known as frill, girdle, or cut stem) by creating an opening in the bark and applying herbicide to the cambium layer just inside the bark. Norway maples will be treated with the same method. Pre-treatment will minimize the number of re-sprouting black locust compared to mechanical removal alone. If only mechanical removal is used, any remaining root segments are very likely to re-sprout, creating the need for more follow up maintenance to stop the reintroduction of the black locust in the project areas. A "cut and wipe" method will be used to treat individual stems of Asiatic bittersweet and multiflora rose. Low-volume foliar application will be used only where necessary for species like English ivy and vine honeysuckle that are not in close approximation to the diamondback terrapin nesting sites. All herbicide applications will be performed by Massachusetts licensed applicators.

1 Pre-treated vegetation will be removed mechanically in areas that are accessible to equipment. Removal of the basal collar and shallow roots of the black locust are important for the future goals of the project. Black locust are shallow rooted trees with radial roots that can extend about 1 to 1.5 times the tree height. This extensive shallow root system can persist in the soil for years, creating impenetrable barriers for diamondback terrapin nesting sites. The invasive shrubs, like shrub honeysuckle and privet, will also be mechanically removed (known as root grappling). Hand removal of the targeted vegetation will be used to protect native trees and shrubs that are to remain. Where invasive vines, including bittersweet, are intertwined with viable native species, they will be treated and left in place until desiccated, then removed in order to avoid damaging underlying vegetation. The area will be soil conditioned in preparation for seeding to allow the proper seed/soil contact needed for germination. Native soils will not be removed from the project area and no re-contouring is proposed. Plant Management Protocols in the

Appendix on page 12 include species-specific information on the environmental effects of the targeted non-native and invasive species and management strategies of the species. Regenerative pruning techniques will be used on native shrubs which have been shaded-out by invasive vegetation. This pruning technique results in increased biomass of the subject plant over several years.

Immediately following vegetation management, all bare soils will be hydro-seeded with the native seed mix listed on the Restoration Plan. The hydro-seeding will act as an erosion control for the entire site. The mixture of wood and/or paper pulp adheres to the soil surface greatly reducing the chance of sediment run-off. The use of hydro-seeding will also speed up the germination process of the native grasses, which will be the long-term stabilization solution for the project area. In addition, sediment barriers will be installed around the existing boathouse that is to be removed. A second sedimentation barrier will be installed along a portion of the access route along Braddock Way as described on page six.

Protocol for Snag Tree Preservation

The preservation of existing snags and den trees, and the creation of new snags is included with the vegetation management proposal. Though not a main goal of this protocol, den trees will also be identified and cataloged for preservation to maintain habitat features for birds and other wildlife species. Bird boxes will be installed to provide more nesting opportunities for cavity nesting bird species.

Over 50 species of northeastern birds and mammals utilize snag and den trees during part of their life history stage. Some uses of snag and den trees include cavity nest sites, nesting platforms, food caches, dwellings or dens, nesting under bark, overwintering sites, hunting and hawking perches, sources of feeding substrate, and roosting. Snags can be defined as a standing dead or partially dead tree at least 6 inch diameter at breast height (DBH) and 20 feet in height. Den trees are live trees possessing a cavity large enough to serve as shelter for birds and mammals. In general, den trees are 15 inch or greater in DBH and have a minimum cavity opening of 4 inches in diameter.

Identification of potential snags and den trees will include identifying live and dead trees that meet the above dimensions as well as the following signs such as fungal cocks, rot, cracks, lightning damage, mechanical damage, woodpecker holes or cavities, or dead or broken tops. Areas adjacent to Henson's Cove and the salt marsh south of the project area will be a focus of the protocol to preserve perches for raptor and heron bird species as they have been observed perching in this location during site visits.

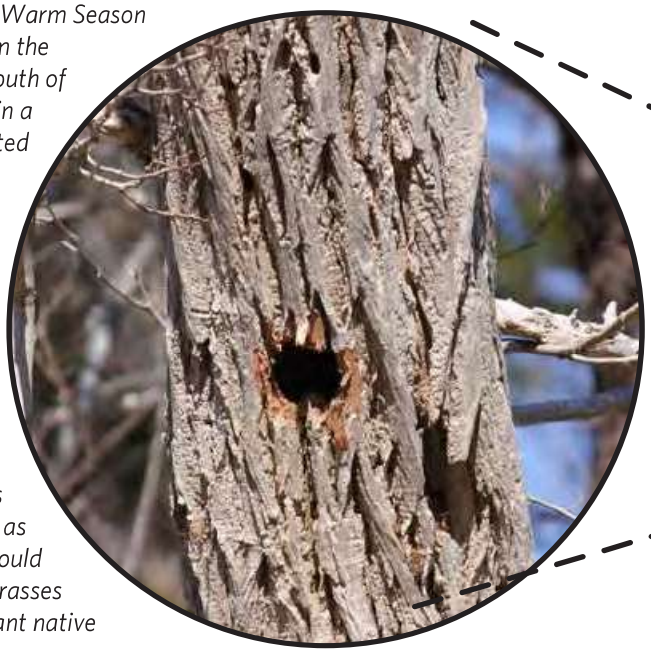
The creation of snags will be accomplished by girdling of suitable DBH black locust, pitch pine, oak, or black cherry and allowing natural decay to take place. All potential snags will be preserved at a safe distance from existing public footpaths to reduce safety concerns from falling debris.

Warm Season Grassland Restoration

The proposed invasive plant management will drastically reduce the invasive tree and shrub densities in the highly degraded portion of the project area. This change in vegetative cover will increase sun exposure and provide optimal

The large image shows the Warm Season Grassland Project area from the existing salt marsh to the south of the property. A cavity nest in a black locust tree is highlighted and shown in detail in the smaller image. This black locust is an invasive tree that would be identified as a potential snag and den tree to be girdled and preserved.

The native cedars seen in the photo would remain and be preserved. Locations where no vegetation exists, as noted in the large image, would be seeded with the native grasses and plugged with salt tolerant native shrubs species.



Cedars to be preserved

conditions to restore a warm season grassland to a portion of the project area. A model for the restoration of a warm season grassland is located just across Henson's Cove. This successful project can be referenced as a case study for the proposed work at 4 Braddocks Way. The image below is from the Henson's Cove property (formerly White's Lane) showing a portion of the restored warm season grassland at sunrise. A set of images documenting the restoration process of the Henson's Cove property can be seen on pages 18 - 21.

Warm season grasslands are early successional communities primarily maintained by disturbance, such as wind damage, salt spray, wild fires, or human management. Without a disturbance regime, these communities would transition into a closed canopy woodland. While it may be argued that this return to forest reflects a more natural state, this argument overlooks the fact that open, early successional habitats have long been an important part of the Massachusetts landscape (Mass Audubon 2013). The proposed invasive plant management and once annual mowing will mimic the natural disturbances required by plant species typically found in these endangered plant communities.

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Eastern Bluebirds are one bird species that would benefit from the restoration of a warm season grassland. They are typically found in open plant communities around trees, but with little understory and sparse ground cover. Original habitats probably included open, frequently burned pine savannas, beaver ponds, mature but open woods, and forest openings. Today, they're most common along pastures, agricultural fields, suburban parks, backyards, and golf courses. Other bird species that will benefit from the restoration of an early successional plant community include barn swallows and other aerial insectivores. Barn swallows, woodcock, and black racers are wildlife that have been observed at the Whites Lane restoration project and would be expected to utilize the early successional habitat proposed at this site.

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A longer term goal of the project is an eventual transition of warm season grassland into a sandplain grassland community. The strategy begins with the removal of the black locust which have fixed nitrogen in the soil. Establishing and maintaining a warm season grassland will, overtime, exhaust the buildup of nitrogen in the soil. As the warm season grassland species exhaust the nitrogen in the soil, the plant communities are expected to transition to a sandplain grassland as has been observed in portions of the Whites Lane restoration project. Sandplain grasslands are considered to have the highest state ranking of S1, which are considered "Critically Imperiled". Restoring and establishing critically imperiled sandplain grassland and the associated diamondback terrapin nesting sites should be considered a significant ecological priority in favor of woodland restoration.

Image of bluebird taken at Henson's Cove OCT property.

Areas that lack existing native woody vegetation will be seeded with native grass and plugged with clusters of native salt tolerate shrubs, like high tide bush.

Cedars to be preserved

Diamondback terrapin nesting sites

A very important aspect of the proposed restoration project is the creation and maintenance of turtle nesting sites. The primary species for the nesting sites will be diamondback terrapin, but other wildlife will also benefit. Black racers, box turtles and black ducks have been observed nesting in the restored habitat at Henson's Cove property.

The following guidelines for the creation of turtle nesting habitat from NHESP (NHESP 2009) have been included for the selection, installation, and maintenance of the diamondback terrapin nesting site. In addition, the selection of the nesting site(s) will be made in consultation with Mass Audubon Wellfleet Bay Wildlife Sanctuary.

Location and Site Factors

It is best to add to existing nesting habitat or to create nesting habitat near known nesting areas. Nesting habitat should be no more than 1000 ft from the wetland edge, but best within 300 ft if possible. A barrier free corridor should be provided between the wetland and nesting habitats. Nesting sites should be on level ground with full southern exposure. The site should get sun, in a 180 degree arc from east to west, throughout most of the day. Total area of the nesting site should be greater than 20 ft in each direction and the site should be above the spring/summer flood plain. The site may need to be larger to get sun exposure throughout the day, depending on the proximity and height of adjacent forested areas. Larger nesting areas or multiple small ones will likely dilute nest predation. The original substrate should consist of well drained soil, sand or gravel. If soil is brought to the site it should be washed sand or gravel. Washed substrate will minimize translocation of weeds or invasive plant species and impede rapid growth of vegetation. Ground vegetation should be sparse and include native sedges, grasses, and a few low growing shrubs (less than 2%-5% cover of the site). Shrubs will provide cover for the gravid females and hatchlings once they emerge from the nest.

Procedure

Where necessary, forest cover and tall vegetation should be removed. Removal of the surface material, to expose the underlying strata, may also be necessary if the area is infested with invasive and/or weedy species. This step in the procedure will be accomplished during vegetation management. In most cases the surface material will need to be disturbed through scarification. In some cases the deposition of sandy soil on top of existing vegetation is all that is necessary. If the exposed native mineral soil is not acceptable, a fine sand (<5% clay and <25% gravel) should be deposited over the parent material to a depth of approximately 12 inches. Sand cover up to 10-12 in depth may also be used to retard growth of some

Image of sunrise over warm-seaosn grassland and a diamondback terrapin nest at the Henson's Cove OCT property.

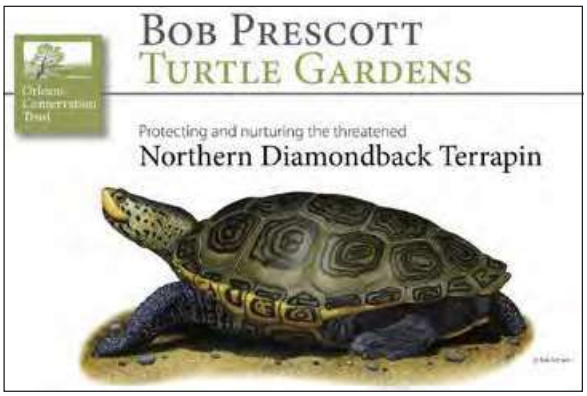
Image of diamondback terripin nest with protective covering at Henson's Cove OCT property.

existing unwanted vegetation. Native, non-spreading bunch grasses should be sparsely planted; at approximately a 50 ft spacing throughout the site. Planting should not occur during dry months.

Maintenance

Annual or biannual Inspection should occur. If encrusting mosses or other exotic weeds encompass >25% of the intended nesting area, those areas should be raked and accretions should be removed. Herbaceous and woody species should never occupy > 50% of the area. In addition, shrubs should be no taller than 24" in height. If this occurs most of these materials should be removed or trimmed. The removal areas should then be raked and lightly tilled.

The Henson's Cove OCT property has diamondback terrapin nesting sites adjacent to the salt marsh and cove. It has become an important place in the regional effort to preserve diamondback terrapins. From 2010 through 2021, volunteers have documented hundreds of terrapin hatchlings born on the site. An image of a terrapin hatchling and the dedication sign near the maintained nesting sites can be seen to the right.



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ADDITIONAL INFORMATION REQUESTED

Many questions relating to the scope of the proposed invasive species management and subsequent restoration of a warm season grassland have been asked during the hearing process. At this point, restating the three main goals of the project and relating those goals to the Area Diagrams will help to explain the justification. They are as follows:

PROJECT GOAL #1: Conserve the degraded portions of Pitch Pine - Oak Woodland plant community.

This goal relates to Area 2 on the Area Diagram of Existing Conditions. This area of existing woodland contains a heathy mature canopy of native trees. Only the State-listed invasive and non-native species in the understory are to be removed. All native plant species in the understory would be preserved. These actions will create a healthy contiguous Pitch Pine - Oak woodland that covers approximately 116,450 square feet (75% of the property). Areas surrounding the proposed grassland, covering approximately 9,000 square feet contain existing cedars and are proposed to include planting of native shrubs (7% of the property). **82% of the property will be vegetated by native trees and shrubs.**

PROJECT GOAL #2- Restore a warm season grassland to areas highly degraded by aggressive non-native and State-listed invasive plant species.

This goal relates to a portion of Area 3 on the Area Diagram Existing Conditions. As described earlier in this document, this area is highly degraded by a dense thicket of State-listed invasive plant species. The management required to eradicate these invasive plant species creates the ideal conditions needed to restore a warm season grassland, with the eventual transition into a sandplain grassland community as a long term goal. The benefit of restoring a sandplain grassland greatly outweighs restoring a secure plant community, like Pitch Pine- Oak Woodlands for the following reasons:

- "Once common along the northeastern seaboard, residential, and commercial development and succession to shrublands has all but eliminated these habitats from other coastal areas from Long Island, New York to coastal Maine. It is currently estimated that between **85-98%** of the worldwide acreage of these habitats have been lost since the 1850's" (Nantucket Conservation Foundation, 2018).

- Sandplain grasslands are ecologically important, showing greater species richness than nearby forested areas. (Lezberg et al, 2006). Additionally, species considered to be endangered or threatened in MA appear in grassland more frequently compared to forests (Dunwiddie et al, 1996).

- Opportunities to restore this critically imperiled plant community are rare, and should be prioritized over restoration of a secure plant community like pitch pine oak woodlands. **18% of the property is proposed for warm-season grassland.**

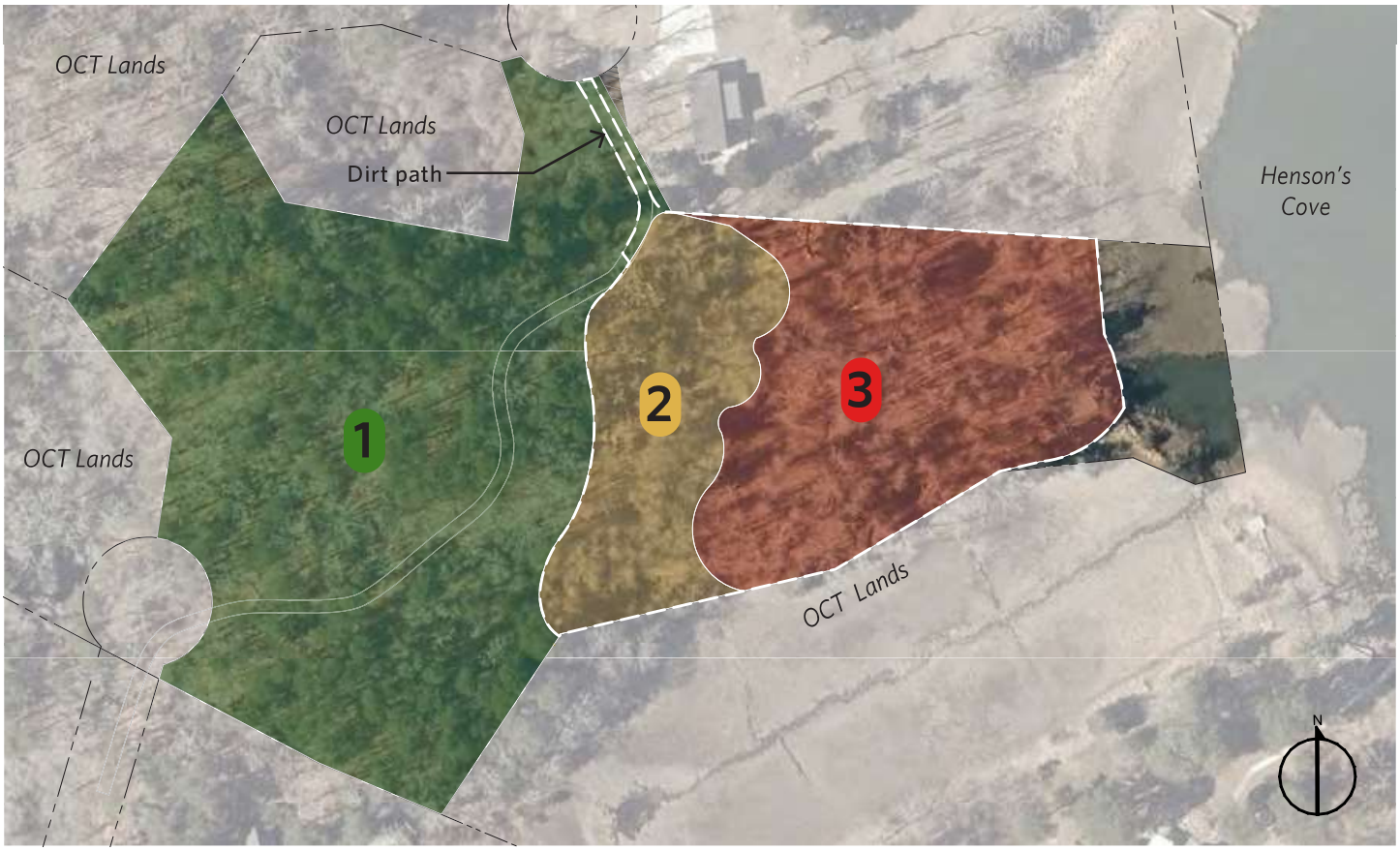
During the hearing process, a number of comments were made that an alternative of leaving a portion of the State listed invasive species within Area 3 should be considered. We feel that leaving a portion of the State listed invasive species within the project area will diminish the second goal of the project because this will reduce the area of a native plant communities to be restored. Revising the project to "conserve" invasive vegetation can create a negative impact to the birds that utilize the area. Studies have shown that migratory birds in the Cape Cod Bay area go out of their way to avoid invasive species (Gallinat et al, 2020) preferring native species of berry even when invasive species are much more abundant. The study shows that non-native species in the area, including privet and shrub honeysuckle to be removed, appeared in migratory bird fecal samples much less frequently than native plants, even when the invasive berries are more prevalent. This echoes several studies showing bird populations primarily consume the fruits of native species (Smith et al., 2013; Whelan et al., 1991). These preferences are likely due to the nutritional differences between invasive and native plants (Ingold and Craycraft, 1983; Smith et al., 2013). Recent study of migratory bird stopover ecology has shown that birds traveling through native plant communities gained mass and had higher immune functions when compared to bird traveling through areas dominated by invasive plants (Oguchi et al., 2017). In some cases, birds in invasive dominated areas lost weight, showing that invasive plants are a threat to the health of migratory bird populations.

PROJECT GOAL #3 - Create diamondback terrapin nesting sites adjacent to Henson's Cove.

This project goal was not questioned and was not in dispute.

WILDLIFE SPECIES EXPECTED TO BE USING THE EXISTING INVASIVE PLANTS:

Deer, rabbit, grey squirrel, mice, and other small mammals. Woodpeckers, robins, chickadees, herons, hawks were observed. Other birds may use the invasive trees for cover and nesting. The same species listed above would be expected to continue utilizing the surrounding shrubs and woodland, and to utilize the warm-seaon grassland. Snag and den tree preservation and installation of bird boxes are proposed to offset any change to the nesting opportunities within invasive trees being converted into grassland (18% of the property). Additional more specialized wildlife that would benefit and utilize the warm-season grassland is expected to include barn swallows, tree swallows, eastern king bird, and other aerial insectivores, woodcock, and black racers, box turtles, and of course diamondback terrapins. These species of wildlife have been observed at the Whites Lane restoration project.



AREA DIAGRAM EXISTING CONDITIONS

AREA DIAGRAM PROPOSED CONDITIONS

THREE YEAR LAND MANAGEMENT TIMELINE

Season 1

Winter/Early Spring Initial Management

- Plant species approved for removal will be pre-treated with an herbicide appropriate to the plant species. Treatment methods, depending on species, size, and environmental conditions, will consist of manual injection, "cut and wipe" method to treat individual stems and low-volume foliar application only where necessary.
- Pre-treated vegetation would be removed mechanically using equipment where possible, leaving native soils in place. Where necessary, hand removal of vegetation will be preformed to protect existing native vegetation.
- Final locations of the diamondback terrapin nesting sites to be finalized and implemented prior to seeding disturbed soils.
- All disturbed soils would be hydro-seeded with the specified native grass mix.

General Notes:

- All invasive species management will be directly overseen by a professional environmental technician possessing a MA Invasive Plant Management Certificate.
- Herbicides used are to be applied by knowledgeable, licensed individuals only.
- All herbicide applications will avoid non-target native species.

Summer/Fall

- Mass Audubon Wellfleet Bay Wildlife Sanctuary volunteers will monitor nesting areas regularly, following protocols for identifying and protecting terrapin nests and collecting data on both adults and hatchlings.
- Monitor plant response to earlier management treatments and calibrate follow-up treatments accordingly.
- After July 15th, as previously treated shrub and vine plants re-sprout and any remaining seed bank germinates, selectively treat using low-volume foliar spot applications or cut and wipe applications to all species approved for removal at the appropriate rates.
- An annual Monitoring Report will be submitted to the Orleans Conservation Commission. The report shall include information on the work completed during the calender year, general conditions of the restoration efforts, photo documentation of the project area, and recommended steps for the subsequent season to reach the project goals. The report will also include information from the Mass Audubon Wellfleet Bay Wildlife Sanctuary volunteers monitoring of diamondback terrapin nesting areas.

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Season 2

Winter/Spring

- After most other deciduous plants have gone dormant, conduct a low-volume foliar application to any persistent targeted species (only if necessary, otherwise hand-pull small quantities).
- Once annual maintenance mowing of warm season grassland to occur.
- Mass Audubon Wellfleet Bay Wildlife Sanctuary volunteers will monitor nesting areas regularly, following protocols for identifying and protecting terrapin nests and collecting data on both adults and hatchlings.

Summer/Fall

- Monitor plant response to earlier management treatments and calibrate follow-up treatments accordingly.
- Mass Audubon Wellfleet Bay Wildlife Sanctuary volunteers will monitor nesting areas regularly, following protocols for identifying and protecting terrapin nests and collecting data on both adults and hatchlings.
- After July 15th, as previously treated shrub and vine plants re-sprout and any remaining seed bank germinates, selectively treat using low-volume foliar spot applications or cut and wipe applications to all species approved for removal at the appropriate rates.
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1

Season 3

Winter/Spring

- After most other deciduous plants have gone dormant, conduct a low-volume foliar application to any persistent targeted species (only if necessary, otherwise hand-pull small quantities).
- Once annual maintenance mowing of warm season grassland to occur.
- Mass Audubon Wellfleet Bay Wildlife Sanctuary volunteers will monitor nesting areas regularly, following protocols for identifying and protecting terrapin nests and collecting data on both adults and hatchlings.

Summer/Fall

- Monitor plant response to earlier management treatments and calibrate follow-up treatments accordingly.
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Ongoing Maintenance

After the treatments of the third season, the management plan should be assessed and re-evaluated. If land management treatments have been successful, only monitoring and hand removal will be required to keep non-native, invasive, and aggressive species from being reintroduced (this will vary depending on actual carbohydrate stores in the roots and environmental conditions throughout the treatment period). Invasive plants generally take a minimum of three to five years of active management to reach a level of successful control.

Invasive plant removal is recommended to be an ongoing condition in the Certificate of Compliance for this project to maintain the restored plant communities. Ongoing invasive plant removal is typically carried out three to five times per year depending on the site conditions and client preference. We ask that this condition be incorporated into the Certificate of Compliance as an ongoing condition.

APPENDIX

Invasive Plant Management Protocol

Invasive Plant Management Protocols are designed to maximize the effectiveness of treatments and minimize disturbance to natural resources through mechanical removal, hand removal, or selective herbicide application where necessary. Appropriately timed treatments are based on individual plant life cycles, growing seasons and levels of infestation. A program of selective herbicide application will be instituted during time periods when the plants will translocate the herbicide most efficiently to the roots materials. As the carbohydrate transfer is dictated primarily by weather, the management timeline is specified by season only, necessitating field expertise to initiate timely management procedures. Please reference the Three Year Land Management Timeline for specific treatment times. The Massachusetts Invasive Plant Advisory Group (MIPAG) is responsible for classifying plants as invasive in the state of Massachusetts. The plant species listed in the protocols below include their invasive status as defined by MIPAG.

1. Asiatic Bittersweet *(Celastrus orbiculatus)* poses a threat to the preservation of native plant communities because it has the ability to form dense stands in open fields and forests alike. It is most effectively controlled using a "cut-and-wipe" method of herbicide application with an ultra-low volume Triclopyr-based herbicide. A low volume foliar spray or a basal bark treatment is also very effective. (MIPAG Listed Invasive).

2. Black Locust (*Robinia pseudoacacia*) is a tree species capable of rapidly colonizing nutrient poor soils via seed dispersal and root suckers. Black locust has been documented to produce allelopathic effects on the soil which inhibit the growth of other plant species in the surrounding area. A cut and wipe application of Glyphosate-based herbicide is recommended to eradicate this species. Follow up applications will be necessary for suckering root growth. Note: Black Locust is known to re-sprout vigorously after removal. Substantial root sucker growth should be expected from the remaining root material within 60 days of the initial removal. Re-sprouting can be minimized with the application of a Glyphosate-based herbicide applied directly to the cut stem. (MIPAG Listed Invasive, Massachusetts Prohibited Plant List).

4. Chinese Privet (*Ligustrum sinense*) is a ubiquitous garden escapee that can be particularly aggressive in heavier soils and adjacent to wetlands. Mature plants annually produce hundreds of viable seedlings which spread the species rapidly through a variety of habitats. Plants up to 4-inch basal caliper can be mechanically uprooted. A cut stump herbicide application is most effective treatment method for these species when the basal diameter exceeds 4 inches. (Not a State-Listed invasive MIPAG - Do not list at this time).

5. Japanese Honeysuckle *(Lonicera japonica)* is an aggressive perennial vine that can thrive in a range of habitats. It grows in full sun to full shade and can form dense mats that out-compete native vegetation. It produces many seeds that are dispersed by birds and mammals. Japanese honeysuckle is semi-evergreen and will continue to photosynthesize after surrounding deciduous vegetation is dormant. Taking advantage of its persistent leaves, control should consist of a late fall application of Glyphosate-based herbicide to eradicate. (MIPAG Listed Invasive).

7. English Ivy (*Hedera helix*) is an aggressive evergreen vine that is often used as an ornamental groundcover. It has the potential to completely out-compete all low-growing vegetation where it is growing. English ivy can also grow into trees where it will cover the trunk and branches, excluding light from the leaves and killing the branches from the ground up. The tree eventually becomes susceptible to blow over due to its weakened state and the added weight of the vine. Mechanical uprooting followed by treatments of a Triclopyr-based herbicide is the preferred treatment method for this plant. (Not a State-Listed invasive).

8. Green Briar and Cat Briar *(Similax rotundifolia, glauca) (Vitis spp.)* are aggressive native vines that play a functional habitat role, serving as cover, a food source, and nest sites for some animal species, but can also out-compete other native species and hinder restoration efforts by rapidly colonizing recently managed areas. Selective management of these species should be carefully conducted as part of the restoration plan to prevent excessive colonization of re-planted areas. As eradication is not the goal for this species, only mechanical management is recommended. (Not a State-Listed invasive).

9. Garlic Mustard *(Alliaria petiolata)* is a bieannial that thrives in shady conditions and can rapidly invade the woodland understory through prolific seed dispersal. Garlic mustard can be hand-pulled in early spring before the plant flowers can be an effective control method if undertaken consistently. Because garlic mustard is remains green at times of the year when most native plants are still dormant, targeted foliar herbicide application using a low concentration Glyphosate solution, in late fall through the early spring, are effective in controlling this plant while limiting potential damage to dormant native plants. (MIPAG Listed Invasive).

10. Multiflora Rose *(Rosa multiflora)* is a perennial vine or shrub occurring in upland, wetland and coastal habitats and growing in full sun to full shade. Forms impenetrable thorny thickets that can overwhelm other vegetation; bird dispersed. Multiflora rose aggressively out competes An extremely prolific plant, multiflora rose (Rosa multiflora) invades and damages pastures and unplowed lands, crowding out vegetation and creating dense, impenetrable thickets. Cattle are often reluctant to enter fields dominated by multiflora rose; its hedges cause lower crop yields on adjacent fields by competing for nutrients.

11. Norway maple (*Acer platanoides*) is a significant invasive tree species observed throughout Massachusetts. Norway maple readily re-sprouts from the stump when cut. This species' dense foliage and understory growth habit can significantly impact the native forest understory stratification. This tree spreads rapidly at maturity because of the large volume of seed that are produced. By managing this invasive tree, the numerous understory species will respond positively, increasing fruit production and understory canopy development. Additional sunlight will also enhance the herbaceous groundcovers. A cut and wipe treatment with Glyphosate-based herbicide is recommended, with follow up treatments for suckering growth. (MIPAG Listed Invasive, Massachusetts Prohibited Plant List).

12. Shrub Honeysuckle *(Lonicera morrowii & bella)* poses a major threat to native habitats. These species aggressively out-competes other native shrubs in the edge habitat and woodland understory. Shrub honeysuckle will invade a wide variety of native habitats, with or without any previous disturbance. According to vegetation management guidelines published by the University of Illinois at Urbana-Champaign, shrub honeysuckle is suspected of producing allelopathic chemicals that inhibit the growth of other plants and allows the honeysuckle to out-compete native plants. Honeysuckle should be mechanically uprooted if conditions allow, where this is not possible a cut and wipe herbicide treatment should be used. Regular hand pulling of juvenile plants and spot herbicide treatments are also recommended for persistent re-sprouts. (MIPAG Listed Invasive, Massachusetts Prohibited Plant List).

Plant Inventory

Native species: Tree and Shrub

American Holly	*Ilex opaca*
Arrowwood	*Viburnum dentatum*
Bayberry	*Morella caroliniensis*
Black Cherry	*Prunus serotina*
Black Oak	*Quercus velutina*
Eastern Red Cedar	*Juniperus virginiana*

Native species: Vine and Herbaceous

Black Raspberry	*Rubus occidentalis*
Common Blackberry	*Rubus allegheniensis*
Crinklehair Grass	*Deschampsia flexuosa*
Greenbriar	*Smilax spp.*
Poison-Ivy	*Toxicodendron radicans*
Smooth Goldenrod	*Solidago gigantea*
Virginia Creeper	*Parthenocissus quinquefolia*

Invasive and Non-Native species: Tree and Shrub

Black Locust	*Robinia pseudoacacia*
Chinese Privet	*Ligustrum sinense*
English Ivy	*Hedera helix*
Multi-flora Rose	*Rosa multiflora*
Shrub Honeysuckle	*Lonicera morrowii & bella*
Norway Maple	*Acer platanoides*

Invasive and Non-Native species: Vine and Herbaceous

Asiatic Bittersweet	*Celastrus orbiculatus*
Garlic Mustard	*Alliaria petiolata*
Japanese Honeysuckle	*Lonicera japonica*

** Additional native, non-native, and invasive species may exist within in the project area, but were not readily identifiable due to the heavy invasive cover and identification during the winter when herbaceous species are dormant.*

Definitions

1. Native plants:
A native (indigenous) species is one that occurs in a particular region, ecosystem, and habitat without direct or indirect human actions. Native plants suited for our coastal areas bind sediments with their fibrous roots. Grasses and forbs create a groundcover that not only stabilize sediments, but improve the quality of wildlife habitat and slow water runoff. Many invasive plants lack fibrous root systems and often have allelopathic chemicals which inhibit the growth of surrounding vegetation, thus creating areas of bare earth which lead to faster rates of erosion, decreased wildlife habitat quality and increased storm water runoff. The loss of native vegetation to invasive plant species degrades wetlands and public interests (as stated below), and decreases the diversity of the biological community.

2. Invasive Plants:
As defined by the Massachusetts Invasive Plant Advisory Group, invasive plants are non-native species that have spread into native plant systems, causing economic or environmental harm by developing self-sustaining populations and dominating and/or disrupting those native systems. Invasive plant's biology and physiology equip them with the means to out-compete native plants, disrupting native plant communities, and compromising the integrity of that ecosystem. Invasive plant species can alter hydrological patterns, soil chemistry, moisture holding capacity and can accelerate erosion.

3. Sapling (tree):
The Massachusetts Department of Environmental Protection Division(DEP), in their handbook entitled, "Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act", defines sapling as woody vegetation under 20 feet in height with a diameter at breast height (dbh) greater than or equal to 0.4 inches to less than 5 inches.

4. Tree:
Massachusetts DEP defines tree as woody plants with a dbh of 5 inches or greater and a height of 20 feet or more in their handbook entitled, "Delineating Bordering Vegetated Wetlands: Under the Massachusetts Wetlands Protection Act"

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Series of images from the White's Lane invasive species management and restoration project

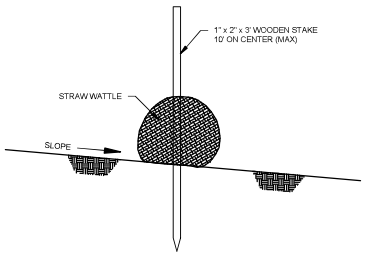
2007 - Images of the density of invasive tree species prior to initial invasive management

2009 - Image of project during invasive plant management following removal of the invasive tree and vines.

2009 - Native seed mix establishing in first season following invasive plant management.

2010 - Diamondback terrapin release day.

2017 - Sunrise in summer looking over the warm season grassland.



SEDIMENTATION BARRIER DETAIL

NOT TO SCALE

EROSION & SEDIMENTATION CONTROL NOTES:

1. THE SEDIMENT CONTROL BARRIER SHALL BE INSTALLED PRIOR TO THE START OF CONSTRUCTION AND MAINTAINED UNTIL STABILIZATION AND REVEGETATION OF DISTURBED AREAS.
2. DURING CONSTRUCTION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR EROSION CONTROL AND SHALL PROTECT THE CONSTRUCTION SITE FROM EROSION UNTIL COMPLETION OF SITEWORK AND ESTABLISHMENT OF VEGETATIVE GROUND COVER.
3. AFTER GRADING, ALL STEEP SLOPES REMAINING SHALL BE SEEDED AND BLANKETED WITH 100% BIODEGRADABLE COCONUT/STRAW EROSION CONTROL BLANKET, FOLLOWED BY PLANTING OF BEACH GRASS AND/OR WOODY VEGETATION (SEE RESTORATION NOTE).
4. THE CONTRACTOR SHALL PRACTICE GOOD HOUSEKEEPING MEASURES DURING THE DAY TO DAY OPERATION AT THE SITE. THE SITE SHOULD BE POLICED DAILY TO REMOVE ANY LITTER OR DEBRIS.
5. MATERIAL STOCKPILES THAT ARE IN PLACE FOR AN EXTENDED PERIOD OF TIME SHALL BE STABILIZED WITH VEGETATION, MULCHING, EROSION CONTROL BLANKETS, AND OTHER MEASURES THAT RE NECESSARY TO PREVENT THE DISCHARGE OF SEDIMENT FROM PROJECT SITE.
6. SEDIMENTATION BARRIER SHALL BE REMOVED UPON RE-VEGETATION OF DISTURBED AREAS.

REFERENCE:

ASSESSORS MAP 49, PARCEL 50

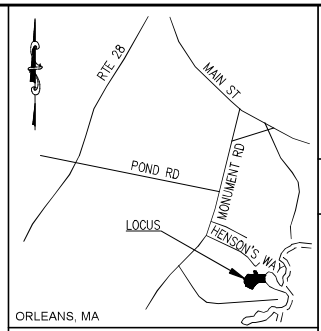
PLAN BOOK 674, PAGE 53

FLOOD ZONE:

FLOOD ZONE AE AS SHOWN ON FEMA FIRM PANEL #25001C0438J REVISED JULY 16, 2014

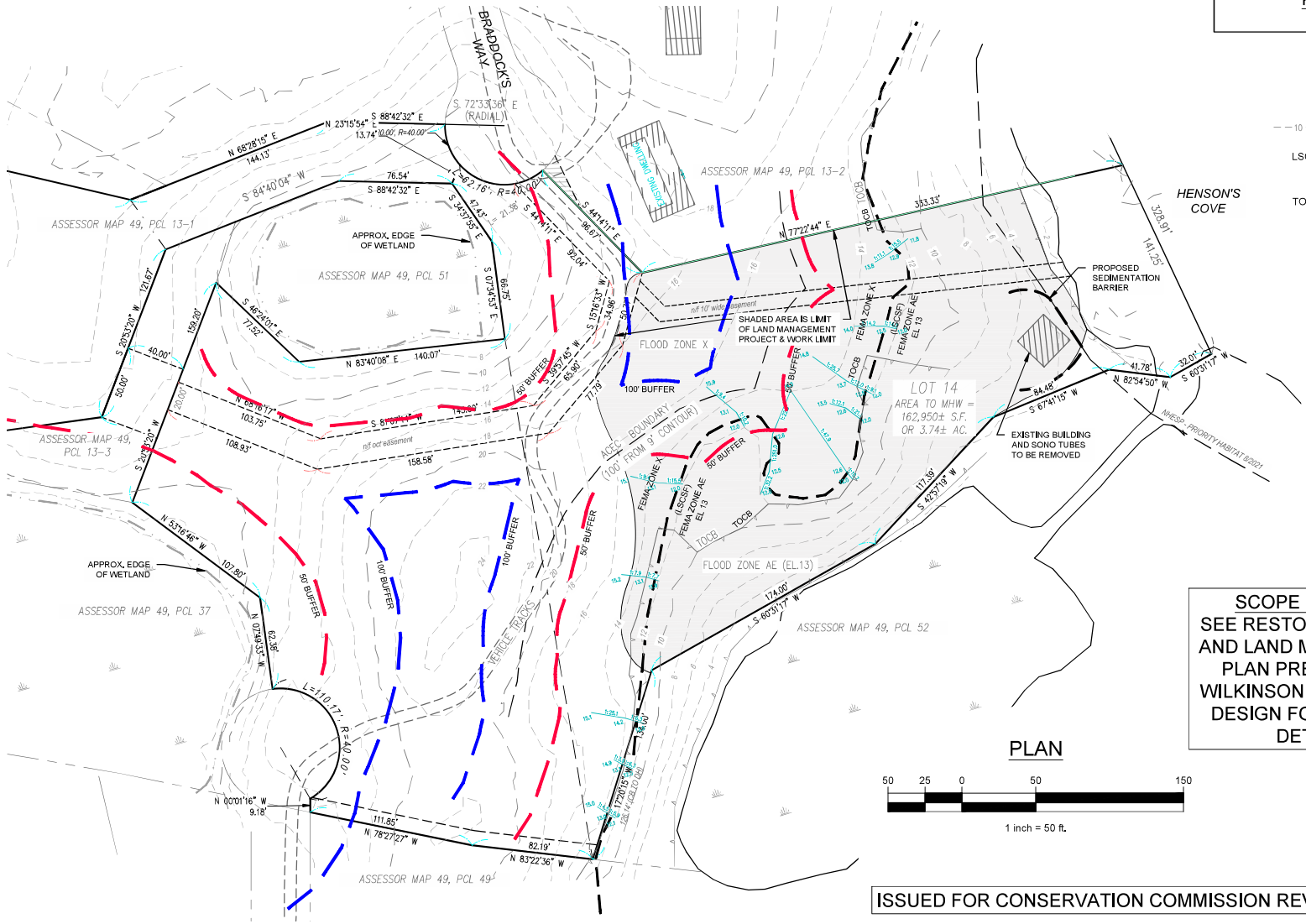
DATUM:

ELEVATIONS SHOWN HEREON ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 1988)



KEY MAP

NO SCALE



LEGEND

10	CONTOUR
LSCSF	LAND SUBJECT TO COASTAL STORM FLOWAGE
TOCB	TOP OF COASTAL BANK

SCOPE OF WORK

SEE RESTORATION PLAN AND LAND MANAGEMENT PLAN PREPARED BY WILKINSON ECOLOGICAL DESIGN FOR PROJECT DETAILS

PLAN

50 25 0 50 150

1 inch = 50 ft.

ISSUED FOR CONSERVATION COMMISSION REVIEW 06-28-2022

COASTAL engineering co.
260 Cranberry Hwy, Orleans, MA 02653
508.255.6868 P 508.255.6002 F

NO.	DATE	REVISION	BY
1	06-28-2022	MODIFY TOCB BOUNDARY; CORRECT BAR SCALE	BPM/JLH

SEAL

SEAN M. RILEY CIVIL No. 40715 REGISTERED PROFESSIONAL ENGINEER

PROJECT: ORLEANS CONSERVATION TRUST
4 BRADDOCKS WAY ORLEANS, MA

SHEET TITLE: PLAN SHOWING PROPOSED LAND MANAGEMENT ACTIVITIES

SCALE: AS NOTED

DRAWING FILE: C17793-05-CIV.dwg

DATE: REV 6-28-2022 ~~02-24-2022~~

DRAWN BY: DAP/JLH/BPM

CHECKED BY: BPM

C2.0.1

1 OF 1 SHEETS

PROJECT NO. C17793.05

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