Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 8A – Request for Certificate of Compliance

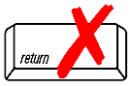
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

DEP File Number:

006-1459
Provided by DEP

A. Project Information

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. This request is being made by:

Michael Creasey (Superintendent of National Parks of Boston)
Name

21 2nd Avenue, National Parks of Boston
Mailing Address

Charlestown	MA	02129
City/Town	State	Zip Code

(617) 242-5601
Phone Number

2. This request is in reference to work regulated by a final Order of Conditions issued to:

Gile Parker (former Superintendent of Boston Harbor Islands National and State Park)
Applicant

5/31/2016	006-1459
Dated	DEP File Number

Upon completion of the work authorized in an Order of Conditions, the property owner must request a Certificate of Compliance from the issuing authority stating that the work or portion of the work has been satisfactorily completed.

3. The project site is located at:

Thompson Island	Boston
Street Address	City/Town
00000000	00000000
Assessors Map/Plat Number	Parcel/Lot Number

4. The final Order of Conditions was recorded at the Registry of Deeds for:

Arthur Pearson (Thompson Island Outward Bound)
Property Owner (if different)

Suffolk	28699	304
County	Book	Page

Certificate (if registered land)

5. This request is for certification that (check one):

☒ the work regulated by the above-referenced Order of Conditions has been satisfactorily completed.

☐ the following portions of the work regulated by the above-referenced Order of Conditions have been satisfactorily completed (use additional paper if necessary).

☐ the above-referenced Order of Conditions has lapsed and is therefore no longer valid, and the work regulated by it was never started.

A. Project Information (cont.)

6. Did the Order of Conditions for this project, or the portion of the project subject to this request, contain an approval of any plans stamped by a registered professional engineer, architect, landscape architect, or land surveyor?

☐ Yes — If yes, attach a written statement by such a professional certifying substantial compliance with the plans and describing what deviation, if any, exists from the plans approved in the Order.

☒ No

B. Submittal Requirements

Requests for Certificates of Compliance should be directed to the issuing authority that issued the final Order of Conditions (OOC). If the project received an OOC from the Conservation Commission, submit this request to that Commission. If the project was issued a Superseding Order of Conditions or was the subject of an Adjudicatory Hearing Final Decision, submit this request to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html).

Thompson Island Ecological Restoration Project (DEP File # 006-1459)
Certificate of Compliance Request – Overview Document

November 1st, 2022

In 2016, the National Park Service at Boston Harbor Islands National Recreation Area (a.k.a. Boston Harbor Islands National and State Park) began a habitat restoration project on a 6-acre site on Thompson Island, in partnership with Thompson Island Outward Bound Education Center. This project area, which was selected due to its high ecological value that was being actively degraded by highly invasive non-native plants, contains 2.4 acres of freshwater wetland, separated into 3 hydrologically connected cells. The project area also contains upland meadow and upland forest habitats. Our restoration efforts primarily consisted of invasive plant removal, native plant revegetation, and environmental monitoring.

The National Park Service (Michael Creasy, superintendent of National Parks of Boston) is requesting a Certificate of Compliance for the Ecological Restoration Order of Conditions (006-1459) on Thompson Island. The COC materials submitted as part of this request are:

- Certificate of Compliance Request – Overview Document
- Thompson Island 006-1459 COC Request Form
- Thompson Island Project Area Map with Wetland Buffer Zones
- DEP 006-1459 COC Invasive Plant Treatment Summary
- DEP 006-1459 COC Native Plantings Summary
- DEP 006-1459 COC Herbicide Usage Summary
- DEP 006-1459 COC Vegetation Transect Monitoring Summary
- DEP 006-1459 COC Photo Monitoring Summary
- DEP 006-1459 COC Wildlife Observations Summary
- DEP 006-1459 COC Nitrogen Study Technical Report

As outlined in the original Notice of Intent, several Success Criteria were established as part of this project proposal. Below is a list of each of those criteria, followed by an evaluation of how effectively those criteria were met:

- ***Successful establishments of more than ten native species in both wetland and upland project areas on Grape and Thompson Island (a successfully established "population" for each species with be based on a species- and site- specific factors, as outlined in final implementation plan")***

Over the course of the project, 28 species of plants (3598 individuals) were planted in the habitat restoration area (see Native Plantings Summary). The primarily methods we used to assess native plant establishment were survivorship monitoring, vegetation monitoring transect data and photo monitoring.

Survivorship percentage and qualitative plant health for each species planted was recorded at the end of each planting year. The following species had >80% survivorship at the end of the season in which they were planted:

Year 1

- *Deschampsia flexuosa* (wavy hairgrass)
- *Oenothera biennis* (evening primrose)
- *Schizachyrium scoparium* (little bluestem)
- *Scirpus cyprinus* (woolsedge)
- *Solidago sempervirens* (seaside goldenrod)
- *Symphiotrichum novae angleae* (New England aster)
- *Verbena hastata* (blue vervain)

Year 2

- *Acer rubrum* (red maple)
- *Amelanchier canadensis* (serviceberry)
- *Asclepias incarnata* (swamp milkweed)
- *Betula populifolia* (grey birch)
- *Deschampsia flexuosa* (wavy hairgrass)
- *Iris versicolor* (blue flag iris)
- *Panicum virgatum* (panic switchgrass)
- *Scirpus cyperinus* (common woolsedge)
- *Vaccinium corymbosum* (highbush blueberry)

Year 3

- *Carex lurida* (sallow sedge)
- *Deschampsia flexuosa* (wavy hairgrass)
- *Euthamia graminifolia* (grass-leaved goldenrod)
- *Panicum virgatum* (panic switchgrass)
- *Schizachyrium scoparium* (little bluestem)
- *Scirpus cyperinus* (common woolsedge)
- *Sisyrinchium angustifolium* (narrowleaf blue-eyed grass)
- *Solidago alttissima* (Canada goldenrod)

In total, 17 species achieved >80% survivorship by the end of the seasons in which they were planted. Unfortunately, none of the plantings were monitored using this protocol over the course of multiple seasons, so this data is limited in its ability to convey long-term establishment success. However, field observations in 2022confirm that many of these species are still present and thriving in the project area.

In addition to survivorship monitoring, vegetation monitoring transect data provides some limited supplemental information on native planting establishment (see Vegetation Monitoring Transect Summary). The monitoring protocol was developed by the Department of Forest and Rangeland Stewardship at Colorado State University, with analyses performed by the NPS Northeast Temperate Inventory and Monitoring Network (NETN) The protocol consisted of establishing 21 randomly placed permanent 10 meter transects throughout the project area (in wetland, upland, and upland control zones), and recording every plant species along each transect on a yearly basis in herb, shrub, and tree layers. Following the implementation of this protocol for four years, and subsequent analyses, we have learned that the use of permanent transects limited the value of the data, since the majority of planted areas did not happen to be covered by the randomized transect locations. Nevertheless, some interesting findings regarding planted species were that *Solidago sempervirens* (seaside goldenrod) increased in % cover from 0% in 2015 to 2% in 2019 in the wetland zone, and that

there was a marginal net increase in frequency of *Solidago alttissima* (tall goldenrod) in the upland zone (increase in 2018 and decrease in 2019). . In addition, the vegetation transect monitoring did show an increase in cover and frequency of all native species in the upland zone, and a slight decrease in cover and frequency of all native species in the wetland zone.

Photo monitoring was also utilized to provide qualitative, landscape-scale information on how the project area vegetation composition changed on a year-to-year basis (see Photo Monitoring Summary). In terms of native planting establishment, the photo progressions show an increase in native plant coverage in the upland meadow habitat, most notably the *Solidago alttissima* (Canada goldenrod) and *Eurybia divaricata* (white wood aster).

- ***Less than 10% cover of invasive non-native plant species within both wetland and upland project areas on Grape and Thompson Island***

A central focus of our Thompson Island habitat restoration efforts has been invasive plant control. Over the duration of the project, our team has manually or chemically a treated acres and 15 invasive plant species over a combined absolute area of 17.3 acres (several species treatments overlap within the project area) (see Invasive Plant Treatment Summary).

As mentioned, the vegetation monitoring transect data was intended to be the best method to understand how invasive plant cover changed in the project area, but ended up being of relatively less value than anticipated. . Nevertheless, the summary analysis shows that there was little change in total cover or frequency of target non-native species in upland treatment areas, and that there was a decrease in frequency of target species in the wetland zone (likely driven by a reduction in Phragmites). ,The statistics for a few individual invasive species show some promising trends as well as challenges. *Rosa multiflora* (multiflora rose), one of the most prominent invasive plants in the project area and throughout the Harbor Islands, showed a reduction in % cover from 23% in 2015 to 10% in 2019 in the upland zones of the project area. *Frangula alnus* (glossy buckthorn) has also shown a reduction in % cover from 2% in 2015 to 1% in 2019. However, other species of invasive plants, such as *Phragmites australis* (common reed aka phragmites), *Lythrum salicaria* (purple loosestrife), and *Celastrus orbiculatus* (Asiatic bittersweet) have had similar or increased % cover from 2015 to 2019 in wetland and upland zones, respectively, indicating that more work needs to be done to control the populations of these persistent species.

Our photo monitoring points show some promising visual progress in terms of invasive plant reduction. Overall abundance of Asiatic bittersweet has reduced significantly in the upland meadow habitat, as well as in the strip of upland forest berm that splits the northeast and southwest wetland cells. Additionally, the density of phragmites in the northeast wetland cell (aka the “skating pond”) has also been visually reduced.

There are a few potential explanations for the discrepancy between the vegetation transect monitoring data and the qualitative visual progress in the project area. While the monitoring transects are an attempt at capturing large-scale changes in plant cover/frequency, in reality the transects only cover a limited amount of area. An analysis done last year showed that there is only a 50.3% overlap with the monitoring transects and invasive plant treatment polygons.

- **Documented use of wetland habitats on both islands by mammals and waterbirds, and documented pollinator use of both wetland and upland sites (pollinator monitoring protocol is being developed by partner at Colorado State University)**

While there was no standardized wildlife monitoring protocol implemented for this project due to staff limitations, the Colorado State investigator dropping off of the project, and no dedicated funding, there have been a significant number of wildlife observations made by NPS staff in and around the Thompson Island project area over the past several years (see Wildlife Observations Summary). The primary way in which we have cataloged these observations is through iNaturalist. Additionally, there have been several other documented wildlife sightings that were not uploaded to iNaturalist. Below is a list of notable sightings that were made in the wetland and upland zones of the project area (Research Grade iNaturalist observations and staff observations):

<u>Mammals</u>

- *Canis latrans* (coyote)
- *Microtus pennsylvanicus* (Eastern meadow vole)
- *Odocoileus virginianus* (white-tailed deer)
- *Ondatra zibethicus* (muskrat)
- *Procyon lotor* (common raccoon)
- *Urocyon cinereoargenteus* (grey fox)

<u>Waterbirds</u>

- *Anas platyrhynchos* (mallard)
- *Ardea alba* (great egret)
- *Ardea herodias* (great blue heron)
- *Branta bernicla* (brant)
- *Branta canadensis* (Canada goose)
- *Bucephala albeola* (bufflehead)
- *Charadrius vociferus* (killdeer)
- *Egretta thula* (snowy egret)
- *Larus argentatus* (herring gull)
- *Nycticorax nycticorax* (black-crowned night heron)
- *Pandion haliaetus* (osprey)
- *Phalacrocorax auritus* (double-crested cormorant)
- *Plegadis falcinellus* (glossy ibis)
- *Somateria mollissima* (common eider)

<u>Pollinators</u>

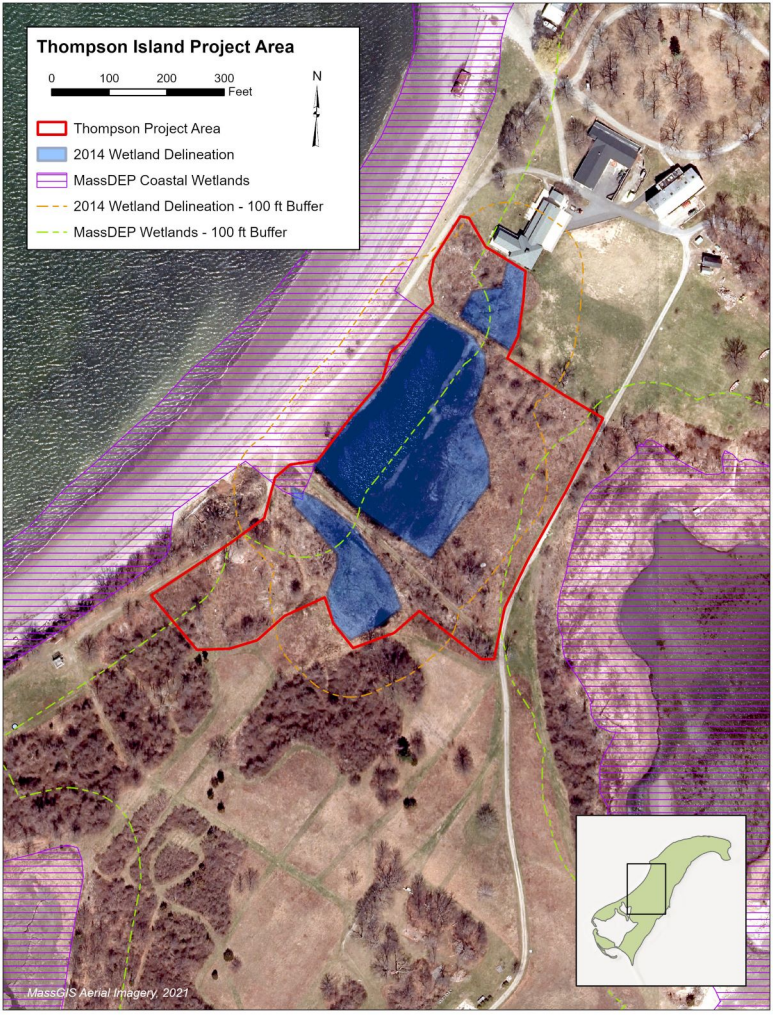
- *Apis mellifera* (Western honey bee)
- *Bombus griseocollis* (brown-belted bumble bee)
- *Bombus impatiens* (common Eastern bumble bee)
- *Calophasia lunula* (toadflax brocade moth)
- *Haematopis grataria* (chickweed geometer moth)
- *Halysidota tessellaris* (banded tussock moth)
- *Hyles lineata* (white-lined sphynx)
- *Danaus plexippus* (monarch)

- *Lon zabulon* (zabulon skipper)
- *Papilio glaucus* (Eastern tiger swallowtail)
- *Papilio polyxenes* (black swallowtail)
- *Pieris rapae* (cabbage white)
- *Xylocopa virginica* (Eastern carpenter bee)
- *Xylocopa virginica virginica* (Virginia carpenter bee)

Unfortunately, the Colorado State University pollinator protocol was never developed. Additionally, there were no baseline population assessments for mammals, waterbirds or pollinators made in/around the project area prior to starting habitat restoration work, so it is difficult to quantitatively measure how much of an impact our work had on local wildlife abundance and biodiversity. For future habitat restoration efforts, we are considering how to develop standardized inventory and monitoring protocols for vegetation, pollinator use, and bird habitat value and bird use that we would use for baseline data collection and subsequent effects monitoring.

- **Establishment of a new baseline range of variability for the hydrology of both wetland sites (average annual period of standing water, average groundwater level by month, frequency of ocean storm overwash events, and the effects of overwash events on the salinity of standing water and groundwater)**

Our research partners at U.S. Forest Service Rocky Mountain Research Station and Northeastern University conducting nitrogen research ended up not using water level monitoring devices, so we did not track overwash events (see Nitrogen Study Technical Report). We are currently working with partners at UMass Boston as part of the Stone Living Lab partnership to track storm impacts across the Boston Harbor Islands, so we should have more information on this in the future.

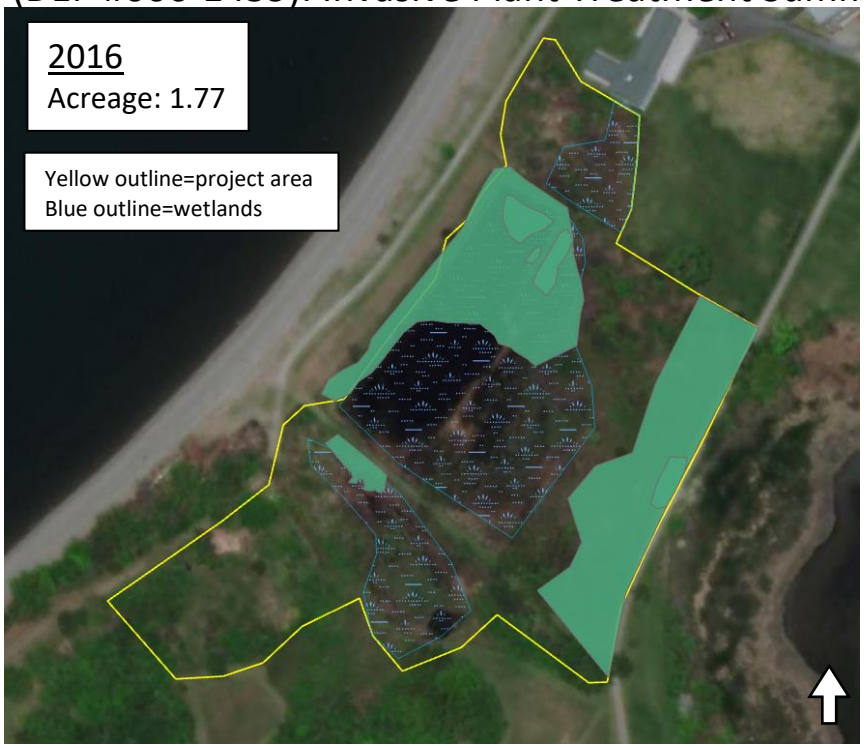

Thompson Island Project Area
0
100
200
300
Feet
N
Thompson Project Area
2014 Wetland Delineation
MassDEP Coastal Wetlands
2014 Wetland Delineation - 100 ft Buffer
MassDEP Wetlands - 100 ft Buffer
MassGIS Aerial Imagery, 2021

Herbicide usage summary for OOC Order of Conditions 006-1459, Thompson Island.

Over the course of the Thompson Island habitat restoration project, several herbicides were used in order to control invasive plant species in the project area. Herbicide selection and reporting was done in accordance with the NPS Pesticide Use Proposal System (PUPS), which is a service-wide pesticide permitting system that is a part of the NPS Integrated Pest Management (IPM) program. Herbicides were applied by NPS staff who held Core Applicator Licenses from the Massachusetts Department of Agricultural Resources (MDAR), and all use was reported to MDAR as part of licensing processes. All herbicides were applied according to label instructions and limitations. Below is a list of herbicides that were used during the project:

Year	Herbicide Product Name	Active Ingredient	Species Treated
2016	Garlon 3A	Triclopyr	tree of heaven, glossy buckthorn, common buckthorn
2017	Garlon 3A	Triclopyr	multiflora rose, glossy buckthorn, black swallowwort
2017	Pathfinder II	Triclopyr	multiflora rose, bittersweet, Morrow's honeysuckle
2018	Habitat	Isopropylamine salt of imazapyr	multiflora rose, bittersweet, tree of heaven, common buckthorn, black swallowwort
2018	Pathfinder II	Triclopyr	multiflora rose, bittersweet, tree of heaven, common buckthorn, glossy buckthorn, Canada thistle, bull thistle
2018	Rodeo	Glyphosate	multiflora rose, bittersweet, tree of heaven, common buckthorn, black swallowwort

Ecological restoration of nearshore freshwater wetlands and buffer zones, Thompson Island, Boston (DEP #006-1459). Invasive Plant Treatment Summary 2016-2019 (Acreage includes overlapping polygons) .



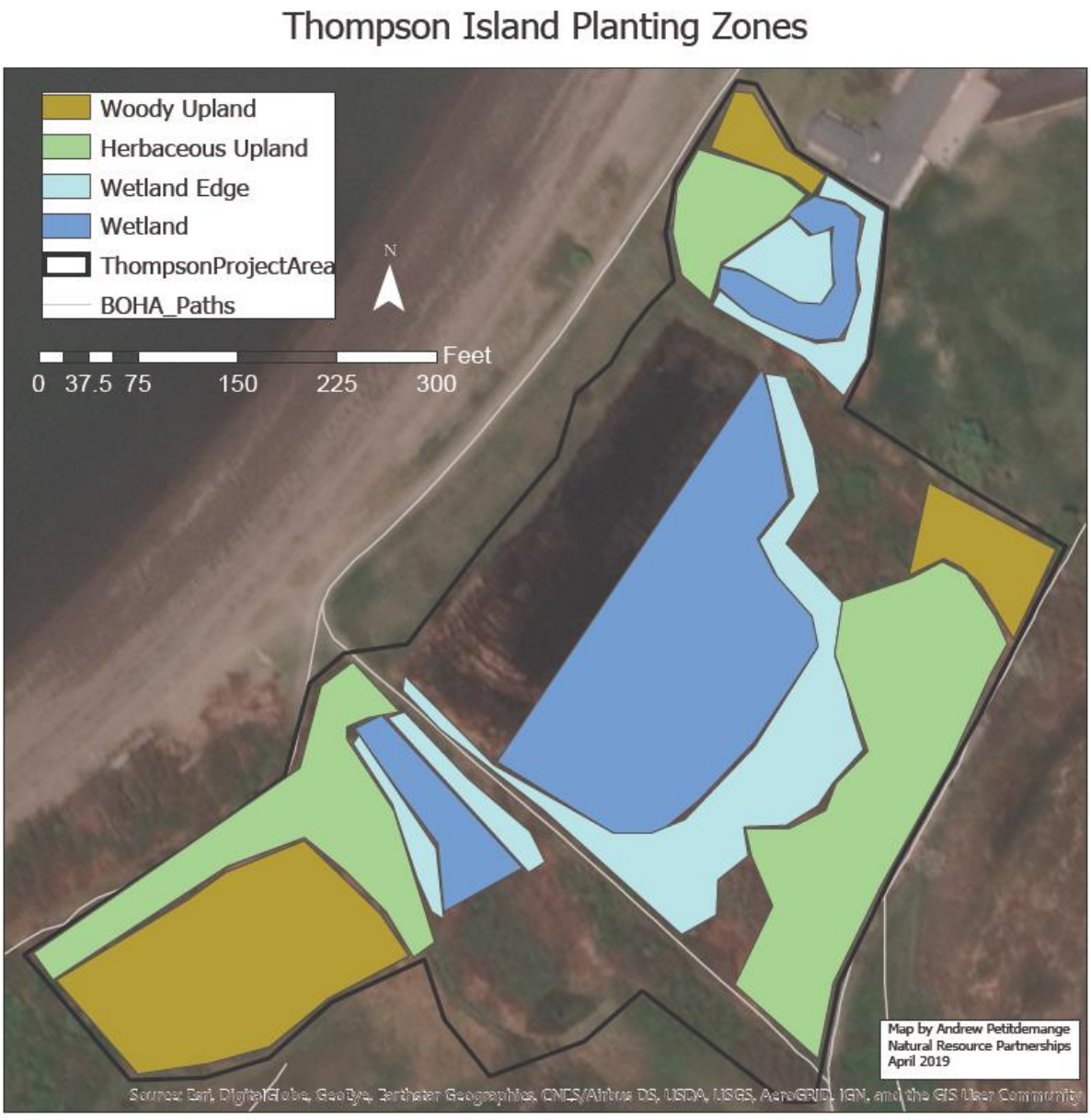
Ecological restoration of nearshore freshwater wetlands and buffer zones, Thompson Island, Boston (DEP #006-1459). Invasive Plant Treatment Summary 2016-2019 (Acreage includes overlapping polygons) .

Year	Acreage (counting overlapping polygons)	Species treated
2016	1.77	multiflora rose, Asiatic bittersweet, phragmites, common buckthorn, Canada thistle, bull thistle, purple loosestrife, Morrow's honeysuckle, broadleaf pepperweed
2017	6.77	multiflora rose, Asiatic bittersweet, phragmites, tree of heaven, common buckthorn, glossy buckthorn, Canada thistle, bull thistle, spindle tree, purple loosestrife, Morrow's honeysuckle
2018	7.62	multiflora rose, Asiatic bittersweet, tree of heaven, black swallowwort, common buckthorn, Canada thistle, Norway maple, spindle tree
2019	1.12	multiflora rose, Asiatic bittersweet, phragmites, broadleaf pepperweed
Total	17.28	multiflora rose, Asiatic bittersweet, phragmites, tree of heaven, common buckthorn, glossy buckthorn, Canada thistle, bull thistle, spindle tree, purple loosestrife, Morrow's honeysuckle, broadleaf pepperweed, Norway maple, black swallowwort

Data includes manual, chemical, and mechanical treatment of invasive plant species

Thompson Island Ecological Restoration Planting Summary for Certificate of Compliance, DEP #006-1459.

A key aspect of our habitat restoration work in the Thompson Island project area was native plant revegetation. In conjunction with invasive plant removal, we planted a wide variety of native plant species in several planting zones throughout the project area (see map below). These plants, which were sourced from the Native Plant Trust in Framingham, were propagated using seeds collected from Thompson Island and other local sources in Massachusetts. The goal of revegetation efforts was to supplement extant native plant populations as part of converting the freshwater wetland and surrounding upland plant assemblages from invasive-dominated to native-dominated biodiversity.



In total, 3598 plants were planted on Thompson Island during the habitat restoration project (see spreadsheet below). The 28 species planted included trees, shrubs, grasses, and herbaceous perennials. Survivorship of plantings was generally good (see below), although it varied substantially across the area, with wetland buffer zone and upland area plantings surviving better than plantings in the wetland. This appears to be due to the highly variable water levels across seasons and years in the wetlands in this area. Establishment of plantings is likely more difficult in these locations due to the partially-altered topography and surficial geology of the site, and thus the hydrology, which includes compacted elevated berms (created decades to centuries ago as part of the former farm and trade schools on the site) that divide the wetland complex into distinct 'cells.' Future restoration efforts should consider addressing this altered topography and hydrology.

Scientific name	Common name	Planting zone	Year 1	Year 2	Year 3	Total
Acer rubrum	Red maple	Upland woodland, wetland edge		9		9
Amelanchier canadensis	Serviceberry	Upland woodland, upland meadow		6		6
Andropogon virginicus	Broomsedge bluestem	upland meadow			42	42
Ascelpia incarnata	Swamp milkweed	Wetland edge, wetland	150	100	17	267
Betula populifollia	Grey birch	Upland woodland	45	18		63
Carex lurida	Sallow sedge	Wetland edge, wetland			96	96
Deschampsia flexuosa	Wavyhair grass	Upland woodland, upland meadow	175	50	50	275
Eurybia divaricata	White wood aster	Upland woodland, upland meadow	150			150
Euthamia graminafolia	Grass-leaved goldenrod	Upland meadow, wetland edge	175		96	271
Eutrochium maculatum	Joe-pye weed	Wetland edge, wetland	125	50	53	228
Iris versicolor	Blue flag iris	Wetland edge, wetland		25		25
Iva frutescens	Marsh elder	Wetland edge, wetland	12			12
Juncus gerardii	Saltmarsh rush	Wetland edge, wetland			46	46
Mimulus ringens	Allegheny monkey flower	Wetland edge, wetland	125	50		175
Oenothera biennis	Evening primrose	Upland meadow, wetland edge	100			100
Panicum virgatum	Panic switchgrass	Upland meadow, wetland edge		50	46	96
Rhus copallinum	Winged sumac	Upland woodland, upland meadow		24		24
Schizachyrium scoparium	Little bluestem	Upland woodland, upland meadow	150	50	101	301
Schoenoplectus americanus	Chairmaker's bulrush	Wetland edge, wetland		50		50
Scirpus cyprinus	Woolsedge	Wetland edge, wetland	125	50	94	269
Sisyrinchium angustifolium	Blue-eyed grass	Upland meadow		60	100	160
Solidago altissima	Canada goldenrod	Upland meadow			48	48
Solidago sempervirens	Seaside goldenrod	Upland meadow, wetland edge	100			100
Symphiotrichum novae angleae	New England aster	Upland woodland, upland meadow	250			250
Symphiotrichum novi belgii	New York aster	Upland meadow, wetland edge	250			250
Vaccinium corymbosum	Highbush blueberry	Upland woodland, upland meadow		20	25	45
Verbena hastata	Blue vervain	Upland meadow, wetland edge	175		50	225
Viburnum acerifolium	Maple-leaf viburnum	Upland woodland		15		15
			2107	**627**	**864**	**3598**

Staff and volunteers planting in wetlands

White wood aster in the eastern upland meadow

During each planting year, our team made survivorship observations for each species planted. These observations, which were both quantitative (# of plants surviving) and qualitative (visual plant health), enabled us to learn which species do well in which microhabitats of the project area. This information will be used to inform our future habitat restoration efforts across the Park, especially at freshwater wetland sites.

Below are a few examples of survivorship data that was collected throughout the project:

Common name	Scientific Name	Number of plants	Individuals lost	Percent Survivorship
TOTAL		**839**	**144**	**82.8**
broomsedge bluestem	*Andropogon virginicus*	42	0	100
narrowleaf blue-eyed grass	*Sisyrinchium angustifolium*	100	0	100
wavy hairgrass	*Deschampsia flexuosa*	50	0	100
common woolsedge	*Scirpus cyperinus*	94	0	100
little bluestem	*Schizachryium scoparium*	101	22	98
Canada goldenrod	*Solidago altissima*	48	1	97.9
sallow sedge	*Carex lurida*	96	5	94.8
panic switchgrass	*Panicum virgatum*	46	3	93.5
grass-leaved goldenrod	*Euthamia graminifolia*	96	14	85.4
blue vervain	*Verbena hastata*	50	25	50
saltmarsh rush	*Juncus gerardii*	46	27	41.3
swamp milkweed	*Asclepias incarnata*	17	14	17.6
spotted joe pye weed	*Eutrochium maculatum*	53	53	0

End-season survivorship percentages for each species planted in Year 3

End-season survivorship map for Year 3 (all species). Survivorship rating key on the next page. Each point represents a planting cluster, each of which consists of 3 to 7 plants of a single species.

Positive Rating __1—2	Neutral Rating__ 3	Negative Rating__4—5
• Visible growth: plants were taller, fuller and more visibly established • First Season Flowering: plants produced flowers in their first growth year • Seed Production: plants produced seed in their first growth year	• Visible growth: plants made little to no visible growth in their first growth year • First Season Flowering: plants produced few or no flowers in their first growth year • Seed Production: plants produced little to no seed in their first growth year	• Visible growth: plants visibly deteriorated and senesced in their first growth year • First Season Flowering: plants produced no flowers at all in their first growth year • Seed Production: plants produced no seeds at all in their first growth year

Qualitative survivorship rating key (1=best, 5=worst)

Below is an excerpt from the Discussion section of the Year 3 planting report:

Successes

Some of the greatest successes from planting this year were with upland species. In particular all 4 of the grass species planted this season thrived. With 3 individual exceptions, every planting of **Broomsedge Blue-Stem**, **Little Blue-Stem**, **Wavy-Hair Grass**, and **Panic Switchgrass** made it through to their first fall—and most flowered and fruited in their first year.

All of the goldenrod species performed well in sunny upland sites and would be excellent species to continue transplanting in similar locations. Nearly every individual **Grassleaf Goldenrod** (*Euthamia graminifolia*) in particular flowered in their first year and produced ripe fruit by season's end.

Blue-Eyed Grass (*Sisyrinchium angustifolium*) also demonstrated its reliability as a transplanted species. Of 195 individuals, only 5 did not survive their first growing season. The rest, all planted in sunny, open, upland sites, grew excellently and flowered their first year, producing seed by August.

Sallow Sedge (*Carex lurida*) was a new species for our team this year, and it flourished in wetland sites on both Thompson and Grape. In many cases the sedges tripled in size—even as wetland areas flooded. This species is an excellent candidate for future plantings in wetland and wetland edge sites.

Common Woolsedge (*Scirpus cyperinus*) has proven itself probably the single-most successful species for direct transplant in the field. Both in last season's drought and this year's abundant rain each specimen we planted not only survived, but in most cases doubled or tripled in size, and produced abundant flowers and seeds.

Challenges

4 of the 13 plant species we worked with struggled this year. In particular many wetland sites flooded far more than expected and drowned out species that prefer wetland edge settings—including Blue Vervain (*Verbena hastata*) and Spotted Joe-Pye Weed *(Eutrochium maculatum*).

Joe-Pye Weed experienced the greatest losses. On Thompson Island, not a single planted specimen of that species survived into the fall. This may have been directly caused by higher-

than expected levels of standing water—but we had trouble establishing Joe-Pye Weed last year as well. Improved site selection for direct transplant could address this issue. But the past two seasons suggest that manual dispersal of seed could be a more likely strategy to establish new populations on the islands.

Blue Vervain was a tricky species to establish through direct transplant. And similar to Joe-Pye Weed it would be a good candidate for trying manual seed dispersal in future planting years.

Salt Marsh Rush was variable in its performance. It seemed to do well in deep wetland sites, alongside or even within stands of cattail. But many of the plantings that ventured further from crowded cattail cover ultimately disappeared into the competing vegetation.

Our team had incredible success last year with **Swamp Milkweed**, however many specimens planted this season did not survive. This may be because they were planted in sites that became too inundated— based off previous plantings it seems that Swamp Milkweed does best in wetland edge sites as opposed to wetland center. Swamp Milkweed should remain a candidate for direct transplant, but could potentially benefit from manual seed dispersal.

Examining the Interactions between Nitrogen Cycling and Non-native Species Removal at Boston Harbor Islands

Final technical Report 10/1/19

Background

Human activities have greatly increased atmospheric nitrogen (N) inputs, changed the availability of reactive forms of soil N, and altered plant species diversity in many terrestrial ecosystems (Fenn et al. 2003; Galloway et al. 2003; Bobbink et al. 2010; Pardo et al. 2011; Clark et al. 2013). Nitrogen enrichment alters plant growth in most terrestrial ecosystems and can alter competitive relations in favor of fast-growing, invasive species in upland (Clark and Tilman 2008) and wetland ecosystems (Bertness et al. 2002; Kettenring et al. 2011). Addressing the consequences of N enrichment has become a significant land management challenge for protection of native plant biodiversity and provision of ecosystem services that regulate clean water and sustain soil productivity and other benefits (Lovett et al. 1999; Bakker and Berendse 1999; Blett et al. 2014). Nitrogen enrichment creates cascading effects that alter plant community composition, ecosystem nutrient reserves and biogeochemical cycling (Aber et al. 1998) and efforts to reverse N enrichment must address complex, poorly-understood interrelationships between these factors.

A survey of National Park Service sites in the Northeastern US classified pollutant exposure of Boston Harbor Islands as Very High (Sullivan et al. 2011). The Boston urban core and surrounding areas receive 15-20 and 10-15 kg N ha^{-1} yr^{-1}, respectively, as wet plus dry deposition (NADP wetfall + modelled CASTNET). N inputs to island, near-shore and tidal ecosystems are less certain than to nearby inland areas due to complex coastal weather patterns and nutrient enrichment from surface and groundwater sources. Non-native species often alter ecosystem N cycling (Ehrenfeld 2003) and may exacerbate the effects of N enrichment. This is likely the case for the several widespread and abundant wetland and upland invaders of Boston Harbor Islands. Invasive plant species such as *Phragmites australis* - Common Reed and *Rhamnus cathartica* - Common Buckthorn are known to influence ecosystem N dynamics (Otto et al. 1999; Mozdzer et al. 2010; Windham and Meyson 2003; Hengehan et al. 2004; Mascaro and Schnitzer 2007). Both species increase aboveground biomass compared to native vegetation and alter litter decomposition and soil N mineralization in ways important for N storage and release. Removal of these species is not only costly and technically challenging (Blossey 1999, 2003, Martin and Blossey 2013), but has complicated biogeochemical effects (Meyerson et al. 1999; Findlay et al. 2003; Holdredge and Bertness 2011) that warrant long-term monitoring (Reid et al. 2009). It is essential to quantify the specific effects of abundant invading species on the harbor islands such as *Rosa multiflora* – multiflora rose, *Lonicera morrowii* – Morrow's honeysuckle, and *Celastrus orbiculatus* – oriental bittersweet) on the N storage capacity of the harbor islands.

Objectives of this study

The goal of this work was to examine ecosystem restoration practices in the Boston Harbor Islands, and the effect these practices have on N cycling. We examined the effects of restoration of native plant communities in unique ecosystems that were degraded by N enrichment and non-native plant invasion. This was a pilot project with the aim of deriving preliminary data to assess the following questions. 1) To what extent does non-native species removal alter ecosystem N cycling? 2) Are restoration efforts that focus on invasive plant removal and replacement with native species effective at reducing the impacts of excess N? The specific objectives of this work included to assess restoration activities and

biogeochemical responses in priority restoration sites on Grape and Thompson Islands of the Boston Harbor Islands National & State Park (Fig. 1). Non-native species removal efforts have been underway for numerous years and will require continued intervention and monitoring.

Figure 1. Boston Harbor, Boston Massachusetts, including the islands of Grape and Thompson, where this study occurred. Green areas indicate areas that are a part of the Boston Harbor Islands National and State park. Figure from Bowen et al. 2019.

We outlined two specific goals to derive preliminary data to meet our main objective. These goals included:

1) Quantifying the effect of removal of non-native plants on N stocks and N cycling in sites that transitioned from a dense cover of invasive species, compared to sites dominated by invasive plant species that have not yet been restored and sites that still retain primarily native vegetation.

2) Compare percent cover, taxonomic dominance, and end of season standing biomass for dominant species of native wetland and upland vegetation plants following non-native plant removal and native planting to assess how re-vegetation with native species alters N stocks.

Approach

We established three sampling areas each on Grape Island (Fig. 2) and Thompson Island (Fig. 3). At each location we measured N pools and N cycling assessments, in conjunction with the National Park Service analysis of plant community diversity and biomass in three locations on each island: (1) sites where invasive non-native vegetation removal and native planting is ongoing (removal sites), (2) sites where there are extensive stands of untreated invasive non-native vegetation (invaded sites), and (3) sites where vegetation coverage is largely comprised of native plants (native sites). From each site we established sampling locations that we sampled in spring and late summer for two years.

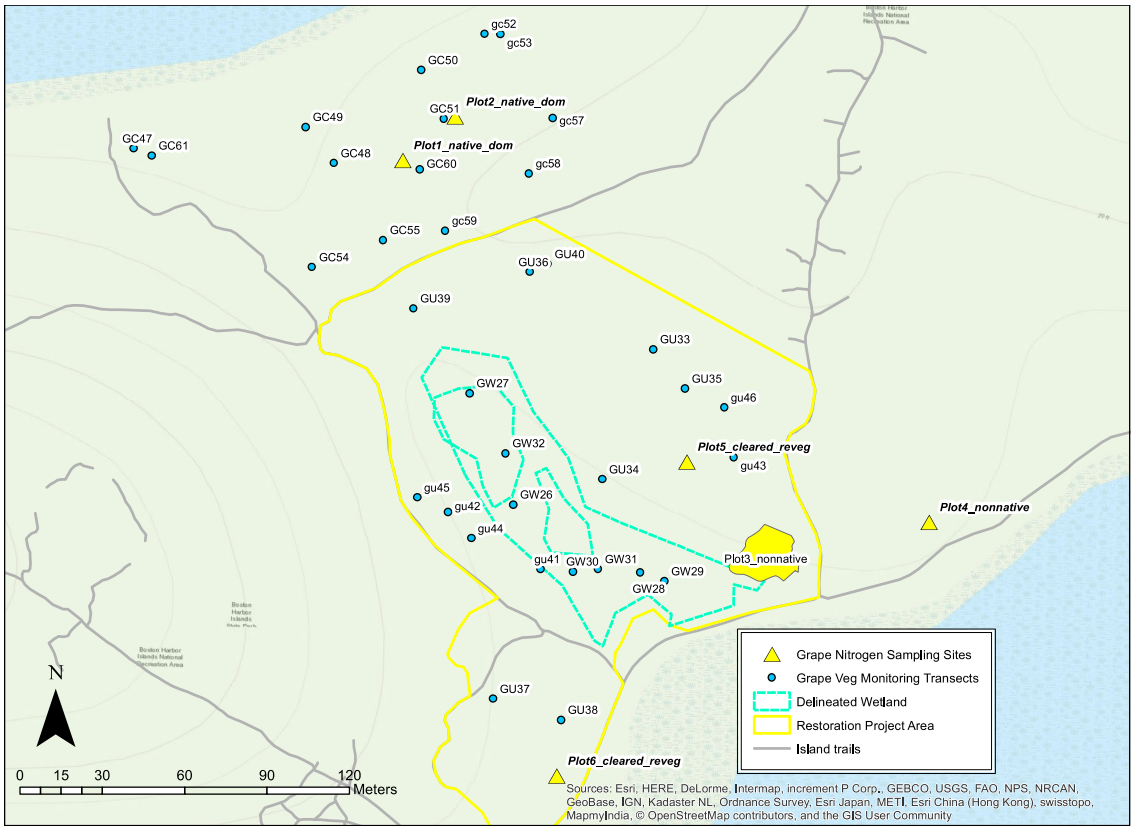


Figure 2: Location of sites on Grape Island. The yellow shaded region identifies an area of intact non-native habitat. The yellow outline describes the area of land undergoing restoration by the National Park Service, and the green area represents the delineation of the wetlands. Within each habitat, native, non-native, and cleared and revegetated, we established two permanent sites for long-term monitoring.

At each site we measured the following response variables: the N contained in above and belowground plant biomass and leaf litter, soil total C and N, net N mineralization, nitrate leaching, and denitrification, as well as common soil edaphic characteristics at each site. We also collaborated with the National Park Service to estimate cover of each species and assess species richness, at each site in order to track restoration process and to lay the foundation for future work. To measure these variables, within each site we collected leachate via soil lysimeters at a depth of 60 cm, collected leaf litter in litterfall

traps, assessed extent of litter decomposition via decomposition bags, and measured in situ rates of denitrification via sediment cores and slurry incubations.

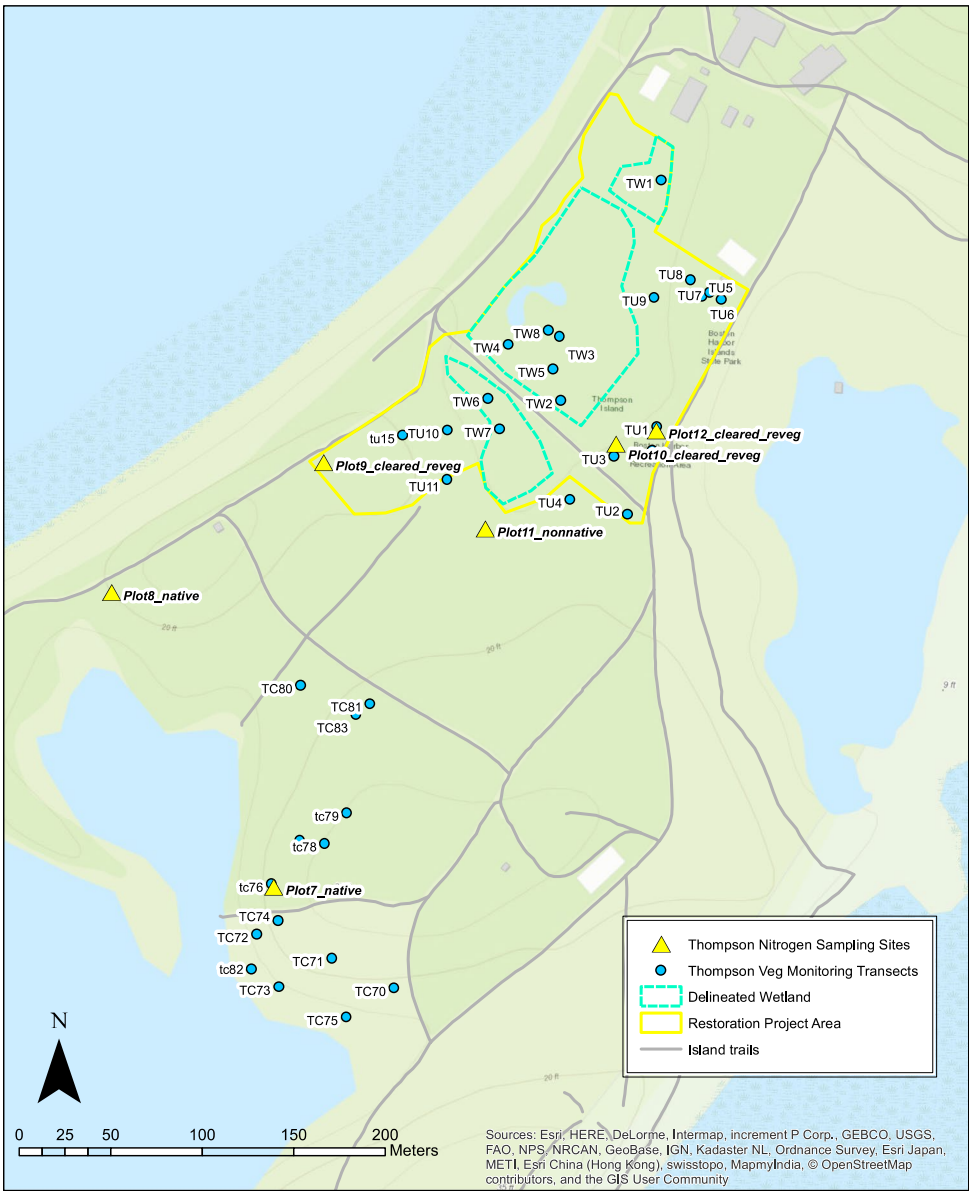


Figure 3: Location of sites on Thompson Island. The yellow shaded region identifies an area of intact non-native habitat. The yellow outline describes the area of land undergoing restoration by the National Park Service, and the green area represents the delineation of the wetlands. Within each habitat, native, non-native, and cleared and revegetated, we established two permanent sites for long-term monitoring.

A brief summary of results

One measure of the system's capacity to retain atmospheric N is a measure of the accumulation of N in the porewater underlying the vegetation. We found that the concentration of ammonium (NH4) in the pore water underlying each vegetation differed both by location and habitat (Fig. 4). The porewater ammonium concentrations demonstrated opposite patterns on the two islands, which could be a reflection of the different local soil types. In Grape, the native vegetation had considerably lower ammonium concentrations in the porewater compared to the areas with invasive vegetation and areas where invasive vegetation had been removed. This result could be a feature of the type and biomass of vegetation present in the native stands (eg higher demand for ammonium from the native vegetation). Further, these results suggest that revegetating Grape Island with native vegetation may help reduce excess bioavailable N being exported from the land and into the coastal ocean. On Thompson Island, however, the opposite pattern was observed. There, the native vegetation had higher concentrations of ammonium in the pore water, compared to the invasive and recently cleared habitats, indicating that in that system, local geological features may play a more important role than vegetation history in determining the flux of ammonium through the system.

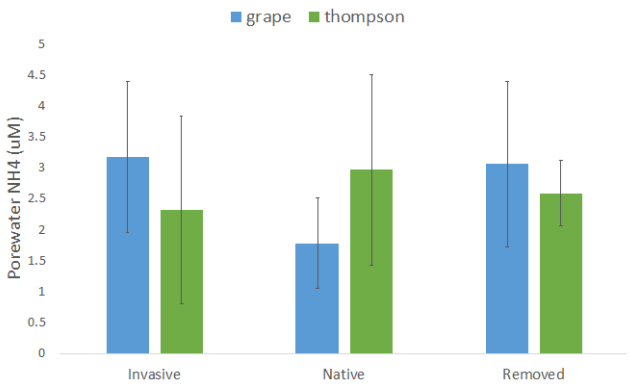


Figure 4: Ammonium (NH4) concentrations in porewater from Grape (blue) and Thompson (green) Island. Grape had lower porewater concentrations in native vegetation than in invasive and cleared invasive habitats, whereas Thompson island had the inverse pattern.

We also measured the capacity of these systems to remove N through denitrification (Fig. 5). We added sediment to a solution of glucose, acetylene, and nitrate. The sediment slurry and headspace were sparged with N_2 gas for approximately 10 minutes in order to create anaerobic conditions

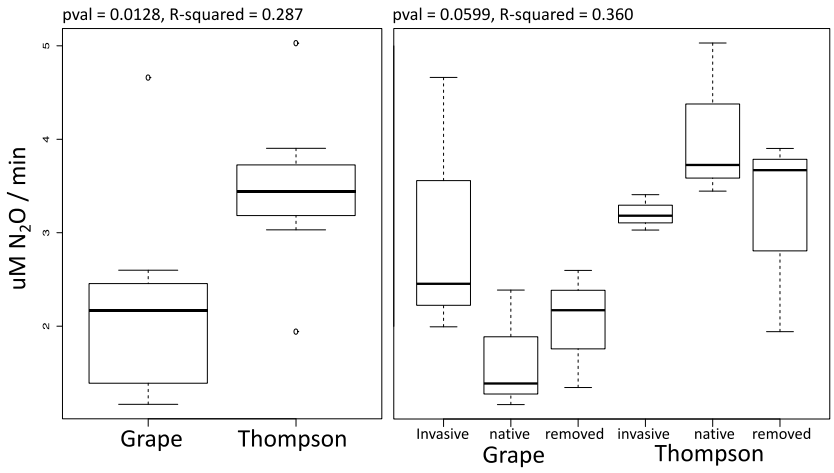


Figure 5: comparison of denitrification capacity between Grape and Thompson Islands. Thompson Island had significantly higher denitrification capacity than Grape (Island (left). Mirroring the ammonium concentrations, Grape Island had the lowest denitrification capacity in the native vegetation stand while Thompson had the highest denitrification capacity in the native stand.

before the reaction was placed on a shaker table and allowed to incubate before gas was removed from the reaction at 60, 120, and 180 minutes. We measured N_2O on a GC analyzer and estimated the concentration of each sample based on derivation of a standard curve. We used these estimates to calculate an estimated rate of denitrification for each sediment sample. We tested for significant differences between the two islands and among habitats using analysis of variance (Fig. 5). Our results indicate that Thompson Island has a higher denitrification capacity than Grape Island, regardless of the habitat. Consistent with the results from the porewater analysis, the native vegetation on Grape Island had the lowest denitrification capacity and the native vegetation on Thompson Island had the highest denitrification capacity.

Additional work

We are continuing to analyze gathered data and synthesize those findings into finalized results. We have been invited by Drs. Danny Haelewaters and Marc Albert to prepare a manuscript on these data for a special issue of the *Northeast Naturalist* titled 'Boston Harbor Islands National Recreation Area: Overview of Recent Research'. We are actively preparing a manuscript for this special issue, which we intend to submit in June 2020.

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Ecological restoration of nearshore freshwater wetlands and buffer zones, Thompson Island, Boston (DEP #006-1459)

Photo Monitoring 2016-2019.

Thompson Island photo monitoring and vegetation transect reference map

(photo directions indicated by white arrows)

Annual photos were taken from both landscape photo monitoring points and photopoints looking across vegetation monitoring transects

- T2A and T10C are landscape photo points,
- TW7 and TW4 are transect photo points

T2A (landscape photo point)

2016

2018

2019

T10C (landscape photo point)

2016

2018

2019

TW7 (transect photo point)

2016

2018

2019

TW4 (transect photo point)

2016

2017

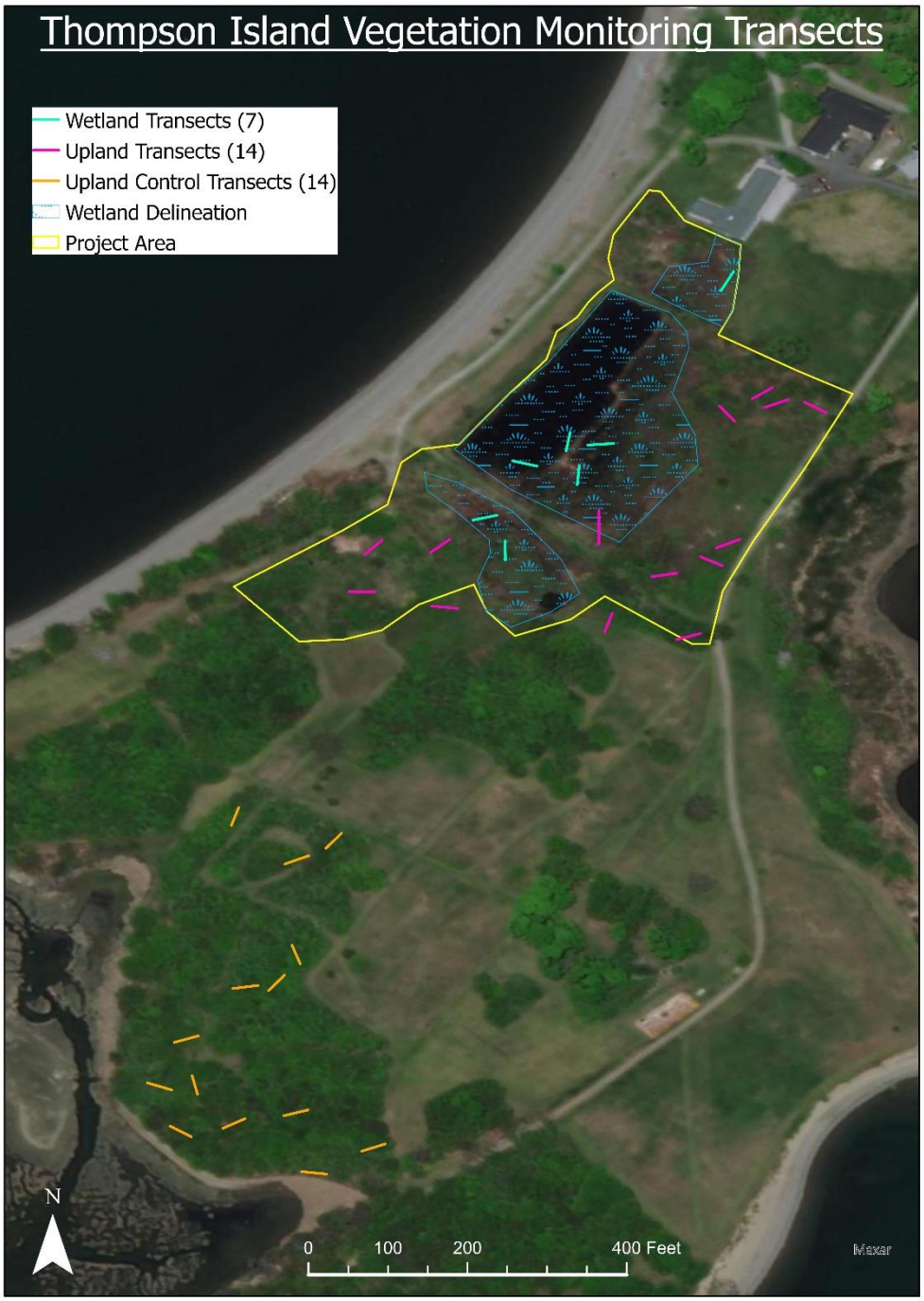
2018

2019

Ecological restoration of nearshore freshwater wetlands and buffer zones, Thompson Island, Boston (DEP# 006-1459): Quantitative Vegetation Monitoring

A critical component of our habitat restoration work on Thompson Island was vegetation monitoring. In collaboration with the Department of Forest and Rangeland Stewardship at Colorado State University and the NPS Northeast Temperate Inventory and Monitoring Network (NETN), we designed a vegetation monitoring protocol that was implemented through the duration of the project.

The initial phase of vegetation monitoring protocol was the establishment of randomly distributed 10-meter transects throughout the project area and in a control plot outside of the project area (see map below). The transects were randomly distributed within project zones through a restricted random sampling design, in order to ensure a balanced sampling design among wetland, upland and control zones. In total, 35 transects were established on the island (7 wetland, 14 upland, and 14 upland control).



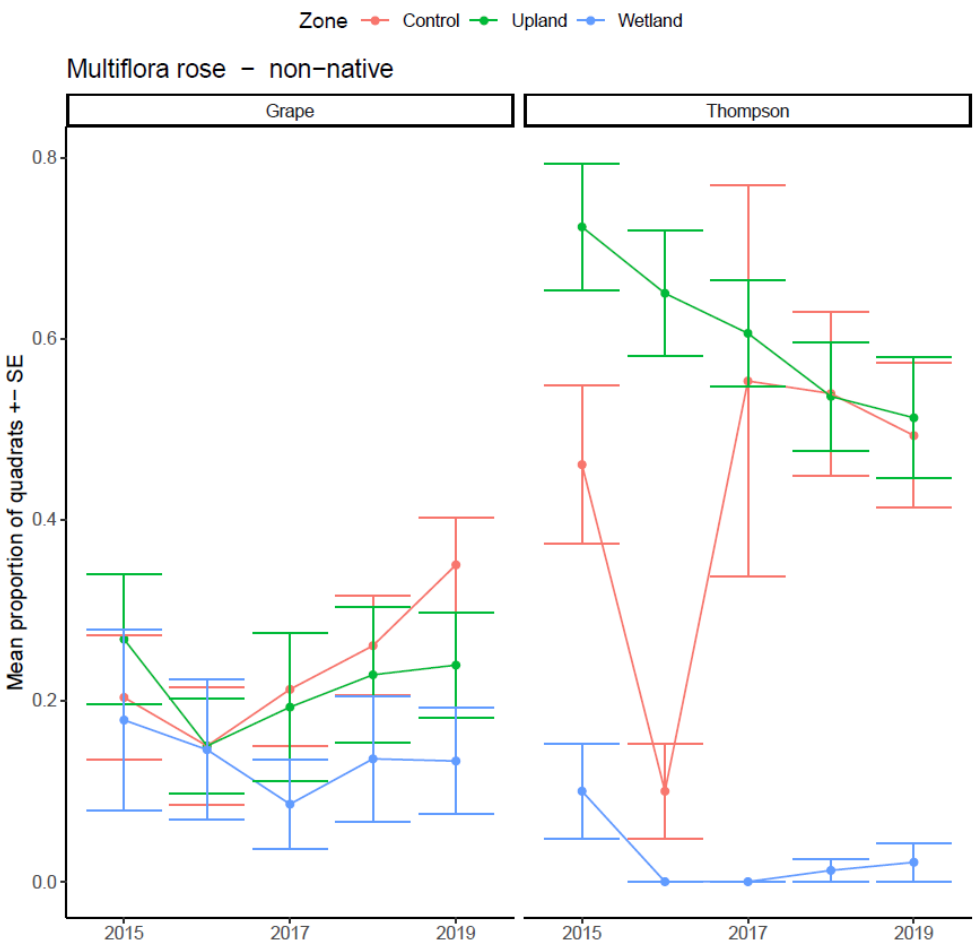
During each monitoring year, staff and volunteers collected data from within twenty (20) 0.5m x 0.5m quadrats along each transect, recording the presence or absence, cover, and number of stems of each woody and herbaceous plant species. These data result in frequency and percent cover statistics for each transect and thus can be combined to provide summary statistics for each zone (upland, wetland, control), or for the entire project area (wetland and upland zones). In addition, photos were taken from the origin point of each transect (see photo monitoring document for year-to-year comparisons).

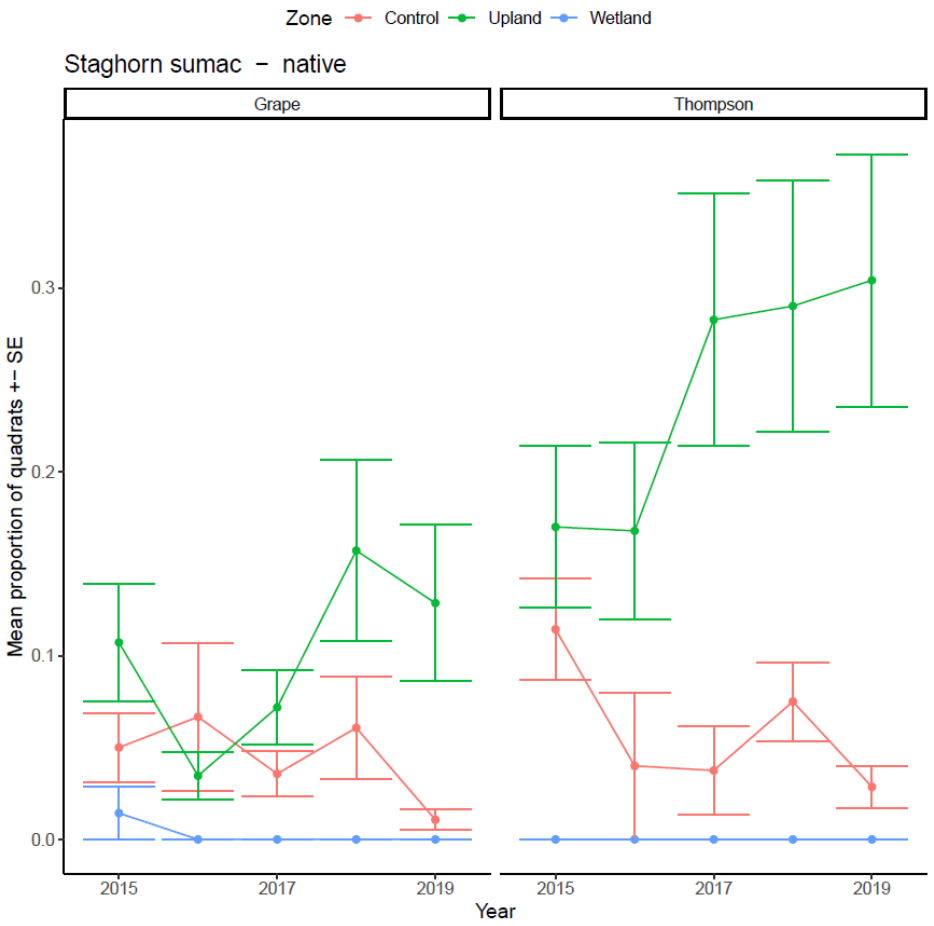
We have not yet conducted a full, final summary of all of the data broken into each possible constituent unit (e.g. by species/zone/site/groupings of species). However in 2021 a National Park Service intern working alongside Dr. Aaron Weed (Ecologist, National Park Service Inventory and Monitoring Division) collated all of the data and Dr. Weed utilized these data to create summary statistics and graphs for a representative sample of frequency and cover data, using the statistical software program R.

The final output was a series of charts that summarize the changes in individual species' percent cover and frequency across all years for each transect group (wetland, upland, upland control). From these charts, we can extrapolate how species dynamics shifted throughout the entire project area and control area. This analysis was done for several priority native and invasive plant species (below are some example charts). This data acts as a mechanism that allows us to quantitatively measure the success/failure of our habitat restoration efforts on a species-specific basis.

NOTE: A parallel iteration of this habitat restoration project was conducted simultaneously on Grape Island, Weymouth, MA. These graphs show results for both islands that were part of the project.

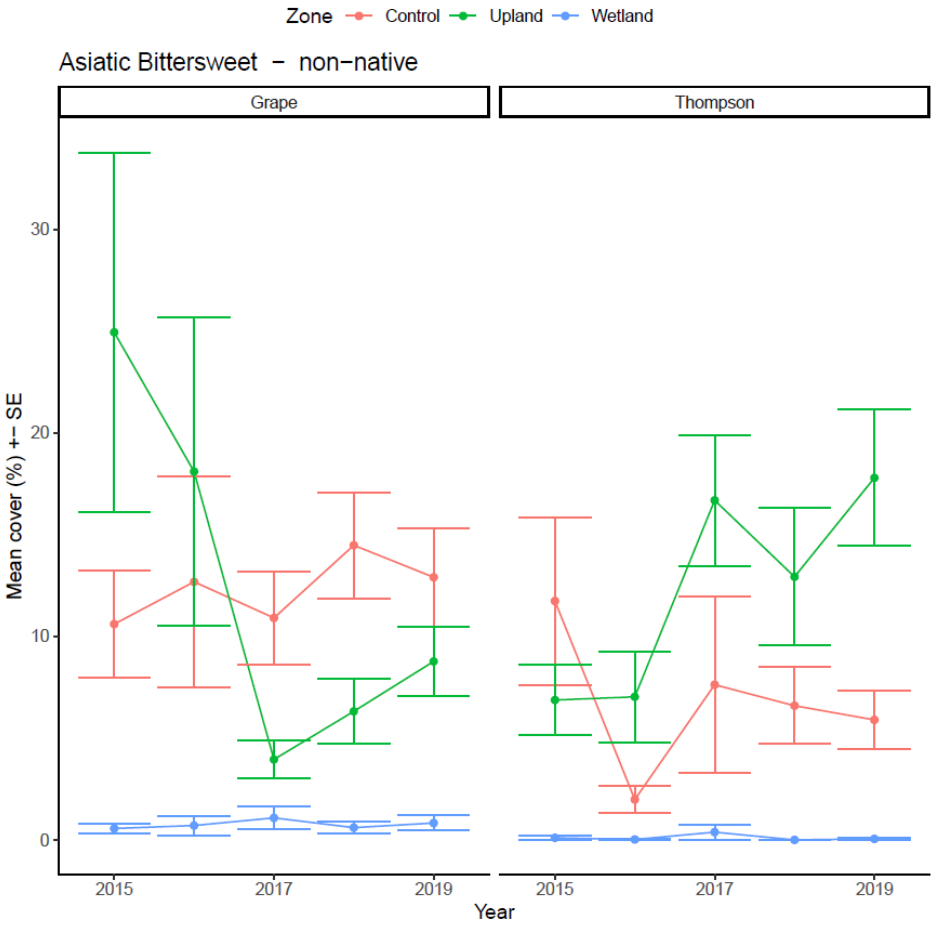
<u>Frequency Charts</u>
x-axis unit=mean proportion of quadrats with the species present (each transect was separated into multiple sampling quadrats)
Vertical lines with brackets=Standard Error (SE)

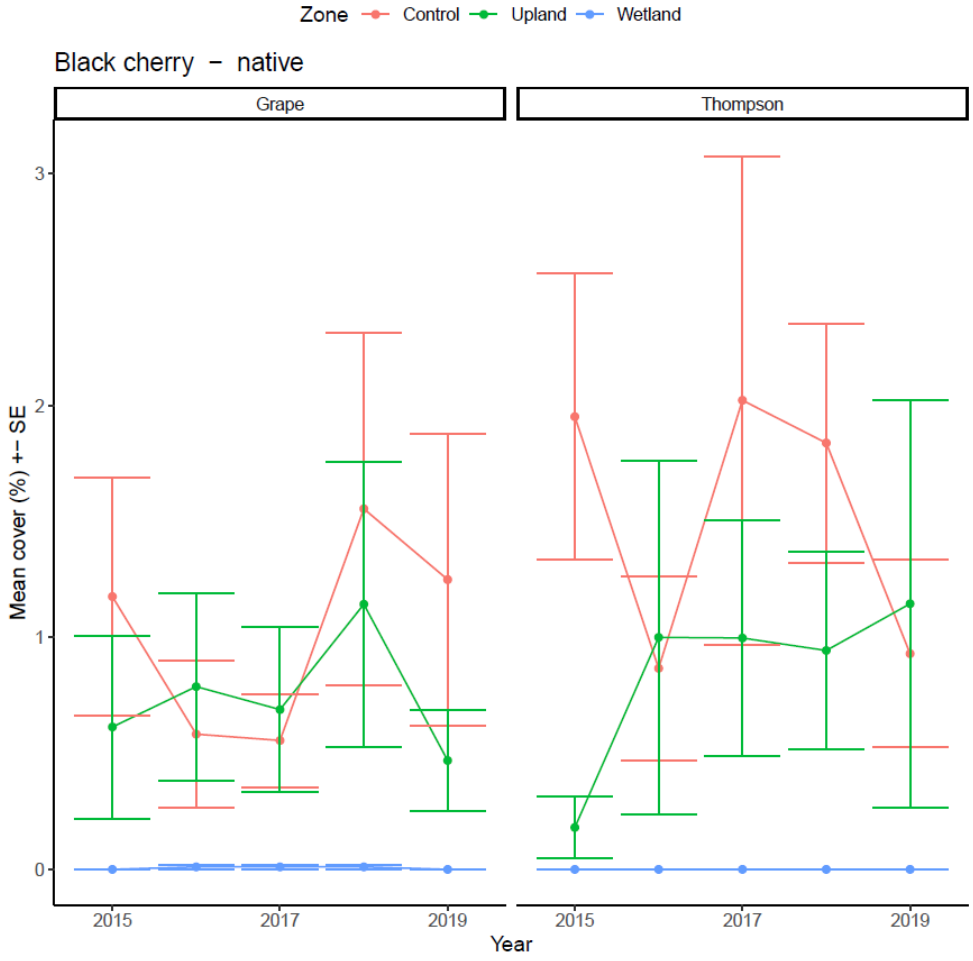


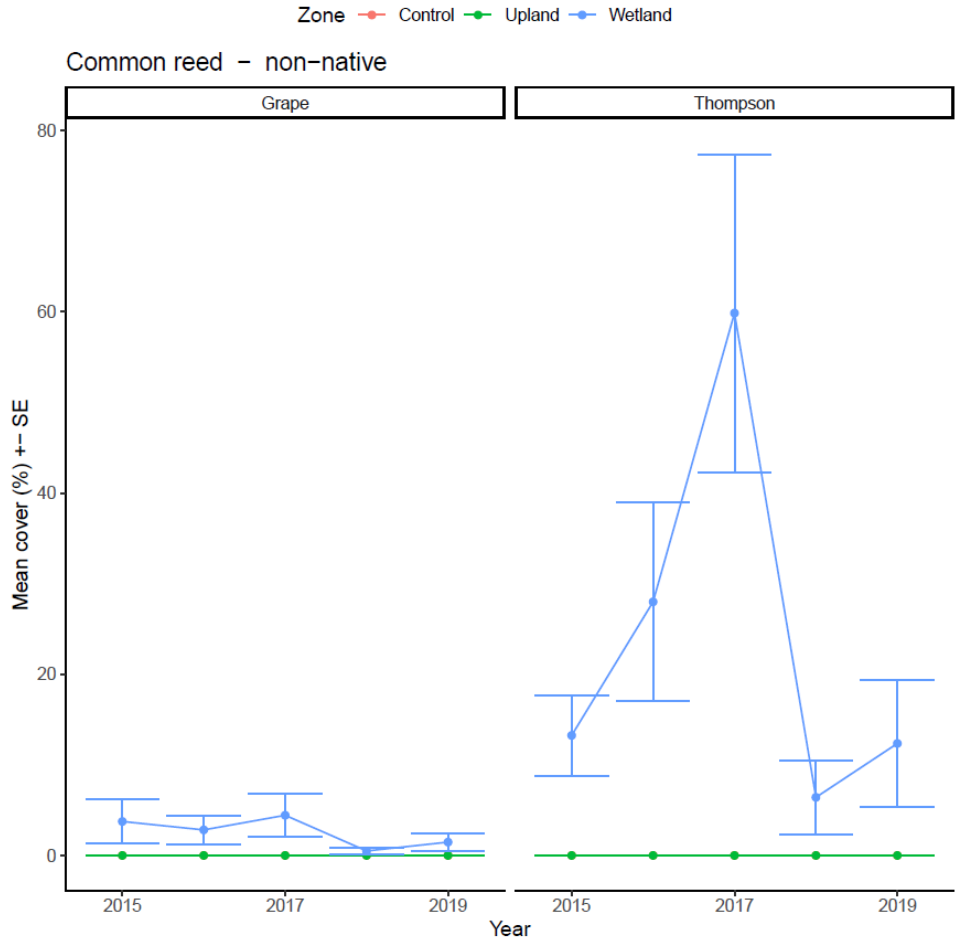


Percent Cover Charts

x-axis unit=mean percent cover

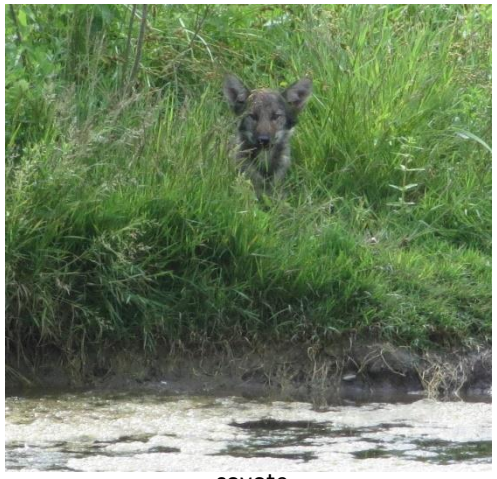



Zone Control Upland Wetland
Black cherry – native
Grape
Thompson
Mean cover (%) +– SE
0
1
2
3
2015
2017
2019
Year

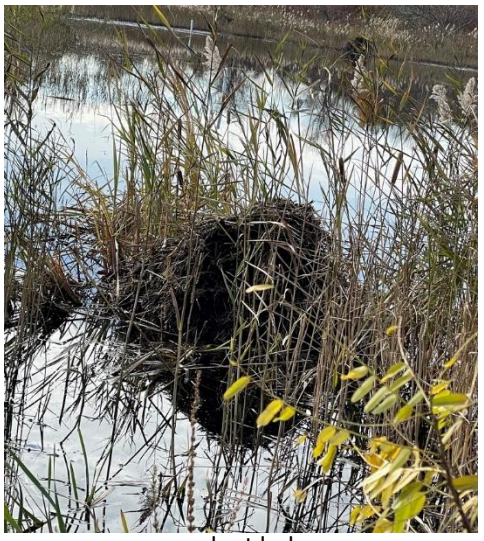

Zone Control Upland Wetland
Common reed – non–native
Grape
Thompson
Mean cover (%) +– SE
0
20
40
60
80
2015
2017
2019
Year

Thompson Island Wildlife Observations Summary (2016-present)


white-footed mouse


coyote

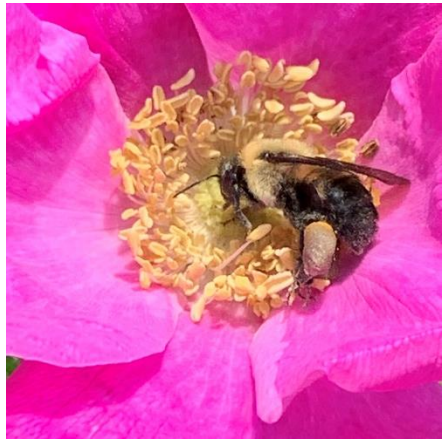

monarch butterfly

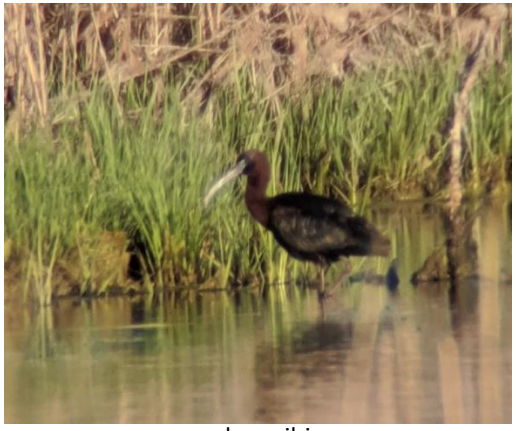

muskrat lodge


black-crowned night heron


banded garden spider


cedar waxwing


brown-belted bumblebee


glossy ibis


golden tortoise beetle


white-tailed deer


white-lined sphinx moth

While there wasn't a formal wildlife monitoring protocol in place for the Thompson Island habitat restoration project, there have been a substantial number of wildlife observations made on island by park staff and volunteers over the past six years. The primary way in which these observations have been cataloged is through iNaturalist, which is a community science-based app that allows users to upload wildlife photos to a central database. These submissions are then identified via artificial intelligence and other iNaturalist users in the community. Below are compiled lists of "Research Grade" observations made in/within 100 ft of the Thompson Island project area from 2016 to present ("Research Grade" means that the observations have been vetted by the iNaturalist community).

In addition to iNaturalist, there have been many other documented wildlife sightings in/around the project area by staff over the years. Some of these additional observations include coyote (*Canis latrans*), grey fox (*Urocyon cinereoargenteus*), Eastern meadow vole (*Microtus pennsylvanicus*), osprey (*Pandion haliaetus*), snowy egret (*Egretta thula*), great blue heron (*Ardea herodias*), black-crowned night heron (*Nycticorax nycticorax)*, glossy ibis (Plegadis falcinellus), and common eider (*Somateria mollissima*).

Birds

observed_on	user_login	url	latitude	longitude	scientific_name	common_name
8/5/2017	wefwef	https://www.inaturalist.org/observations/73608025	42.31643	-71.0107	Spinus tristis	American Goldfinch
9/16/2017	wefwef	https://www.inaturalist.org/observations/79436650	42.31773	-71.0097	Somateria mollissima	Common Eider
9/16/2017	wefwef	https://www.inaturalist.org/observations/79436657	42.3177	-71.0094	Charadrius vociferus	Killdeer
4/27/2018	kelpfish	https://www.inaturalist.org/observations/11510531	42.31755	-71.01	Charadrius vociferus	Killdeer
4/27/2018	kelpfish	https://www.inaturalist.org/observations/11510851	42.31755	-71.0097	Branta canadensis	Canada Goose
7/6/2018	cradonic	https://www.inaturalist.org/observations/14102409	42.31615	-71.0105	Ardea alba	Great Egret
7/7/2018	wefwef	https://www.inaturalist.org/observations/14131331	42.31735	-71.0098	Phalacrocorax auritus	Double-crested Cormorant
8/17/2018	rachel3000	https://www.inaturalist.org/observations/15630302	42.3154	-71.0094	Meleagris gallopavo	Wild Turkey
4/27/2019	marc_albert	https://www.inaturalist.org/observations/23382204	42.3167	-71.0085	Turdus migratorius	American Robin
4/27/2019	marc_albert	https://www.inaturalist.org/observations/23383759	42.31603	-71.0088	Ardea alba	Great Egret

4/27/2019	rsvincent	https://www.inaturalist.org/observations/23389896	42.3169	-71.01	Branta canadensis	Canada Goose
4/27/2019	rsvincent	https://www.inaturalist.org/observations/23389953	42.31675	-71.0101	Anas platyrhynchos	Mallard
4/27/2019	rsvincent	https://www.inaturalist.org/observations/23400066	42.31668	-71.0088	Mimus polyglottos	Northern Mockingbird
4/27/2019	rsvincent	https://www.inaturalist.org/observations/23402763	42.31706	-71.009	Turdus migratorius	American Robin
4/27/2019	jdelaneynp	https://www.inaturalist.org/observations/23412787	42.31674	-71.0102	Branta canadensis	Canada Goose
4/27/2019	curious_bos	https://www.inaturalist.org/observations/23441613	42.31611	-71.0089	Ardea alba	Great Egret
4/27/2019	kelpfish	https://www.inaturalist.org/observations/23461759	42.31663	-71.0086	Turdus migratorius	American Robin
4/27/2019	kelpfish	https://www.inaturalist.org/observations/23462143	42.31608	-71.009	Ardea alba	Great Egret
4/27/2019	kelpfish	https://www.inaturalist.org/observations/23462332	42.3158	-71.0088	Ardea alba	Great Egret
5/30/2019	ifreedman	https://www.inaturalist.org/observations/26071908	42.31642	-71.0108	Ardea alba	Great Egret
6/22/2019	ifreedman	https://www.inaturalist.org/observations/27436618	42.31696	-71.01	Ardea alba	Great Egret
10/5/2019	jsherman1997	https://www.inaturalist.org/observations/33898135	42.31694	-71.0103	Larus argentatus	Herring Gull
4/10/2020	periwinkle1988	https://www.inaturalist.org/observations/41829848	42.31687	-71.0089	Cathartes aura	Turkey Vulture
3/21/2021	periwinkle1988	https://www.inaturalist.org/observations/71752952	42.31687	-71.0104	Charadrius vociferus	Killdeer
6/11/2021	lampleyjohn	https://www.inaturalist.org/observations/82605735	42.31596	-71.0101	Bombycilla cedrorum	Cedar Waxwing
6/11/2021	wefwef	https://www.inaturalist.org/observations/83646127	42.31641	-71.0108	Phalacrocorax auritus	Double-crested Cormorant
6/11/2021	wefwef	https://www.inaturalist.org/observations/83646387	42.31643	-71.0107	Branta canadensis	Canada Goose
6/25/2021	lampleyjohn	https://www.inaturalist.org/observations/84972340	42.31583	-71.0098	Dumetella carolinensis	Gray Catbird

9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95210639	42.31567	-71.0091	Mimus polyglottos	Northern Mockingbird
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95847578	42.31577	-71.0093	Dumetella carolinensis	Gray Catbird
10/29/2021	wefwef	https://www.inaturalist.org/observations/99753386	42.31597	-71.0102	Accipiter cooperii	Cooper's Hawk
11/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/101529779	42.31642	-71.0108	Bucephala albeola	Bufflehead

Insects and arachnids

observed_on	user_login	url	latitude	longitude	scientific_name	common_name
8/1/2017	emarkng	https://www.inaturalist.org/observations/7308339	42.31699667	-71.00927778	Danaus plexippus	Monarch
8/5/2017	wefwef	https://www.inaturalist.org/observations/7359593	42.31619482	-71.01048312	Papilio glaucus	Eastern Tiger Swallowtail
8/22/2017	tenleyspataro	https://www.inaturalist.org/observations/7604392	42.31588808	-71.01119697	Atteva aurea	Ailanthus Webworm Moth
8/22/2017	tenleyspataro	https://www.inaturalist.org/observations/7604407	42.315846	-71.01125779	Leucauge venusta	Orchard Orbweaver
8/22/2017	rsvincent	https://www.inaturalist.org/observations/7606384	42.31720157	-71.00914093	Bombus impatiens	Common Eastern Bumble Bee
8/22/2017	nitrogenscreaming	https://www.inaturalist.org/observations/7606871	42.31591732	-71.0090604	Dissosteira carolina	Carolina Grasshopper
8/22/2017	taylor89	https://www.inaturalist.org/observations/7607363	42.31630177	-71.01062209	Pieris rapae	Cabbage White
8/29/2017	marc_albert	https://www.inaturalist.org/observations/7700440	42.31631476	-71.00898569	Apis mellifera	Western Honey Bee

8/29/2017	marc_albert	https://www.inaturalist.org/observations/7700456	42.31625043	-71.00880297	Xylocopa virginica	Eastern Carpenter Bee
8/29/2017	marc_albert	https://www.inaturalist.org/observations/7700609	42.31629607	-71.00894965	Xylocopa virginica virginica	Virginia Carpenter Bee
8/29/2017	ajbucca	https://www.inaturalist.org/observations/7704868	42.31624218	-71.00888771	Bombus impatiens	Common Eastern Bumble Bee
8/29/2017	ajbucca	https://www.inaturalist.org/observations/7704891	42.31580749	-71.00909759	Pieris rapae	Cabbage White
8/29/2017	ajbucca	https://www.inaturalist.org/observations/7704923	42.31562041	-71.0090442	Ancyloxypha numitor	Least Skipper
8/29/2017	marc_albert	https://www.inaturalist.org/observations/7706001	42.31619515	-71.01000577	Xylocopa virginica virginica	Virginia Carpenter Bee
4/27/2018	dgarvs	https://www.inaturalist.org/observations/11952129	42.31703507	-71.00927353	Stenodema trispinosum	Three-spined Grass Bug
7/21/2018	wefwef	https://www.inaturalist.org/observations/14569002	42.31579852	-71.01088269	Chinavia hilaris	Green Stink Bug
7/21/2018	wefwef	https://www.inaturalist.org/observations/14574750	42.3157406	-71.01116675	Atteva aurea	Ailanthus Webworm Moth
7/21/2018	wefwef	https://www.inaturalist.org/observations/14574890	42.31574936	-71.01115627	Euodynerus foraminatus	
7/21/2018	rachel3000	https://www.inaturalist.org/observations/14577741	42.31597833	-71.01059722	Atteva aurea	Ailanthus Webworm Moth
8/17/2018	wefwef	https://www.inaturalist.org/observations/15583542	42.31595535	-71.01036695	Xylocopa virginica	Eastern Carpenter Bee

8/21/2018	susanhf	https://www.inaturalist.org/observations/15753516	42.31543936	-71.0093374	Harmonia axyridis	Asian Lady Beetle
8/21/2018	linaazizi	https://www.inaturalist.org/observations/15755248	42.31629172	-71.01075218	Bombus impatiens	Common Eastern Bumble Bee
8/21/2018	linaazizi	https://www.inaturalist.org/observations/15755270	42.31591083	-71.01001976	Danaus plexippus	Monarch
8/21/2018	hollykb	https://www.inaturalist.org/observations/15755515	42.3162871	-71.0093172	Dysdera crocata	Woodlouse Spider
8/21/2018	susanhf	https://www.inaturalist.org/observations/15755653	42.31537888	-71.00931728	Harmonia axyridis	Asian Lady Beetle
8/28/2018	brez4132	https://www.inaturalist.org/observations/15973073	42.31635672	-71.01069116	Pieris rapae	Cabbage White
8/28/2018	brandon207	https://www.inaturalist.org/observations/15974581	42.31632872	-71.01056767	Arctosa littoralis	Shoreline Wolf Spider
9/1/2018	thiennguyen2	https://www.inaturalist.org/observations/16132868	42.31570816	-71.00947571	Oecanthus fultoni	Snowy Tree Cricket
9/1/2018	thiennguyen2	https://www.inaturalist.org/observations/16133030	42.3156929	-71.00943756	Halysidota tessellaris	Banded Tussock Moth
9/22/2018	wefwef	https://www.inaturalist.org/observations/16795286	42.31567154	-71.01155232	Pachypsylla celtidismamma	Hackberry Nipplegall Psyllid
10/6/2018	brandonscott1	https://www.inaturalist.org/observations/17250211	42.31637502	-71.01087714	Tenodera sinensis	Chinese Mantis
10/6/2018	rsvincent	https://www.inaturalist.org/observations/17250213	42.31637626	-71.00901431	Tenodera sinensis	Chinese Mantis

7/10/2019	samfisch	https://www.inaturalist.org/observations/28669193	42.31563	-71.01085	Atteva aurea	Ailanthus Webworm Moth
8/10/2019	ifreedman	https://www.inaturalist.org/observations/30644856	42.31634618	-71.00891578	Papilio polyxenes	Black Swallowtail
8/27/2019	emmaj357	https://www.inaturalist.org/observations/31624014	42.31617968	-71.01082266	Pieris rapae	Cabbage White
8/27/2019	samridhisanghvi	https://www.inaturalist.org/observations/31624045	42.31581483	-71.00983076	Bombus impatiens	Common Eastern Bumble Bee
8/27/2019	audreystraw	https://www.inaturalist.org/observations/31624742	42.31563403	-71.01166941	Nadata gibbosa	White-dotted Prominent
8/29/2019	marcytheminnow	https://www.inaturalist.org/observations/31725231	42.31602978	-71.009096	Halyomorpha halys	Brown Marmorated Stink Bug
8/29/2019	reaganczech	https://www.inaturalist.org/observations/31725267	42.31683129	-71.01036129	Hyles lineata	White-lined Sphinx
8/29/2019	reaganczech	https://www.inaturalist.org/observations/31725545	42.31676065	-71.01030674	Gryllus pennsylvanicus	Fall Field Cricket
8/29/2019	reaganczech	https://www.inaturalist.org/observations/31725956	42.31636184	-71.01067302	Pieris rapae	Cabbage White
8/29/2019	bpowhida	https://www.inaturalist.org/observations/31728092	42.31632503	-71.01056485	Phyllopalpus pulchellus	Red-headed Bush Cricket
8/29/2019	bpowhida	https://www.inaturalist.org/observations/31728306	42.31626007	-71.01053157	Harmonia axyridis	Asian Lady Beetle
8/29/2019	elizabethbarnes1	https://www.inaturalist.org/observations/31740177	42.31652568	-71.01074224	Pieris rapae	Cabbage White
9/6/2019	mirandamoore	https://www.inaturalist.org/observations/32214578	42.315908 7	-71.01082292	Mythimna unipuncta	Armyworm Moth

10/26/2019	rsvincent	https://www.inaturalist.org/observations/35134773	42.31658683	-71.00909869	Bombus impatiens	Common Eastern Bumble Bee
6/20/2020	rsvincent	https://www.inaturalist.org/observations/50298905	42.31588217	-71.01111072	Dermacentor variabilis	American Dog Tick
6/22/2020	laurayates	https://www.inaturalist.org/observations/52518640	42.31554167	-71.01079445	Xylocopa virginica virginica	Virginia Carpenter Bee
5/18/2021	wefwef	https://www.inaturalist.org/observations/79381848	42.31612833	-71.01076388	Charidotella sexpunctata	Golden Tortoise Beetle
6/11/2021	daniel_kruchten	https://www.inaturalist.org/observations/82538468	42.316345	-71.01067222	Bombus impatiens	Common Eastern Bumble Bee
6/11/2021	wefwef	https://www.inaturalist.org/observations/83645034	42.31591167	-71.01010833	Poecilocapsus lineatus	Four-lined Plant Bug
6/11/2021	wefwef	https://www.inaturalist.org/observations/83645113	42.315895	-71.01008612	Tenodera sinensis	Chinese Mantis
6/11/2021	wefwef	https://www.inaturalist.org/observations/83647578	42.31633	-71.01068055	Bombus griseocollis	Brown-belted Bumble Bee
6/25/2021	bencurell	https://www.inaturalist.org/observations/84434646	42.31582167	-71.01005555	Eudryas unio	Pearly Wood-nymph
6/25/2021	wefwef	https://www.inaturalist.org/observations/84465188	42.31582833	-71.01008612	Eudryas unio	Pearly Wood-nymph
6/25/2021	wefwef	https://www.inaturalist.org/observations/84800549	42.31621167	-71.01050555	Aphis nerii	Oleander Aphid
6/25/2021	wefwef	https://www.inaturalist.org/observations/84800706	42.31598667	-71.01021667	Harmonia axyridis	Asian Lady Beetle

6/25/2021	wefwef	https://www.inaturalist.org/observations/84800743	42.31619667	-71.01042222	Myodocha serripes	Long-necked Seed Bug
9/3/2021	m_park	https://www.inaturalist.org/observations/93477558	42.31610031	-71.00924344	Calophasia lunula	Toadflax Brocade Moth
9/3/2021	laurayates	https://www.inaturalist.org/observations/93483377	42.316075	-71.00920833	Calophasia lunula	Toadflax Brocade Moth
9/3/2021	m_park	https://www.inaturalist.org/observations/93485282	42.31558201	-71.00950879	Atteva aurea	Ailanthus Webworm Moth
9/3/2021	wefwef	https://www.inaturalist.org/observations/93529227	42.31597833	-71.00904722	Aedes sollicitans	Eastern Saltmarsh Mosquito
9/3/2021	wefwef	https://www.inaturalist.org/observations/93530506	42.31696333	-71.00920833	Pachydiplax longipennis	Blue Dasher
9/3/2021	wefwef	https://www.inaturalist.org/observations/93530677	42.316075	-71.00918612	Atteva aurea	Ailanthus Webworm Moth
9/3/2021	wefwef	https://www.inaturalist.org/observations/93530977	42.31572833	-71.00929167	Danaus plexippus	Monarch
9/3/2021	laurayates	https://www.inaturalist.org/observations/93534885	42.31606333	-71.0092	Atteva aurea	Ailanthus Webworm Moth
9/17/2021	wefwef	https://www.inaturalist.org/observations/95191909	42.31731333	-71.00894167	Haematopis grataria	Chickweed Geometer Moth
9/17/2021	wefwef	https://www.inaturalist.org/observations/95202614	42.31605833	-71.00931667	Hapithus agitator	Restless Bush Cricket
9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95210743	42.31577074	-71.00931682	Chrysopa oculata	

9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95210925	42.31589957	-71.00903691	Diabrotica undecimpunctata	Spotted Cucumber Beetle
9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95210994	42.31584619	-71.00903172	Melanoplus femurrubrum	Red-legged Grasshopper
9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95211437	42.31592349	-71.00917056	Danaus plexippus	Monarch
9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95212528	42.31600081	-71.00915182	Atteva aurea	Ailanthus Webworm Moth
9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95212597	42.31595902	-71.00916099	Atteva aurea	Ailanthus Webworm Moth
9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95212889	42.315979 8	-71.00933448	Tenodera sinensis	Chinese Mantis
9/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95213555	42.31612646	-71.01026619	Xylocopa virginica virginica	Virginia Carpenter Bee
9/22/2021	laurayates	https://www.inaturalist.org/observations/95797036	42.31670333	-71.00853612	Hapithus agitator	Restless Bush Cricket
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95812766	42.31589806	-71.01079427	Tremex columba	Pigeon Horntail
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95812942	42.31676842	-71.00859878	Hapithus agitator	Restless Bush Cricket
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/95983887	42.315566 9	-71.00931266	Eris militaris	Bronze Jumping Spider
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/96075128	42.31653645	-71.01090706	Pardosa lapidicina	Stone Spider

9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/96084433	42.31577	-71.00948333	Melanophora roralis	Smoky-winged Woodlouse Fly
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/96084515	42.31579167	-71.00963612	Phyllopalpus pulchellus	Red-headed Bush Cricket
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/96084611	42.31588667	-71.00926112	Phyllopalpus pulchellus	Red-headed Bush Cricket
10/29/2021	bencurell	https://www.inaturalist.org/observations/99721934	42.31580833	-71.01015555	Argiope trifasciata	Banded Garden Spider
10/29/2021	wefwef	https://www.inaturalist.org/observations/99753191	42.31578833	-71.01003333	Argiope trifasciata	Banded Garden Spider
6/11/2022	joseph_bozzo	https://www.inaturalist.org/observations/121235477	42.31550308	-71.00921742	Harmonia axyridis	Asian Lady Beetle
7/3/2022	lrobinsonti	https://www.inaturalist.org/observations/124510507	42.31743017	-71.00936443	Lucanus capreolus	Reddish-brown Stag Beetle
7/9/2022	erindrumm	https://www.inaturalist.org/observations/125926473	42.31521667	-71.01139167	Pseudoedophrys hilleri	Peach Root Weevil

Mammals

observed_on	user_login	url	latitude	longitude	scientific_name	common_name
4/20/2017	patrickmaloney	https://www.inaturalist.org/observations/5871772	42.31587	-71.0091	Procyon lotor	Common Raccoon
9/22/2021	harleyfoundaspider	https://www.inaturalist.org/observations/96046450	42.31574	-71.0111	Odocoileus virginianus	White-tailed Deer
11/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/101409570	42.31684	-71.0099	Ondatra zibethicus	Muskrat
11/17/2021	harleyfoundaspider	https://www.inaturalist.org/observations/101409866	42.31643	-71.0108	Odocoileus virginianus	White-tailed Deer

Fungi

observed_on	user_login	url	latitude	longitude	scientific_name	common_name
8/5/2017	wefwef	https://www.inaturalist.org/observations/7361816	42.3159	-71.0108	Rhytisma acerinum	Black Tar Spot
5/4/2019	natpie14	https://www.inaturalist.org/observations/24508335	42.31572	-71.0095	Scutellinia scutellata	Common Eyelash
6/21/2019	ifreedman	https://www.inaturalist.org/observations/27390263	42.31588	-71.0112	Schizophyllum commune	splitgill mushroom
6/30/2019	liliana67	https://www.inaturalist.org/observations/27962602	42.31601	-71.0101	Coprinellus micaceus	mica cap
8/29/2019	reaganczech	https://www.inaturalist.org/observations/31727152	42.31551	-71.0092	Tremella mesenterica	witch's butter
10/12/2019	kc1lqm	https://www.inaturalist.org/observations/34462247	42.31591	-71.009	Tremella mesenterica	witch's butter

CITY OF BOSTON
THE ENVIRONMENT DEPARTMENT

Boston City Hall, Room 709 • Boston, MA 02201 • 617/635-3850 • FAX: 617/635-3435

May 31, 2016

Giles Parker
Boston Harbor Islands National and State Park
15 State Street
Boston, MA 02109

CERTIFIED MAIL: 7011 1150 0000 5777 6718

RE: DEP File No. 006-1459 National Park Service, Boston Harbor Islands National and State Park, ecological restoration of nearshore freshwater wetlands and buffer zones, Thompson Island, Boston (Bordering Vegetated Wetland, Buffer Zone)

Dear Mr. Giles Parker,

Pursuant to the Massachusetts Wetlands Protection Act, General Laws, Chapter 131, Section 40, I have enclosed the Order of Conditions ("the Order") for the above referenced project. Please arrange to have the Order recorded at the Suffolk County Registry of Deeds in accordance with General Condition 9. Work on the project may not begin until the Boston Conservation Commission receives the completed Recording Information form.

In accordance with General Condition 12 of the Order, upon completion of the project a Request for a Certificate of Compliance (WPA Form 8A), must be filed with the Commission stating that the work has been satisfactorily completed. If the project filing included plans stamped by a registered professional engineer, architect, landscape architect or land surveyor a written statement by such professional must accompany the Certificate request confirming that the project has been completed in substantial compliance with the plans and the conditions of the Order.

Please make certain that all contractors and workers involved in the project review the permit conditions as required. Please also ensure that the pre-construction requirements listed in the section with the heading "Prior to Construction" are satisfied prior to the start of construction.

If you should have any questions regarding the enclosed Order of Conditions I may be reached at 617-635-3850.

For the Commission,

Carl Spector, Commissioner
Environment Department
City of Boston

Enclosure: WPA Form 5

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 5 - Order of Conditions
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
MassDEP File #:006-1459
eDEP Transaction #:831249
City/Town:BOSTON

A. General Information

1. Conservation Commission: BOSTON
2. Issuance: a. ☑ OOC b. ☐ Amended OOC

3. Applicant Details

a. First Name	GILES		b. Last Name	PARKER	
c. Organization	BOSTON HARBOR ISLANDS NATIONAL AND STATE				
d. Mailing Address	15 STATE STREET				
e. City/Town	BOSTON	f. State	MA	g. Zip Code	02109

4. Property Owner

a. First Name	ARTHUR		b. Last Name	PEARSON	
c. Organization	THOMPSON ISLAND OUTWARD BOUND				
d. Mailing Address	P.O. BOX 127				
e. City/Town	BOSTON	f. State	MA	g. Zip Code	02127

5. Project Location

a.Street Address	THOMPSON ISLAND		
b.City/Town	BOSTON	c. Zip Code	02127
d. Assessors Map/Plat#	00000000	e. Parcel/Lot#	00000000
f. Latitude	42.31624N	g. Longitude	71.00999W

6. Property recorded at the Registry of Deed for:

a. County	b. Certificate	c. Book	d. Page
SUFFOLK		28699	304

7.Dates

a. Date NOI Filed : 3/15/2016 b. Date Public Hearing Closed: 5/4/2016 c. Date Of Issuance: 5/31/2016

8.Final Approved Plans and Other Documents

a. Plan Title:	b. Plan Prepared by:	c. Plan Signed/Stamped by:	d. Revised Final Date:	e. Scale:

THOMPSON ISLAND NATIVE PLANT REVEGETATION BOSTON HARBOR ISLANDS NATIONAL AND STATE PARK NATURAL AND CULTURAL RESOURCE STEWARDSHIP PROGRAM	NATIONAL PARK SERVICE	4/2016	1" = 140'

B. Findings

1.Findings pursuant to the Massachusetts Wetlands Protection Act

Following the review of the the above-referenced Notice of Intent and based on the information provided in this application and presented at the public hearing, this Commission finds that the areas in which work is proposed is significant to the following interests of the Wetlands Protection Act.

Check all that apply:

a. ☑ Public Water Supply	b. ☐ Land Containing Shellfish	c. ☑ Prevention of Pollution
d. ☑ Private Water Supply	e. ☑ Fisheries	f. ☑ Protection of Wildlife Habitat
g. ☑ Ground Water Supply	h. ☑ Storm Damage Prevention	i. ☑ Flood Control

2. Commission hereby finds the project, as proposed, is:

Approved subject to:

a. ☑ The following conditions which are necessary in accordance with the performance standards set forth in the wetlands regulations. This Commission orders that all work shall be performed in accordance with the Notice of Intent referenced above, the following General Conditions, and any other special conditions attached to this Order. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, these conditions shall control.

Denied because:

b. ☐ The proposed work cannot be conditioned to meet the performance standards set forth in the wetland regulations. Therefore, work on this project may not go forward unless and until a new Notice of Intent is submitted which provides measures which are adequate to protect interests of the Act, and a final Order of Conditions is issued. **A description of the performance standards which the proposed work cannot meet is attached to this Order.**

c. ☐ The information submitted by the applicant is not sufficient to describe the site, the work or the effect of the work on the interests identified in the Wetlands Protection Act. Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides sufficient information and includes measures which are adequate to protect the interests of the Act , and a final Order of Conditions is issued. **A description of the specific information which is lacking and why it is necessary is attached to this Order as per 310 CMR 10.05(6)(c).**

3. ☐ Buffer Zone Impacts: Shortest distance between limit of project disturbance and the wetland resource area specified in 310CMR10.02(1)(a). _____ a. linear feet

Inland Resource Area Impacts:(For Approvals Only):

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
4. ☐ Bank	a. linear feet	b. linear feet	c. linear feet	d. linear feet
5. ☑ Bordering Vegetated Wetland	264845 a. square feet	264845 b. square feet	0 c. square feet	d. square feet
6. ☐ Land under Waterbodies and Waterways	a. square feet	b. square feet	c. square feet	d. square feet
	e. c/y dredged	f. c/y dredged		
7. ☐ Bordering Land Subject to Flooding	a. square feet	b. square feet	c. square feet	d. square feet
Cubic Feet Flood Storage	e. cubic feet	f. cubic feet	g. cubic feet	h. cubic feet
8. ☐ Isolated Land Subject to Flooding	a. square feet	b. square feet		
Cubic Feet Flood Storage	c. cubic feet	d. cubic feet	e. cubic feet	f. cubic feet
9. ☐ Riverfront Area	a. total sq. feet	b. total sq. feet		
Sq ft within 100 ft	c. square feet	d. square feet	e. square feet	f. square feet
Sq ft between 100-200 ft	g. square feet	h. square feet	i. square feet	j. square feet

Coastal Resource Area Impacts:

Resource Area	Proposed Alteration	Permitted Alteration	Proposed Replacement	Permitted Replacement
10. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below			
11. ☐ Land Under the Ocean	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
12. ☐ Barrier Beaches	Indicate size under Coastal Beaches and/or Coastal Dunes below			
13. ☐ Coastal Beaches	a. square feet	b. square feet	c. c/y nourishment	d. c/y nourishment
14. ☐ Coastal Dunes				

	a. square feet	b. square feet	c. c/y nourishment	d. c/y nourishment
15. ☐ Coastal Banks	a. linear feet	b. linear feet		
16. ☐ Rocky Intertidal Shores	a. square feet	b. square feet		
17. ☐ Salt Marshes	a. square feet	b. square feet	c. square feet	d. square feet
18. ☐ Land Under Salt Ponds	a. square feet	b. square feet		
	c. c/y dredged	d. c/y dredged		
19. ☐ Land Containing Shellfish	a. square feet	b. square feet	c. square feet	d. square feet
20. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above			
	c. c/y dredged	d. c/y dredged		
21. ☐ Land Subject to Coastal Storm Flowage	a. square feet	b. square feet		

22.

☑ Restoration/Enhancement (For Approvals Only)

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.5.c & d or B.17.c & d above, please entered the additional amount here.

264845
a. square feet of BVW

b. square feet of Salt Marsh

23.

☐ Streams Crossing(s)

If the project involves Stream Crossings, please enter the number of new stream crossings/number of replacement stream crossings.

a. number of new stream crossings

b. number of replacement stream crossings

C. General Conditions Under Massachusetts Wetlands Protection Act

The following conditions are only applicable to Approved projects

1. Failure to comply with all conditions stated herein, and with all related statutes and other regulatory measures, shall be deemed cause to revoke or modify this Order.
2. The Order does not grant any property rights or any exclusive privileges; it does not authorize any injury to private property or invasion of private rights.
3. This Order does not relieve the permittee or any other person of the necessity of complying with all other applicable federal, state, or local statutes, ordinances, bylaws, or regulations.
4. The work authorized hereunder shall be completed within three years from the date of this Order unless either of the following apply:

a. the work is a maintenance dredging project as provided for in the Act; or
b. the time for completion has been extended to a specified date more than three years, but less than five years, from the date of issuance. If this Order is intended to be valid for more than three years, the extension date and the special circumstances warranting the extended time period are set forth as a special condition in this Order.

5. This Order may be extended by the issuing authority for one or more periods of up to three years each upon application to the issuing authority at least 30 days prior to the expiration date of the Order.
6. If this Order constitutes an Amended Order of Conditions, this Amended Order of Conditions does not exceed the issuance date of the original Final Order of Conditions.
7. Any fill used in connection with this project shall be clean fill. Any fill shall contain no trash, refuse, rubbish, or debris, including but not limited to lumber, bricks, plaster, wire, lath, paper, cardboard, pipe, tires, ashes, refrigerators, motor vehicles, or parts of any of the foregoing.
8. This Order is not final until all administrative appeal periods from this Order have elapsed, or if such an appeal has been taken, until all proceedings before the Department have been completed.
9. No work shall be undertaken until the Order has become final and then has been recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land upon which the proposed work is to be done. In the case of the registered land, the Final Order shall also be noted on the Land Court Certificate of Title of the owner of the land upon which the proposed work is done. The recording information shall be submitted to the Conservation Commission on the form at the end of this Order, which form must be stamped by the Registry of Deeds, prior to the commencement of work..
10. A sign shall be displayed at the site not less then two square feet or more than three square feet in size bearing the words,
" Massachusetts Department of Environmental Protection"
[or 'MassDEP"]
File Number :"006-1459"
11. Where the Department of Environmental Protection is requested to issue a Superseding Order, the Conservation Commission shall be a party to all agency proceedings and hearings before Mass DEP.
12. Upon completion of the work described herein, the applicant shall submit a Request for Certificate of Compliance (WPA Form 8A) to the Conservation Commission.
13. The work shall conform to the plans and special conditions referenced in this order.
14. Any change to the plans identified in Condition #13 above shall require the applicant to inquire of the Conservation Commission in writing whether the change is significant enough to require the filing of a new Notice of Intent.
15. The Agent or members of the Conservation Commission and the Department of Environmental Protection shall have the right to enter and inspect the area subject to this Order at reasonable hours to evaluate compliance with the conditions stated in this Order, and may require the submittal of any data deemed necessary by the Conservation Commission or Department for that evaluation.
16. This Order of Conditions shall apply to any successor in interest or successor in control of the property subject to this Order and to any contractor or other person performing work conditioned by this Order.
17. Prior to the start of work, and if the project involves work adjacent to a Bordering Vegetated Wetland, the boundary of the wetland in the vicinity of the proposed work area shall be marked by wooden stakes or flagging. Once in place, the wetland boundary markers shall be maintained until a Certificate of Compliance has been issued by the Conservation Commission.
18. All sedimentation barriers shall be maintained in good repair until all disturbed areas have been fully stabilized with vegetation or other means. At no time shall sediments be deposited in a wetland or water body. During construction, the applicant or his/her designee shall inspect the erosion controls on a daily basis and shall remove accumulated sediments as needed. The applicant shall immediately control any erosion problems that occur at the site and shall also immediately notify the Conservation Commission, which reserves the right to require additional erosion and/or damage prevention controls it may deem necessary. Sedimentation barriers shall serve as the limit of work unless another limit of work line has been approved by this Order.

NOTICE OF STORMWATER CONTROL AND MAINTENANCE REQUIREMENTS

19. The work associated with this Order(the "Project") is (1) ☐ is not (2) ☑ subject to the Massachusetts Stormwater Standards. If the work is subject to Stormwater Standards, then the project is subject to the following conditions;

a) All work, including site preparation, land disturbance, construction and redevelopment, shall be implemented in accordance with the construction period pollution prevention and erosion and sedimentation control plan and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge Elimination System Construction General Permit as required by Stormwater Standard 8. Construction period erosion, sedimentation and pollution control measures and best management practices (BMPs) shall remain in place until the site is fully stabilized.

b) No stormwater runoff may be discharged to the post-construction stormwater BMPs unless and until a Registered Professional Engineer provides a Certification that: *i.* all construction period BMPs have been removed or will be removed by a date certain specified in the Certification. For any construction period BMPs intended to be converted to post construction operation for stormwater attenuation, recharge, and/or treatment, the conversion is allowed by the MassDEP Stormwater Handbook BMP specifications and that the BMP has been properly cleaned or prepared for post construction operation, including removal of all construction period sediment trapped in inlet and outlet control structures; *ii.*. as-built final construction BMP plans are included, signed and stamped by a Registered Professional Engineer, certifying the site is fully stabilized; *iii.* any illicit discharges to the stormwater management system have been removed, as per the requirements of Stormwater Standard 10; *iv.* all post-construction stormwater BMPs are installed in accordance with the plans (including all planting plans) approved by the issuing authority, and have been inspected to ensure that they are not damaged and that they are in proper working condition; *v.* any vegetation associated with post-construction BMPs is suitably established to withstand erosion.

c) The landowner is responsible for BMP maintenance until the issuing authority is notified that another party has legally assumed responsibility for BMP maintenance. Prior to requesting a Certificate of Compliance, or Partial Certificate of Compliance, the responsible party (defined in General Condition 19(e)) shall execute and submit to the issuing authority an Operation and Maintenance Compliance Statement ("O&M Statement") for the Stormwater BMPs identifying the party responsible for implementing the stormwater BMP Operation and Maintenance Plan ("O&M Plan") and certifying the following: i.) the O&M Plan is complete and will be implemented upon receipt of the Certificate of Compliance, and ii.) the future responsible parties shall be notified in writing of their ongoing legal responsibility to operate and maintain the stormwater management BMPs and implement the Stormwater Pollution Prevention Plan.

d) Post-construction pollution prevention and source control shall be implemented in accordance with the long-term pollution prevention plan section of the approved Stormwater Report and, if applicable, the Stormwater Pollution Prevention Plan required by the National Pollutant Discharge Elimination System Multi-Sector General Permit.

e) Unless and until another party accepts responsibility, the landowner, or owner of any drainage easement, assumes responsibility for maintaining each BMP. To overcome this presumption, the landowner of the property must submit to the issuing authority a legally binding agreement of record, acceptable to the issuing authority, evidencing that another entity has accepted responsibility for maintaining the BMP, and that the proposed responsible party shall be treated as a permittee for purposes of implementing the requirements of Conditions 19(f) through 19(k) with respect to that BMP. Any failure of the proposed responsible party to implement the requirements of Conditions 19(f) through 19(k) with respect to that BMP shall be a violation of the Order of Conditions or Certificate of Compliance. In the case of stormwater BMPs that are serving more than one lot, the legally binding agreement shall also identify the lots that will be serviced by the stormwater BMPs. A plan and easement deed that grants the responsible party access to perform the required operation and maintenance must be submitted along with the legally binding agreement.

f) The responsible party shall operate and maintain all stormwater BMPs in accordance with the design plans, the O&M Plan, and the requirements of the Massachusetts Stormwater Handbook.

g) The responsible party shall:

1. Maintain an operation and maintenance log for the last three (3) consecutive calendar years of inspections, repairs, maintenance and/or replacement of the stormwater management system or any part thereof, and disposal (for disposal the log shall indicate the type of material and the disposal location);
2. Make the maintenance log available to MassDEP and the Conservation Commission ("Commission") upon request; and

3. Allow members and agents of the MassDEP and the Commission to enter and inspect the site to evaluate and ensure that the responsible party is in compliance with the requirements for each BMP established in the O&M Plan approved by the issuing authority.

h) All sediment or other contaminants removed from stormwater BMPs shall be disposed of in accordance with all applicable federal, state, and local laws and regulations.

i) Illicit discharges to the stormwater management system as defined in 310 CMR 10.04 are prohibited.

j) The stormwater management system approved in the Order of Conditions shall not be changed without the prior written approval of the issuing authority.

k) Areas designated as qualifying pervious areas for the purpose of the Low Impact Site Design Credit (as defined in the MassDEP Stormwater Handbook, Volume 3, Chapter 1, Low Impact Development Site Design Credits) shall not be altered without the prior written approval of the issuing authority.

l) Access for maintenance, repair, and/or replacement of BMPs shall not be withheld. Any fencing constructed around stormwater BMPs shall include access gates and shall be at least six inches above grade to allow for wildlife passage.

Special Conditions:

D. Findings Under Municipal Wetlands Bylaw or Ordinance

1. Is a municipal wetlands bylaw or ordinance applicable? ☐ Yes ☑ No

2. The Conservation Commission hereby(check one that applies):

a. ☐ DENIES the proposed work which cannot be conditioned to meet the standards set forth in a municipal ordinance or bylaw specifically:

1. Municipal Ordinance or Bylaw _____ 2. Citation _____

Therefore, work on this project may not go forward unless and until a revised Notice of Intent is submitted which provides measures which are adequate to meet these standards, and a final Order or Conditions is issued. Which are necessary to comply with a municipal ordinance or bylaw:

b. ☐ APPROVES the proposed work, subject to the following additional conditions.

1. Municipal Ordinance or Bylaw _____ 2. Citation _____

3. The Commission orders that all work shall be performed in accordance with the following conditions and with the Notice of Intent referenced above. To the extent that the following conditions modify or differ from the plans, specifications, or other proposals submitted with the Notice of Intent, the conditions shall control.

The special conditions relating to municipal ordinance or bylaw are as follows:

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

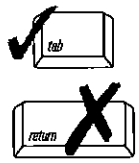
WPA Form 5 – Order of Conditions

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
006-1459
MassDEP File #
B31249
eDEP Transaction #
BOSTON
City/Town

E. Signatures

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



This Order is valid for three years, unless otherwise specified as a special condition pursuant to General Conditions #4, from the date of issuance.

5/31/2016
1. Date of Issuance

Please indicate the number of members who will sign this form.
This Order must be signed by a majority of the Conservation Commission.

4
2. Number of Signers

The Order must be mailed by certified mail (return receipt requested) or hand delivered to the applicant. A copy must be mailed, hand delivered or filed electronically at the same time with the appropriate MassDEP Regional Office.

Signatures:

☐ by hand delivery on

Date

☑ by certified mail, return receipt requested, on 5/31/2016

Date

F. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate MassDEP Regional Office to issue a Superseding Order of Conditions. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order associated with this appeal will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order, or providing written information to the Department prior to issuance of a Superseding Order.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act (M.G.L. c. 131, § 40), and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal ordinance or bylaw, and not on the Massachusetts Wetlands Protection Act or regulations, the Department has no appellate jurisdiction.

G. Recording Information

This Order of Conditions must be recorded in the Registry of Deeds or the Land Court for the district in which the land is located, within the chain of title of the affected property. In the case of recorded land, the Final Order shall also be noted in the Registry's Grantor Index under the name of the owner of the land subject to the Order. In the case of registered land, this Order shall also be noted on the Land Court Certificate of Title of the owner of the land subject to the Order of Conditions. The recording information on this page shall be submitted to the Conservation Commission listed below.

BOSTON
Conservation Commission

Detach on dotted line, have stamped by the Registry of Deeds and submit to the Conservation Commission.

To:

BOSTON
Conservation Commission

Please be advised that the Order of Conditions for the Project at:

THOMPSON ISLAND — Project Location

006-1459 — MassDEP File Number

Has been recorded at the Registry of Deeds of:

County — Book — Page

for:

Property Owner ARTHUR PEARSON

and has been noted in the chain of title of the affected property in:

Book — Page

In accordance with the Order of Conditions issued on:

Date

If recorded land, the instrument number identifying this transaction is:

Instrument Number

If registered land, the document number identifying this transaction is:

Document Number

Signature of Applicant

Rev. 4/1/2010

20. The Applicant is hereby instructed to review such conditions with all contractors and workers involved in on site operations prior to the commencement of construction on this project. Any contractors and workers arriving after construction commences shall also be apprised of these conditions.

21. The Applicant shall attach a copy of this Final Order of Conditions (hereinafter "the Order") to the contract documents associated with this project.

22. If at any time during the implementation of the project a fish kill or significant water quality problem occurs in the vicinity of the project, all site related activities impacting the water shall cease until the source of the problem is identified and adequate mitigating measures employed to the satisfaction of the Boston Conservation Commission (hereinafter "the Commission").

23. Where relevant, all facilities and equipment will be continually operated and maintained so as to comply with the conditions and the Massachusetts Wetlands Protection Act (hereinafter "the Act"). The Applicant, owner, successor or assigns shall be responsible for assuring the lasting integrity of the surface cover on the site and the prevention of erosion, siltation, sedimentation, chemical contamination or other detrimental impact to the on-site and/or off-site resources areas. This condition shall be a maintenance condition, and shall not expire upon the issuance of a Certificate of Compliance.

24. A copy of the Order, including all referenced documents and plans, and all other subsequent approvals and directives issued by the Commission, shall be available for inspection at the work area.

25. The Commission reserves the right to impose additional conditions or require the submittal of additional information as necessary to protect the interests of the Act.

26. There shall be no discharge or spillage of fuel, oil, or any other pollutant from this project into adjacent wetlands resource areas or 100-foot Buffer Zone (hereinafter "buffer zone") associated with those resource areas. Any equipment used in the resource area or buffer zone that uses fuel, oil or hydraulic fluid shall be inspected daily for leakage. Any equipment that requires repair shall be repaired outside of the resource area and the buffer zone. Any equipment that uses fuel, oil and/or hydraulic fluid shall be staffed at all times while operational within the resource area or buffer zone. Equipment shall not be re-fueled within any wetland resource areas.

27. The Applicant and/or their contractor shall develop a spill management plan for any hazardous materials that may be employed during work in the buffer zone or over the water. Specifically, the Applicant should prepare to effectively deal with spillage of fuel or hydraulic fluids from equipment. A quick-absorbent material, such as "Speedy Dry" or equivalent, will be stored in a dry readily available area at the work site, and on any project related vessels, for use in the event petroleum-based fluids are spilled or leaked.

28. The Commission shall be notified at least 48 hours in advance of the date upon which project activities on the site are to proceed.

29. The Applicant and/or their contractor shall provide to the Commission written notification of the name, title, address and telephone numbers of the person or persons designated by the project proponent to be responsible for compliance with the Order on site. An emergency telephone number shall be provided in the event that action is required during non-working hours.

30. All project-related materials shall be contained from migration into the resource area and all practical precautions shall be used during any water-based work. The Applicant and/or their contractor shall be responsible for the removal of any project-related debris, material, machinery or equipment lost, dumped, thrown into, or otherwise entering the waterway, regardless of whether it is within or outside of the project limits. The proponent must seek Commission approval for any remedial action involving substantial impacts to wetland resource areas.

31. The applicant shall contact the MA Department of Environmental Protection to determine if they need to obtain a valid BRP WM 04 Permit for the application of herbicides for the designated target species. If the BRP WM 04 Permit is necessary it shall be renewed yearly and a copy submitted to the Commission prior to initiating any treatment of vegetation permitted by this Order.

32. The Commission shall be provided with the End-of-Year Survey and Report, which shall include data on the herbicide treatment(s), observations from the year-end survey and recommendations for the following year.

33. Application of USEPA/MA registered and approved herbicides must be at or below the allowable label rate and follow all product label directions. Application must be consistent with the performance guidelines of the Massachusetts Executive Office of Environmental Affairs Generic Environmental Impact Report on Eutrophication and Aquatic Plant Management in Massachusetts.

34. All practical precautions, methods and measures shall be implemented to prevent impacts to non-target plant species and migration of herbicides beyond the specified treatment locations. Any spray application of herbicide shall be conducted with a low-pressure spray and shall not be applied as an aerosol. Herbicide application shall not occur during periods when wind speed exceeds 10 miles per hour and shall not be applied within four hours before a forecasted rain event, during a rain event, or within four hours after a rain event.

35. All application of herbicides approved for use by this Order shall be applied by an applicator licensed by the Massachusetts Department of Agricultural Resources (DAR), Pesticide Bureau.

36. There shall be no mixing or storage of herbicide and algaecides in wetland resource areas, or the buffer zone.

37. The Applicant shall inform the Commission of any violation of this Order and any other project related spill or accident that may impact wetland resource areas as soon as possible and at least by the end of the business day, and shall take appropriate action to mitigate impacts from such spill or accident. The Applicant or site supervisor shall notify the City of any emergency by calling Commission staff at 617-635-4417 from 9:00 AM - 5:00 PM, Monday - Friday and, at all other times, by calling the Mayor's Office's 24-hour Hotline at 617-635-4500 to contact the Director of the Environment Department. On the date of the issuance of this Order, the appropriate contact names are Charlotte Moffat (Executive Secretary, Boston Conservation Commission, charlotte.moffat@cityofboston.gov).

38. All project related correspondence and submittals to the Boston Conservation Commission regarding this Final Order shall indicate the DEP File number: **006-1459**.

Additional Conditions

39. The restoration must result in topography and soil characteristics similar to those lost. The restoration must result in a density of trees, shrubs, and herbaceous species similar to those lost. At least 75% of the surfaces of the replacement area shall be reestablished with native wetland plant species within two growing seasons, and prior to said vegetative reestablishment, any exposed soil in the replacement area shall be temporarily stabilized to prevent erosion in accordance with US Soil Conservation Service methods.

Project Description from NOI

Thompson Island is owned by Thompson Island Outward Bound Education Center (TIOBEC). As directed by Congress in the national park area's enabling legislation, the islands are managed in cooperation by land owners and the Boston Harbor Islands Partnership, which includes the NPS, the non-profit Boston Harbor Island Alliance, DCR, and TIOBEC. The project area is comprised of a freshwater wetland that occurs at the base of a drumlin hill on Thompson and adjacent upland buffer zones. The wetland includes intermittent open water and emergent marsh vegetation and occurs just above sea level, immediately interior of natural beach berms and unpaved trails, on the lee side of the island with respect to typical storm surges from the Northeast. The wetland receives occasional (approximately every 1-3 years) overwash from very high tides, particularly when the tides are associated with strong Southwest winds. The wetland grades gently into upland buffer zones.

The Thompson island site, approximately 9 acres includes a wetland separated into three distinct sections by two raised earthen berms that are used as trails for island operations. The buffer zone lies at a slightly higher elevation between the freshwater wetland and nearby tidal salt marshes to the south and east. There are additional well used trails that cross this upland buffer zone.

Historic land use of both islands included timber removal for firewood and construction in the 17th century, and agricultural uses including livestock and farming until the 20th century. The Thompson Island wetland pond was used for ice and skating associated with a farm and trade school in the early and mid – 20th century. For several decades starting in the mid 20th century, both wetland project areas and surrounding buffer zones were largely unmanaged. Although the conversion from native species – dominated wetland / buffer habitats on these islands has not specifically been documented, at some point during the past century this conversion has occurred, and it is likely that nitrogen deposition has facilitated this process through differentially stimulating the common invasive non-native plants that are now prevalent on these sites. Both islands came to be increasingly dominated by invasive non-native species, including in particular Phragmites australis (common reed) in the wetland, and a mix of woody invasive non-native species including Frangula alnus (glossy buckthorn), Rosa multiflora (multifloral rose), Celastrus orbiculatum (oriental bittersweet) and Ailanthus altissima (tree-of-heaven).

Freshwater wetlands are rare on the Boston Harbor Islands due to small watershed sizes on islands, minimal topographic variation, and well drained glacial till – derived soils. The freshwater wetlands on Grape and Thompson islands provide scarce water resources for wildlife and habitat for locally uncommon wetland plant communities. Although no definitive study of wildlife use has been conducted, coyote, fox, deer, and waterbirds have been observed frequently on these islands in the vicinity of these wetlands. Despite the continuing impact of invasive non-native species to both wetlands, botanist Dr. Ted Elliman noted in his 2002 floristic survey of the park that both wetland areas were important for remnant native biodiversity and plant community diversity5 .

The work will consist of the following elements:

- Completing site specific implementation plans
- Baseline vegetation monitoring for key biological and physical parameters
- Initial invasive plant control
- Collection and propagation of local native plant species
- Maintenance and control of invasive plant species
- Planting of native species
- Follow-up monitoring for key biological and physical parameters post non-native control and native planting
- Collaborative research with the U.S. Forest Service Rocky Mountain Research Station on the effects of project treatments on nitrogen cycling .

In order to maximize the long term success of both controlling specific invasive non-native plants as well as converting marsh and buffer zone habitats to primarily native vegetation assemblages, revegetation using a large diversity of native plants (from locally collected seeds and propagules) will follow initial control of invasive species. The establishment of native species with low nitrogen requirements following exotic species removal can help immobilize nitrogen in soils and limit future invasion by non-native species.

In addition, follow - up maintenance of treated areas will occur through this project in years 2 and 3, and will be integrated into the ongoing active community stewardship program at the park. These two sites will continue to be high priority among the many sites managed through this program.

The monitoring program will include the following elements:

• Groundwater and standing water level and salinity;
• Plant species richness and cover of individual species, including native species and target invasive non-native species; and
• Survivorship of planted species.

The park and NPS Air Resources Division staffs are working with Dr. Charles Rhodes from the U.S. Forest Service Rocky Mountain Research Station to add a research component on to the restoration project. The research will examine how invasive species removal alters N cycling in the upland buffer ecosystem only. The occasional infusion of salt water into the freshwater system could not be appropriately accounted for in the project design, thus the wetland sites are excluded from the N cycling study. It is anticipated that this research will assess the potential utility of N cycling metrics to help gauge the success of restoration treatments and improve the design of restoration and monitoring activities in other park areas receiving high N deposition. The research will use relatively simple and inexpensive analytical methods, along with a paired replicate sampling design, to examine soil N availability and N leaching. These analyses would allow for indexing the consequences of invasive plant removal treatments on N available to plants and on the potential risks of N losses to groundwater or surface water.

SUCCESS CRITERIA

By the end of project year three (September 2019), restoration work is intended to achieve native species - dominated wetland and upland plant communities in the project areas on Grape Island and Thompson Island that provide high value habitat for wildlife, and will be able to be sustainably maintained by the park Stewardship Program. Specifically, project work is intended to result in the following success criteria:

• Successful establishment of populations of more than ten native species in both wetland and upland project areas on Grape and Thompson Island (a successfully established "population" for each species will be based on species- and site- specific factors, as outlined in final implementation plan);
• Less than 10% cover of invasive non-native plant species within both wetland and upland project areas on Grape and Thompson Island;
• Documented use of wetland habitats on both islands by mammals and waterbirds, and documented pollinator use of both wetland and upland sites (pollinator monitoring protocol is being developed by partner at Colorado State University); and
• Establishment of a new baseline range of variability for the hydrology of both wetland sites (average annual period of standing water, average groundwater level by month, frequency of ocean storm overwash events, and the effect of overwash events on the salinity of standing water and groundwater).