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**ANNUAL WETLAND MITIGATION  
MONITORING REPORT  
YEAR 3, 2015**

**MAINE TURNPIKE AUTHORITY  
MILES YORK FARM BIDDEFORD WETLAND  
MITIGATION SITE**

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**Maine Turnpike Widening Permits:**

**U. S. Army Corps of Engineers Permit 199901278**

**Maine DEP Permit L-19918-31-A-N, L-19918-L6-G-N**

MAINE TURNPIKE AUTHORITY  
2360 CONGRESS STREET  
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**HNTB**

*December 2015*

**MITIGATION REPORT**  
**TRANSMITTAL AND SELF-CERTIFICATION**

DEPARTMENT OF THE ARMY PERMIT NUMBER: 199901278  
PROJECT TITLE: Miles York Farm Biddeford Wetland Mitigation Site  
Maine Turnpike Authority

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ATTACHED MITIGATION REPORT  
TITLE: Annual Wetland Mitigation Monitoring Report Maine Turnpike Authority  
Miles York Farm Biddeford Wetland Mitigation Site

PREPARERS: Kevin Slattery, Nick Henke

DATE: December 09, 2015

CERTIFICATION OF COMPLIANCE: I certify that the attached report is accurate and discloses that the mitigation required by the Department of the Army Permit **[is] ~~is not~~** in full compliance with the terms and conditions of that permit.

CORRECTIVE ACTION: A need for corrective action **[is] ~~is not~~** identified in the attached report.

CONSULTATION: I **[do] ~~do not~~** request consultation with the Corps of Engineers to discuss a corrective strategy or permit modification.

CERTIFIED: \_\_\_\_\_  
(Signature of permittee) Date

12/9/15



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## PROJECT OVERVIEW/EXECUTIVE SUMMARY

This report documents the results of the third year of 10 years of post-construction monitoring at the supplemental compensation site for the southern Maine Turnpike Widening project. Following Army Corps mitigation guidance, monitoring is to be conducted in post construction years 1, 2, 3, 5, 7, and 10 and reports will be provided for subsequent monitoring years. The site is comprised of predominantly one intended wetland cover type (forested) with a riparian component associated with Bush Brook. The site is somewhat rectangular shaped, located within a large tract of undeveloped woodland, has a diverse surface matrix of former drainage furrows and interconnecting channels, and some large upland “islands.” The site is developing well and reflects the intention of the design, the desired functions are developing and the site is stable. The long term prognosis for the site is excellent. All five of the U.S. Army Corps of Engineers Success Standards for post-construction assessment of wetland mitigation sites were met at the site.

The site hydrology is indicative of wetland conditions and existing soils have strong hydric indicators at the monitoring stations. Plant densities and herbaceous covers on site are high, and planting densities are over the success standard of 500 woody plants per acre. The majority of the planted stock on site is surviving well, with the exception of balsam fir. Replacement plantings were made in fall of 2015 as part of the original construction contract planting warrantee. The replacement planting selections took into consideration the species performance, such that better performing plants were used for replacements. Since the site overall plant density is exceeding the success standard listed above, no supplemental plantings are recommended at this time.

Three invasive hydrophytes; reed canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), and cattails (*Typha latifolia*) were found at the mitigation site. Reed canary grass and purple loosestrife are very limited and found as individual plants in select areas of the site. A small patch of reed canary grass was treated in 2013 and re-assessed in 2014 and 2015. Only two or three weak stocks of the grass were observed, and marked for treatment. A new second very small patch was found in 2015 and was marked for treatment. All fruiting parts of the grass were removed to protect against seed dispersal. Two purple loosestrife plants (one flowering and one non-flowering) were observed and removed from the site.

Cattails are found in limited numbers and small isolated patches in the site. Cattails in slightly larger patches occur in the southern portion of the site near Forested Plots 3 and 4 and the northern portion near Forested Plot 1. Cattails are colonizing the small depressions of the site where persistent water provides appropriate conditions for establishment. Hydrology adjustments were made in 2013 near Forested Plot 4 and the changes appear to have made the conditions less suitable for cattails. The cattails in 2015 continued to show signs of stress and are declining in size and density at that location. A new patch of cattails has emerged near Forested Plot 1 that was not present during the



2014 evaluations, but does not appear to pose a threat to the site. The small cattail patch is confined to a small depression where more persistent surface water provides suitable habitat for establishment.

Treatment of reed canary grass using herbicides will be implemented as needed in future monitoring years. Hand digging and removal of purple loosestrife will continue to be implemented as needed in future monitoring years.

The mitigation site already shows very good wildlife use. A variety of songbirds, wading birds, white tailed deer, moose, bear, and many amphibians and reptiles use the site which is an indicator that the desired wildlife function is being achieved.

## **REQUIREMENTS**

### **Mitigation Conditions**

Special conditions for the project mitigation are included in the project permits in Appendix E. Both the US Army Corps of Engineers and Maine DEP permits included special conditions. Other than the recording of the protective Declaration of Covenants and Restrictions for the site, which is in process and should be recorded shortly, all of the special conditions of the permits have been met.

### **Mitigation Goals**

This compensatory wetland mitigation is intended to offset impacts from the Maine Turnpike Modernization and Widening Mile 12 to Mile 42 (herein referred to as “widening project”) in York and Cumberland Counties. The widening project was permitted in 1999 and constructed from 2000 to 2005. The widening project was subject to the compensation requirements of the Maine Department of Environmental Protection (Maine DEP) Natural Resources Protection Act (NRPA) (Code of Maine Rules, Chapter 310; (2) 38 M.R.S.A. Section 480-A et seq. Chapter 310); and the compensatory mitigation requirements of the U.S. Army Corps of Engineers (ACOE) Section 404 of the U.S. Clean Water Act (33 U.S.C. Section 1344). One of the original wetland compensation sites for the widening project (New Dam Road Site in Sanford) failed to completely meet the project’s mitigation objectives; the ACOE and the Maine DEP requested a replacement compensatory mitigation project. Following an alternatives analysis and discussions with the ACOE and the Maine DEP, the Maine Turnpike Authority determined that the York Farm site is the most practicable replacement alternative for this project. Both permitting agencies concurred with the findings and issued permits for the construction activities at the supplemental compensation site.



The site is located south of Newtown Road, between Pool Street and West Street in Biddeford, Maine. The project site can be found on the annotated aerial photograph below (Figure 1). The approximate center point of the mitigation site is located at latitude and longitude coordinates 43.4389706 and -70.3982006 (NAD83). The site is located in the Piscataqua – Salmon Falls Watershed (HUC 8), near the boundary of the Saco River and Portsmouth Harbor Watershed (HUC 8). The mitigation site contains a portion of Bush Brook which drains into the Little River approximately west and downstream of the proposed mitigation site (outlet-ing into the Goosefare Bay to the south of Saco Bay).

The project is designed to provide at least 13.2 acres of primarily deciduous forested wetland through a series of enhancements/restorations to a mowed and partially drained wet meadow and a component of wetland creation. Calculations representing the areas of creation, restoration, enhancement, and preservation can be found in Table 1 reporting distributions by wetland types. The intended functions and values to be provided and enhanced through implementation of this plan include groundwater recharge, floodflow alteration and storage, water quality improvement (sediment/toxicant retention and nutrient removal), production export, wildlife habitat, and recreational opportunities (hiking and bird watching). The site is currently providing all of these functions, which will continue to develop as the site matures and evolves.



Maine Turnpike Authority/MaineDOT  
Biddeford Mitigation Site  
Locus Map

Figure 1



**Table 1 Summary of Wetland Mitigation**

WETLAND TYPE	PROPOSED MITIGATION (acres)				
	CREATION	RESTORATION	ENHANCEMENT	PRESERVATION	TOTAL
Forested	0.73	11.57	1.41	2.39	16.10
Riparian	0	0.40	0	0	0.40
Vernal Pool	0.10	0	0	0	0.10
<b>TOTAL</b>	0.83	11.97	1.41	2.39	16.60

***Mitigation Success Standards***

The five Success Standards for post-construction assessment of wetland mitigation sites established by ACOE are described below. The Success Standards listed below are copied from the Army Corps regulatory guidance for mitigation. Each year of monitoring the mitigation project site will be inspected to determine if it meets the following standards:

*Success Standard 1*

*The site has the hydrology as demonstrated with well data collected at least weekly from March through June or other substantial evidence, to support the designated wetland type.*

*Is the proposed hydrology met at the site?*

*What percentage of the site is meeting projected hydrology levels?*

*Areas that are too wet or too dry should be identified along with suggested corrective measures.*

*Success Standard 2*

*Does the site have at least 500 trees and shrubs per acre, of which at least 350 per acre are trees for proposed forested cover types, that are healthy and vigorous and are at least 18" tall in 75% of each planned woody zone AND at least the following number of non-exotic species including planted and volunteer species? Volunteer species should support functions consistent with the design goals. To count a species, it must be well represented on the site (e.g., at least 50 individuals of that species per acre).*



**Table 2 Volunteer and Planted Species Requirements For Success Standard**

<b># Species Planted (Volunteer And Planted)</b>	<b>Minimum # Species Required</b>
2	2
3	3
4	3
5	4
6	4
7	5
8	5
9 or More	6

*Vegetative zones consist of areas proposed for various types of wetlands (shrub swamp, forested swamp, etc.). The performance standards for density can be assessed using either total inventory or quadrat sampling methods, depending upon the size and complexity of the site.*

**Success Standard 3**

*Does each mitigation site have at least 80% areal cover, excluding planned open water areas or planned bare soil areas (such as for turtle nesting), by noninvasive species? Do planned emergent areas on each mitigation site have at least 80% cover by noninvasive hydrophytes? Do planned scrub-shrub and forested cover types have at least 60% cover by noninvasive hydrophytes, of which at least 15% are woody species? For the purpose of this success standard, invasive species of hydrophytes are:*

- Cattails -- Typha latifolia, Typha angustifolia, Typha glauca;*
- Common Reed -- Phragmites australis;*
- Purple Loosestrife -- Lythrum salicaria;*
- Reed Canary Grass -- Phalaris arundinacea; and*
- Buckthorn – Rhamnus frangula.*

**Success Standard 4**

*Are Common Reed (Phragmites australis), Purple Loosestrife (Lythrum salicaria), Russian and Autumn Olive (Eleagnus spp.), Buckthorn (Rhamnus frangula), Japanese knotweed (Polygonum cuspidatum) and/or Multiflora Rose (Rosa multiflora) plants at the mitigation site(s) being controlled?*

**Success Standard 5**

*Are all slopes, soils, substrates, and constructed features within and adjacent to the mitigation site(s) stabilized?*



## SUMMARY DATA

### Monitoring Methods

For the annual assessments, five fixed monitoring stations were established at the compensation site. The sites were comprised of two cover types (by design); one riparian monitoring station, and four forested stations. The stations were marked with driven re-bar and white pvc pipe, and a second pvc marker was placed nearby to establish bearing references at the station. The fixed monitoring stations were surveyed along with all planted woody stock and volunteer woody stock within a 30 foot radius, and then the information was plotted on base maps.

Assessments of planted stock survivability and health were made at each of the fixed monitoring stations and are included in Appendix A. The fixed monitoring stations also were used to assess dominant herbaceous vegetation using a 5-foot radius assessment plot. All dominant herbaceous vegetation was recorded as estimated percent cover. Invasive species in the 30-foot radius assessment plots were noted. The results of the herbaceous plots are included in Appendix B.

The mitigation site was extensively walked on different occasions during the growing season to search for invasive species. The invasive species observed at the mitigation site included reed canary grass, purple loosestrife, and cattails. Although cattails are considered invasive and occur at the site they are not considered a threat to the overall mitigation site.

During site visits, wildlife use was noted. Sites were inspected for erosion, evidence of ATV or off-road vehicle use and indicators of any improper hydrology.

### *Supplemental Information*

Per the ACOE Guidelines, monitoring reports will include the following appendices A through C:

Appendix A -- Planted stock survivability plots showing the location and extent of the designed plant community types (e.g., shrub swamp).

Appendix B -- A vegetative species list of herbaceous vegetation and volunteer species in each plant community type. The volunteer species list should at a minimum include those that cover at least 5% of their vegetative layer.

Appendix C -- Representative photos of each mitigation site taken from the same locations for each monitoring event.

For this report, one additional appendix is included: Appendix D –Soil pit profile for Forested Plot 1.



## Success Standard Achievement

### Summary of Monitoring Success Standards

**Success Standard 1:** *“The site has the hydrology, as demonstrated with well data collected at least weekly from March through June or other substantial evidence, to support the designed wetland type. Is the proposed hydrology met on the site?”*

The wetland mitigation site was established on poorly drained soils comprised of silts, silt loam and clay. The site is representative of a perched wetland system in low-lying areas, but with some slight vertical relief. These soil types are not conducive for typical groundwater measurements using groundwater monitoring wells. For this reason, site hydrology was assessed using direct observation during site visits. Overall, the primary objective of the mitigation site design was to counteract the former agricultural site modifications that drained wetland areas. In addition, two small areas of wetland creation adjacent to existing wetland were constructed by excavating to perch on site water in mound and pool micro topography and receive some surface flows from adjacent wetlands. Two vernal pools were also constructed at the site with the intent of having isolated wetland pools suitable for use by breeding amphibians.

The site hydrology was observed during several visits from spring through fall of 2015. The overall site hydrology is performing as intended, and additional water retention is occurring and altering the hydrology to a more persistent saturation condition during the growing season. Evidence of appropriate hydrology includes standing shallow water that is not persistent, water flows along the existing furrows and laterally through the interconnecting channels, and softer soils that infer saturation. The wetland creation areas have observable shallow water that varies with the precipitation and observations indicate much of those areas are developing into functional wetlands. The herbaceous species composition of the site is reacting to the hydrology and shifting more toward hydrophytes compared with facultative and upland species. The vernal pools both retained water through the summer in 2015 similar to 2014. Water levels dropped but the pools never completely dried. From the first, second, and third year observations, it is becoming evident that the pools may result in persistent shallow ponds, only potentially drying out during the driest of years, and prolonged drier weather patterns.

Small hydrological modifications were made at the site in 2013 to address surplus water in two locations. One location to improve hydrology was made at the outlet of the creation area in the southern end of the site and the second adjustment was at the northern vernal pool. Both areas exhibited higher water than desired, so shallow outlet channels were hand dug to help lower water levels. Site inspections throughout 2015 found both changes continue to be working as intended.

From the third year observations, this hydrology Success Standard is being met at the site.



**Success Standard 2:** “Does the site have at least 500 trees and shrubs per acre, of which at least 350 per acre are trees for proposed forested cover types that are healthy and vigorous and are at least 18" tall in 75% of each planned woody zone.”

The site design included a very high woody tree and shrub planting density to improve the site development and help to meet the vegetative cover performance standard. The total site plantings included 10,342 of both trees and shrubs, made up of 16 different species. Eleven of the 16 species are trees. Of these tree species, 6,742 plantings were used, resulting in a starting density of over 500 trees per acre. Survival of the total woody vegetation remains very high at over 550 alive/acre. From the third year assessment of survivability, this Success Standard is being met.

**Success Standard 3:** “Does each mitigation site have at least 80% areal cover, excluding planned open water areas or planned bare soil areas (such as for turtle nesting), by noninvasive species? Do planned emergent areas on each mitigation site have at least 80% cover by noninvasive hydrophytes? Do planned shrub-shrub and forested cover types have at least 60% cover by noninvasive hydrophytes, of which at least 15% are woody species.”

From the site observations and from the fixed monitoring station plots, the mitigation site has vegetative cover well over 100% in all areas. The entire site is intended to be forested cover. All five monitoring station plots have hydrophytes as the dominants in the herbaceous stratum with Forested Plot 3 also showing dominant coverage by facultative upland species, common cinquefoil (*Potentilla simplex*) and blue wild rye (*Elymus glaucus*). Due to the site still being relatively new, woody species are a minor component of the cover due to the size of the plantings. Over time, as the site matures, the percentage of cover by woody species will increase dramatically. Invasive hydrophytes are not a substantive component of the site’s composition, therefore this Success Standard is being met.

**Success Standard 4:** “Are Common Reed (*Phragmites australis*), Purple Loosestrife (*Lythrum salicaria*), Russian and Autumn Olive (*Eleagnus spp.*), Buckthorn (*Rhamnus frangula*), Japanese knotweed (*Polygonum cuspidatum*) and/or Multiflora Rose (*Rosa multiflora*) plants at the mitigation site(s) being controlled?”

The mitigation site has almost no invasive species. The two species listed above that were found at the site, reed canary grass and purple loosestrife, were found in extremely isolated occurrences, and measured in single plants or clumps. The purple loosestrife plants were hand removed during the 2015 growing season prior to seed release and the reed canary grass was flagged for treatment in 2016. Reed canary grass inflorescences were removed for off-site disposal to limit chances of seed dispersal at the site. This Success Standard is being met at the site.



***Success Standard 5: Are all slopes, soils, substrates, and constructed features within and adjacent to the mitigation site(s) stabilized?***

The site was constructed with minimal disturbance of soils and grading. Areas not requiring grading retained their existing herbaceous sod and remain stable. Areas that were excavated, graded or disturbed were seeded and mulched and have established suitable cover to maintain stability. No indications of site erosion, stream bank failure or movement were found. This Success Standard is being met at the site.

### **Vernal Pools**

Two vernal pools were constructed at the compensation site. The pools are not a requirement of the overall compensation plan, but they were added to improve the habitat diversity and wildlife function of the site. The entire mitigation site was constructed during the summer and fall of 2012, which means the vernal pools started under relatively “sterile” conditions. Other than perimeter seeding with wetland seed mix, no aquatic invertebrates, leaf litter, or soils were imported to help establish the aquatic assemblage. Tree branches were added to both vernal pools for cover and for use as attachment substrates for amphibian breeding. Hydrology appears to be resulting in persistent water, creating conditions that do not typify classic vernal or seasonal woodland pools, and in effect, is serving as ideal habitat for red spotted newt and green frog, which predate on the eggs, larvae, and juvenile forms of other species.

As observed in May of 2015, spotted salamander egg masses are present in great numbers (47 in the northern pool, 110 in the southern pool). Wood frog use is also evident with egg masses present in the southern pool (35) and in the swale leading into the northern pool (20). The southern pool also had 100’s of wood frog tadpoles present. These numbers are positive indicators of the function of these pools. Conversely, the predatory green frog was found in each pool (10-15+) as well as limited numbers of spotted newts which are directly contributing to the loss of vernal pool species abundance at these locations.

### **Stream Enhancement**

Stream enhancement included adding rounded river stone substrates to six locations along Bush Brook. The stone covers from bank to bank and is approximately 20 linear feet long at each enhancement section. In addition to the added in-water structure, riparian planting enhancements were added to both banks of Bush Brook over a distance of approximately 880 linear feet to provide a shading and cover of the watercourse. Most of the riparian plantings were speckled alders, but black spruce was also used near the northern end of the site. During the site assessment, the alders were found to be very healthy and growing vigorously. We anticipated that the alders will develop a dense protective band along the brook’s riparian zone, which will shade the water, provide food and cover for a variety of wildlife, and add to the watercourse stability.



## Soils Data

According to the Natural Resources Conservation Service soil survey, soils in the wetland mitigation site consist of Scantic silt loam, Lyman fine sandy loam and Lyman-Rock outcrop complex. Most of the southern half of the site is comprised of Scantic silt loam that is poorly drained. Scantic soils are classified as hydric on the NRCS national hydric soils list by Lyman is not a hydric soil type. Generally, the higher ground of the northern half of the site and the southwestern corner of the site are comprised of Lyman fine sandy loam that are somewhat excessively drained, but the low lying areas targeted for restoration are hydric Scantic soils. Small areas of the site (the southeastern corner and northeast edges) are comprised of Lyman-Rock outcrop complex. Within the immediate area of wetland restoration, enhancement and creation the soils range in texture from fine sandy loam to silt loam. Soils were assessed at all fixed monitoring station plots (4 forested, 1 riparian) and results supported the above showing mainly silt loam soil with little to no redox that transitioned to gley at depths greater than 12 inches. The soil assessments show evidence of former agricultural use and manipulation intended to drain wetland areas. To support the soil assessments, a soil pit was dug and soil profile recorded at Plot FO 1. To see the soil profile for Plot FO 1 refer to Appendix D.

## Remedial Actions

Remedial actions during 2015 included minor invasive species control, which involved the hand removal of two purple loosestrife plants. Action also included flagging of two small patches of reed canary grass for treatment in 2016, and removal of the canary grass inflorescences. Locations of the invasive plants are shown on Figure 3.

## Erosion Control Measures

The site is well vegetated by herbaceous cover at both the construction/grading areas and in areas that were not modified. All areas of exposed soil were seeded and mulched and established lush herbaceous cover including the property owner access road through the site which shows established growth and does not show any signs of instability. Internal site control measures such as hay bales in swales draining toward Bush Brook, and perimeter silt fences were removed in 2013. The temporary construction access road from Newtown Road was stabilized with seeding and mulch, growth is established, and all perimeter erosion controls were removed.

## Estimates of Percent Vegetative Cover for Each Mitigation Site and Percent Cover of the Invasive Species

### *Vegetative Cover*

The site has dense herbaceous growth in most areas of the forested and riparian cover. Due to overlapping foliage, the cover exceeds 100% in all plot areas during the growing season. The coverage observed at the monitoring stations ranged from 140% to 212%. On average, the overall percent coverage observed was estimated to be approximately 176%. This is consistent with vegetative cover observed in monitoring year 1 (2013)



which averaged 174% however it is down slightly from observations made last year (2014) which averaged 223% cover.

The list of herbaceous species observed at each of the fixed monitoring stations is included in Appendix B. Using the 50/20 rule for determining dominance, all fixed monitoring stations had dominance by non-invasive hydrophytes. Forested Plot 3 also had two non-hydrophyte dominants; 35% and 10% (absolute cover) respectively, by facultative upland species, common cinquefoil (*Potentilla simplex*) and blue wild rye (*Elymus glaucus*). Hydrophyte dominance is consistent with monitoring years 1 and 2. Year 1 had 100% dominance by hydrophytes and year 2 had dominance by hydrophytes at each Plot. In addition in year 2, the non-hydrophyte cinquefoil (*Potentilla simplex*) was also dominant at Forested Plot 2 and the Riparian Plot. The species composition is indicative of wetland communities maintaining an overall shift away from upland, facultative-upland and facultative species to more hydrophytic vegetation at the site.

### ***Invasive Species***

#### ***Cattails (Typha latifolia)***

Cattails are not a threat at this site. Only a few patches of cattail plants are present at the site at the southern end of the site, near fixed monitoring stations FO 3 and FO 4. In addition, there is also a very small patch at the northern end of the site near FO 1. The cattails near FO 4 occur in the area where hydrological modifications were made during 2013. The cattails became established when persistent standing water provided suitable growing conditions. Since the area hydrology was adjusted, the cattail plants at this location are showing stress and reduced size and numbers. Due to the small amount of cattails, and their declining trend since remediation, they were not shown on the invasive species map (Figure 3). The cattails present near FO 3 were not present during the 2013 evaluation. In 2015 they only exist in limited numbers in the very small micro-topographical pools and are not anticipated to expand or develop into a threat to the site.

#### ***Reed Canary Grass (Phalaris arundinacea)***

Reed canary grass was found at two locations, one near the Riparian monitoring station (same at 2014) and the other in the southern end of the site to the west of the access road. The small patch of grass was treated at the Riparian location in 2013 and now is limited to a few single plants. Plants were marked with survey ribbon for treatment, and the inflorescences were removed to prevent seed dispersal. The locations of the reed canary grass are shown on the invasive species map and shown in Appendix C.

#### ***Purple Loosestrife (Lythrum salicaria)***

One small non-flowering purple loosestrife plant was found at the site near the Riparian monitoring station and another, plant was found flowering near FO 1 in the northern end of the site. The Riparian plant was too small to flower during 2015 and was removed by hand. The larger flowering plant was dug up and removed as well. The locations of the loosestrife plants are shown on the invasive species map and shown in Appendix C.



### **Common Reed (*Phragmites australis*)**

No common reed was identified at the site.

### **Buckthorn (*Rhamnus frangula*)**

Buckthorn is found in adjacent wetlands, particularly to the south of the mitigation site. Very small buckthorn seedlings were noted throughout the mitigation site in 2013. However, assessment during 2015 monitoring when the plants were larger suggests that much of these seedlings are actually *Photinia melanocarpa*, (black chokeberry) a non-invasive hydrophyte, rather than buckthorn. Further verification of the presence of buckthorn adjacent to the site is planned for subsequent monitoring years. No control measures were undertaken during 2015.

### **Russian and Autumn Olive (*Eleagnus spp.*)**

No Russian or autumn olive was identified at the site.

### **Japanese Knotweed**

No Japanese knotweed was identified at the site.

### **Multiflora Rose (*Rosa multiflora*)**

No multiflora rose was identified at the site.

## **Fish and Wildlife**

Wildlife observed or identified by tracks, scat or vocalizations at the site include red tailed hawk, turkey vulture, bluebird, blue jay, catbird, cardinal, mourning dove, killdeer, song sparrow, eastern phoebe, eastern kingbird, tree swallow, black-capped chickadee, American robin, cedar waxwing, yellowthroat, red-winged blackbird, goldfinch, belted kingfisher, great blue heron, hairy woodpecker, American crow, turkey, white tailed deer, moose, black bear, raccoon, grey treefrog, spring peeper, American toad, green frog, pickerel frog, wood frog, spotted salamander, eastern red spotted newt, garter snake, eastern ribbon snake, and numerous insects such as dragonflies, damselflies, honeybees, and mosquitoes. The site is providing very good wildlife habitat and will continue to support this wetland function.

## **Planted Stock Survival**

To assess the relative planted stock survival over the full monitoring period, data from the fixed monitoring stations was used to track stock within a 30-foot radius of the five fixed monitoring stations. Stock was located in 2013 using GPS survey and recorded as alive, dead, or not found (which would potentially be used for future monitoring). The results were evaluated to determine the total stock survivability at the monitoring stations, and to assess the site-wide projected plant density. A high and low survivability can be assessed by including the missing plants in the calculation, assumed as either all alive or all dead. From this data, high and low woody plant survivability can be



measured for each fixed station. A high and low average survivability can be calculated for the site by averaging the high and low survivability of the forested and riparian monitoring stations. There are no planned emergent or open water areas in the site, with the exception of the two vernal pools. The vernal pool areas were not planted and are not included in the overall woody stock site performance.

Average survivability was also estimated per species. Fifteen of the 16 species that were planted were represented in the monitoring plots. For each of these species a percent high and low survivability can also be assessed based upon including the missing plants in the calculation, assumed as either all alive or all dead.

The site had a narrow range of planted stock survivability from a low of 89% in Forested Plots 1 and 3 to a high of 100% in the Riparian Station as shown in Table 3 below. The average of the woody stock survivability for Year 3 in the forested plots was 91%. Overall, the site-wide survivability rate of 93% for the forested and riparian plots, the survivability of plantings is characterized as very high.

The construction contract for the site includes a two year establishment period for all woody stock. All dead or dying stock is to be replaced under warrantee for two years, and replacement plantings were made in early fall 2015. Due to some site-wide species survival trends found in 2013 and 2014, species substitutions were made to exclude varieties that are performing very poorly at the site (ex. balsam fir).

Woody stock survivability data from the plots was projected to the equivalent number of woody trees and shrubs per acre based upon the results from each monitoring station. This projection finds a density range from a low of 432 woody trees and shrubs per acre in the Riparian Plot to a high of 663 in Forested Plot 4. Using the same low and high density method, the site wide average density per acre of woody trees and shrubs taken from the station data equates to 555 plants per acre in the forested and riparian zones. Site-wide survivability data for planted woody stock shows relative consistency with a very slight year to year decrease. Density averaged 578 plants per acre in 2013, 559 plants per acre in 2014, and 555 plants per acre in 2015. These year to year trends can be seen Figure 2. The site-wide density ratings do not take into account volunteer plants.

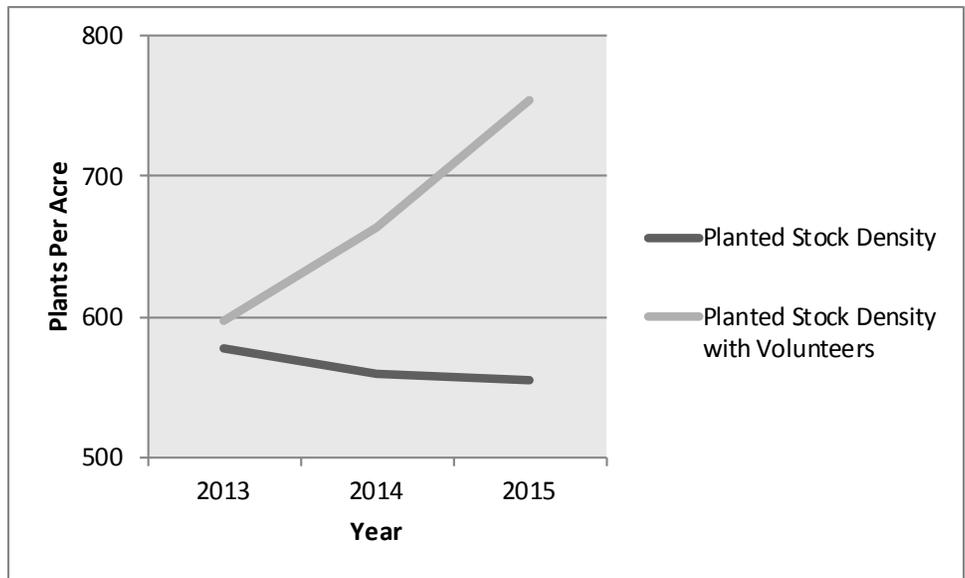
Currently all five plots are showing the presence of woody volunteer plants. Presence ranges from seven plants in Forested Plots 2 and 4 to twenty-one plants in the Riparian Plot. With the inclusion of volunteers, woody tree and shrub densities increase to range from a low of 694 plants per acre in Forested Plot 1 to a high of 786 plants per acre in Forested Plot 3. Volunteers are not reported in the site performance below, but notably already account for 26% of the total living woody trees and shrubs amongst the five monitoring plots. Including the woody volunteers increases the average site-wide woody plant density to 755 plants per acre. Site-wide year to year survivability with volunteers was 597 plants per acre in 2013, 663 plants per acre in 2014, and 755 plants per acre in 2015. These year to year trends can be seen Figure 2.



**Table 3 Woody Stock Survivability at Monitoring Stations**

STATION	Dead Plants	Alive Plants	Not Found Plants	Total Planted	% Survival High	% Survival Low
FO 1	3	33	1	37	92	89
FO 2	4	39	0	43	91	91
FO 3	4	34	0	38	89	89
FO 4	3	43	0	46	93	93
RI	0	28	0	28	100	100
Ave. Forested Stations					91%	91%
Ave. Forested and Riparian					93%	93%

RI – Riparian    FO = Forested

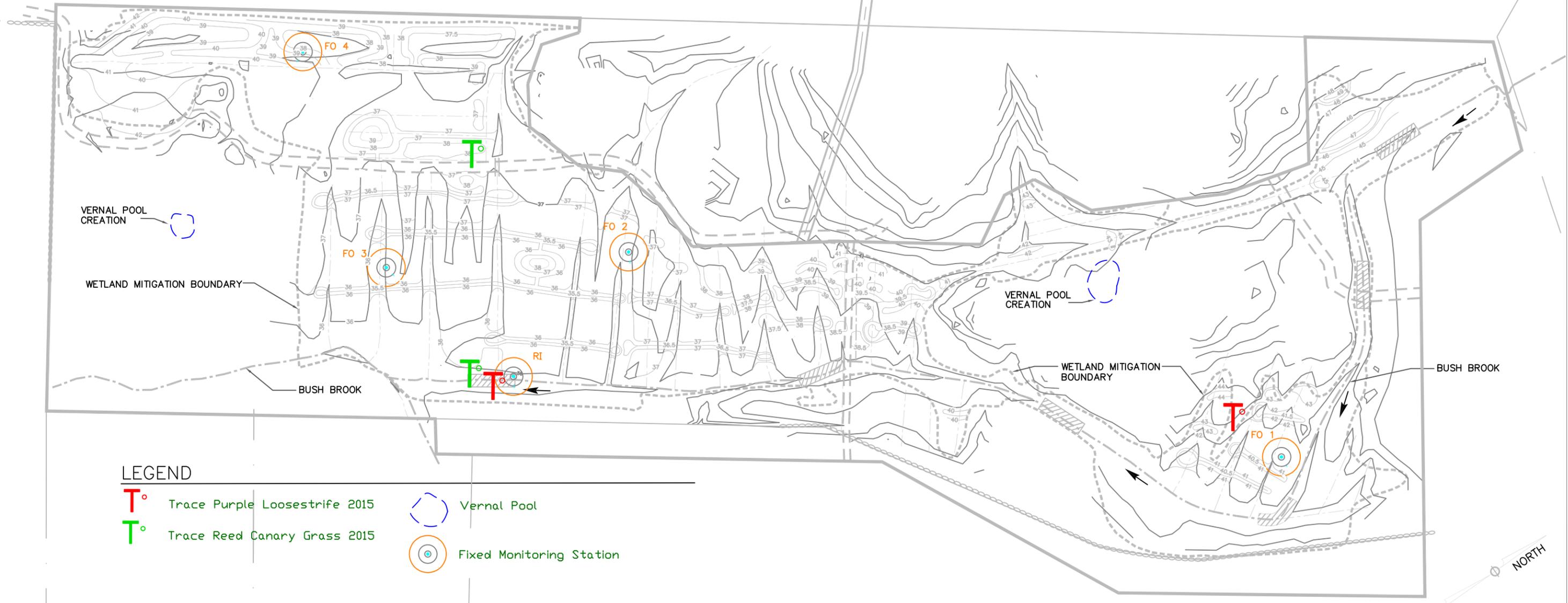


**Figure 2 Planted Stock Survivability**



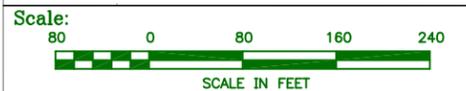
**Table 4 Estimated Woody Stock Survivability and Vigor by Species**

<b>Stock Type</b>	<b>Common Name</b>	<b>Site Survey Quantity</b>	<b>Estimated Survival</b>	<b>Relative Vigor of Live Stock</b>
Wetland Trees	Balsam Fir	900	60%	Fair to Good
	Red Maple	400	98%	Good
	Green Ash	500	90%	Very Good
	Larch	892	98%	Excellent
	American Elm	800	99%	Fair
	Black Willow	600	99%	Good
	Yellow Birch	800	98%	Good
	Grey Birch	800	96%	Good
	Black Ash	300	98%	Very Good
	Black Spruce	150	98%	Good
	Swamp White Oak	600	98%	Excellent
	<b>TOTAL</b>	6,742	6,223	
Wetland Shrubs	Winterberry	800	95%	Good
	Highbush Blueberry	500	98%	Good
	Pussy Willow	900	99%	Good
	Speckled Alder	900	100%	Excellent
	Red Osier Dogwood	500	99%	Very Good
		<b>TOTAL</b>	3,600	3,536
	<b>SITE TOTAL</b>	10,342	9,759	

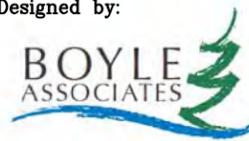


**LEGEND**

- T° Trace Purple Loosestrife 2015
- T° Trace Reed Canary Grass 2015
- Vernal Pool
- Fixed Monitoring Station



Designed by:



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**THE GOLD STAR  
MEMORIAL HIGHWAY**

Biddeford Mitigation  
Invasive Species 2015

No.	Revision	By	Date

	By	Date		By	Date
Designed			Checked		
Drawn			In Charge of		

CONTRACT: \_\_\_\_\_ SHEET NUMBER: \_\_\_\_\_ OF \_\_\_\_\_



## CONCLUSION

All five of the success standards were met on site during the third year of monitoring and the site is developing as anticipated. The results of the third year of monitoring found that the desired functions are developing on site and the site is stable. After the third year of monitoring the prognosis of the site is excellent. Plant densities and herbaceous covers on site are very high. Planting densities at the site are over the success standard of 500 plants per acre and are expected to increase as volunteers continue to colonize at the site. The site hydrology is indicative of wetland conditions and the design objectives have been accomplished. There was no erosion noted on site and all roads, channels and features are stable.

The site has three invasive species but currently none pose an immediate threat to the site. Reed canary grass, cattails, and purple loosestrife were noted in very low numbers. The loosestrife plants were removed. Glossy buckthorn was not present in the site but will be closely monitored at the site in future assessments. The site will continue to be monitored for all invasive species and further remediation measures may be taken if needed to maintain the performance standard.

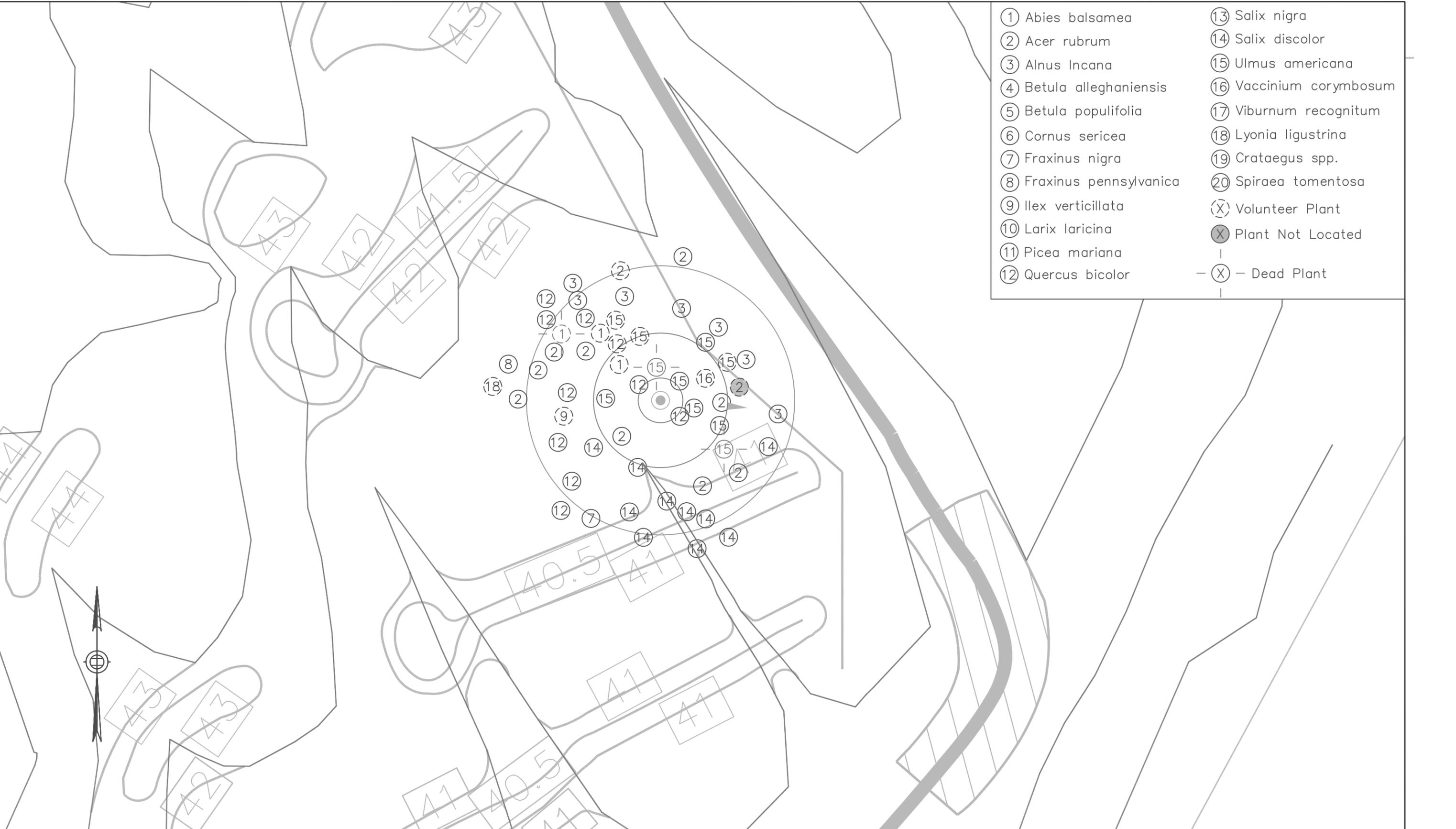
The mitigation site already shows very good wildlife use. Wildlife using the site ranges from small amphibians such as spring peeper to large mammals represented by moose. A diverse assemblage of avian users was noted at the site, and the two vernal pools are being used extensively by breeding amphibians.

The functions and values intended at the site included groundwater recharge, floodflow alteration and storage, water quality improvement (sediment/toxicant retention and nutrient removal), production export, wildlife habitat, and recreational opportunities. Evidence of the targeted functions and values is already found at the site. Most notable are the floodflow alteration and storage, production export, wildlife habitat and recreation.

The third year of monitoring continues to provide evidence that indicates the desired future cover types and functions of the mitigation plan are or will be achieved.

## APPENDIX A Planted Stock Survivability

- ① Abies balsamea
- ② Acer rubrum
- ③ Alnus Incana
- ④ Betula alleghaniensis
- ⑤ Betula populifolia
- ⑥ Cornus sericea
- ⑦ Fraxinus nigra
- ⑧ Fraxinus pennsylvanica
- ⑨ Ilex verticillata
- ⑩ Larix laricina
- ⑪ Picea mariana
- ⑫ Quercus bicolor
- ⑬ Salix nigra
- ⑭ Salix discolor
- ⑮ Ulmus americana
- ⑯ Vaccinium corymbosum
- ⑰ Viburnum recognitum
- ⑱ Lyonia ligustrina
- ⑲ Crataegus spp.
- ⑳ Spiraea tomentosa
- ⊗ Volunteer Plant
- ⊗ Plant Not Located
- ⊖ ⊗ ⊖ Dead Plant



Designed by:

<b>BOYLE ASSOCIATES</b>		<b>HNTB</b> ARCHITECTS ENGINEERS PLANNERS	
Designed	By	Date	Checked
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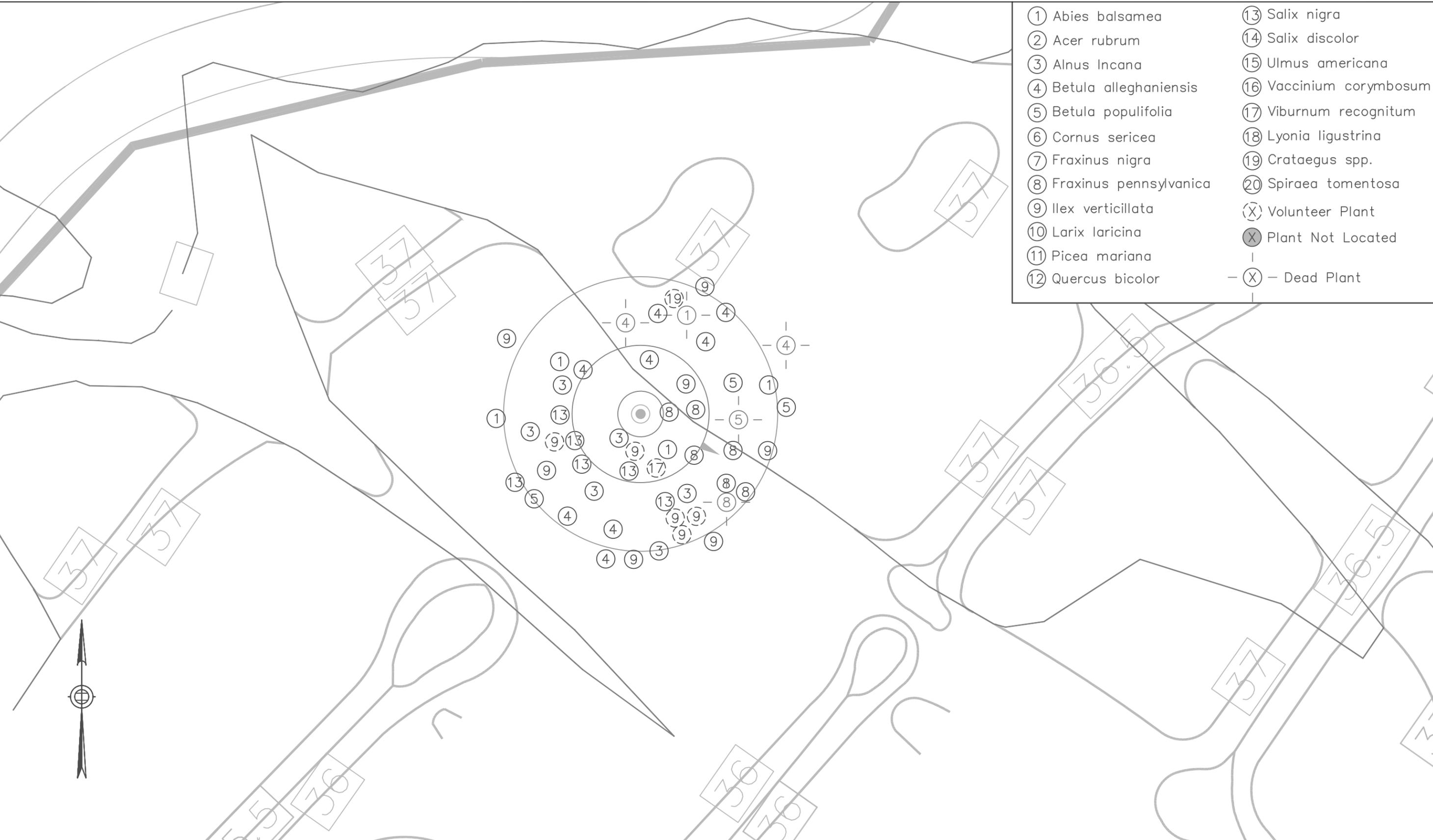
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 FAX (207) 772-7410



## THE GOLD STAR MEMORIAL HIGHWAY

Biddeford Mitigation  
 FO 1 2015

- ① Abies balsamea
- ② Acer rubrum
- ③ Alnus Incana
- ④ Betula alleghaniensis
- ⑤ Betula populifolia
- ⑥ Cornus sericea
- ⑦ Fraxinus nigra
- ⑧ Fraxinus pennsylvanica
- ⑨ Ilex verticillata
- ⑩ Larix laricina
- ⑪ Picea mariana
- ⑫ Quercus bicolor
- ⑬ Salix nigra
- ⑭ Salix discolor
- ⑮ Ulmus americana
- ⑯ Vaccinium corymbosum
- ⑰ Viburnum recognitum
- ⑱ Lyonia ligustrina
- ⑲ Crataegus spp.
- ⑳ Spiraea tomentosa
- (X) Volunteer Plant
- (X) Plant Not Located
- (X) - Dead Plant



Designed by:

Designed	By	Date	Checked
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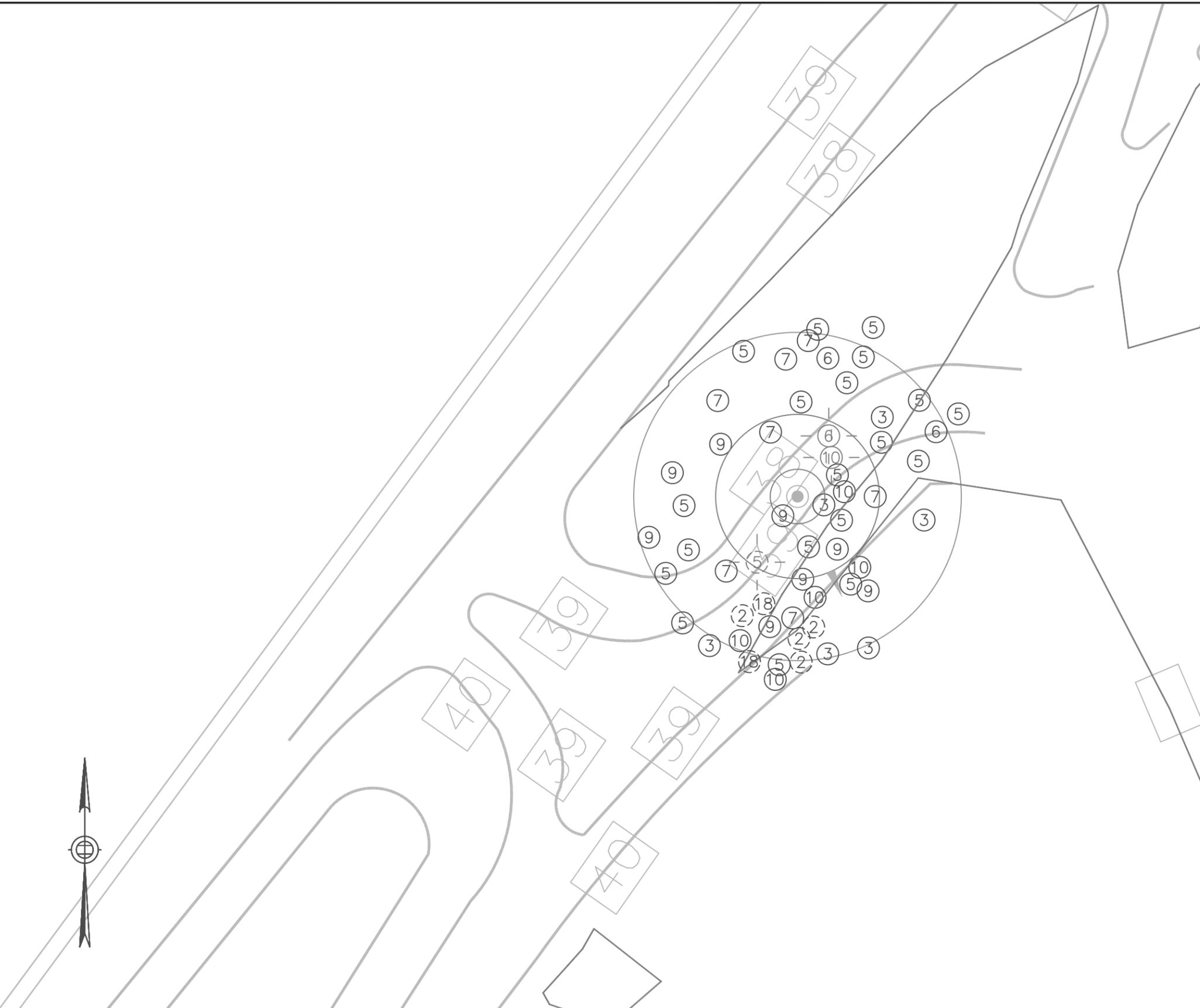


## THE GOLD STAR MEMORIAL HIGHWAY

Biddeford Mitigation  
 FO 2 2015



- ① Abies balsamea
- ② Acer rubrum
- ③ Alnus Incana
- ④ Betula alleghaniensis
- ⑤ Betula populifolia
- ⑥ Cornus sericea
- ⑦ Fraxinus nigra
- ⑧ Fraxinus pennsylvanica
- ⑨ Ilex verticillata
- ⑩ Larix laricina
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- ⑫ Quercus bicolor
- ⑬ Salix nigra
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- ⑮ Ulmus americana
- ⑯ Vaccinium corymbosum
- ⑰ Viburnum recognitum
- ⑱ Lyonia ligustrina
- ⑲ Crataegus spp.
- ⑳ Spiraea tomentosa
- ⓧ Volunteer Plant
- ⓧ Plant Not Located
- ⓧ - Dead Plant



Scale: 0 10' 20'

No.	Revision	By	Date

Designed by:

**BOYLE ASSOCIATES** 

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**THE GOLD STAR  
MEMORIAL HIGHWAY**

Biddeford Mitigation  
FO 4 2015

CONTRACT: \_\_\_\_\_ SHEET NUMBER: \_\_\_\_\_ OF \_\_\_\_\_

- ① Abies balsamea
- ② Acer rubrum
- ③ Alnus Incana
- ④ Betula alleghaniensis
- ⑤ Betula populifolia
- ⑥ Cornus sericea
- ⑦ Fraxinus nigra
- ⑧ Fraxinus pennsylvanica
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- ⑯ Vaccinium corymbosum
- ⑰ Viburnum recognitum
- ⑱ Lyonia ligustrina
- ⑲ Crataegus spp.
- ⑳ Spiraea tomentosa
- (X) Volunteer Plant
- (X) Plant Not Located
- (X) — Dead Plant



Scale: 0 10' 20'

No.	Revision	By	Date

Designed by:

**BOYLE ASSOCIATES**

**HNTB**  
ARCHITECTS ENGINEERS PLANNERS

Designed	By	Date	Checked	By	Date
Drawn			In Charge of		

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**THE GOLD STAR  
MEMORIAL HIGHWAY**

Biddeford Mitigation  
RI 2015

CONTRACT: \_\_\_\_\_ SHEET NUMBER: \_\_\_\_\_ OF \_\_\_\_\_

## APPENDIX B Herbaceous Species

PLOT FO 1

Page 1

8/21/2015

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	PERCENT COVER	COMMENTS
Agrostis alba	Red Top	FACW	45	Dominant
Carex scoparia	Broom Sedge	FACW	15	
Calamagrostis canadensis	Blue-joint Reedgrass	OBL	t	
Lysimachia terrestris	Swamp Candle	OBL	5	
Potentilla simplex	Dwarf/common Cinquefoil	FACU	3	
Solidago rugosa	Wrinkled Goldenrod	FAC	10	
Spiraea latifolia	Meadowsweet	FAC+	45	Dominant
Poa palustris	Fowl Bluegrass	FACW	20	Dominant
Doellingeria umbellata	Parasol White-Top	FACW	5	
Eleocharis palustris	Common Spike-Rush	OBL	15	
Carex Vulpinoidea	Common Fox Sedge	OBL	t	
Juncus effusus	Soft Rush	OBL	20	Dominant
Andropogon virginicus	Broom-Sedge	FACU	t	
Photinia melanocarpa	Black Chokeberry	FAC	20	Dominant
Carex sp.			5	
Iris versicolor	Blue Flag Iris	OBL	2	
Juncus canadensis	Canadian Rush	OBL	2	
Total			212	

PLOT FO 2

Page 1

8/21/2015

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	PERCENT COVER	COMMENTS
Agrostis alba	Red Top	FACW	50	Dominant
Alopecurus pratensis	Field Meadow-Foxtail	FAC	t	
Fragaria virginiana	Virginia Strawberry	FACU	t	
Poa palustris	Fowl Bluegrass	FACW	10	
Potentilla simplex	Dwarf/common Cinquefoil	FACU	25	
Spiraea latifolia	Meadowsweet	FAC+	30	Dominant
Anthoxanthum odoratum	Large Sweet Vernal Grass	FACU	5	
Carex scoparia	Broom Sedge	FACW	3	
Lysimachia terrestris	Swampcandles	OBL	t	
Euthamia graminifolia	Flat-topped Fragrant Gold	FAC	1	
Vicia cracca	Cow Vetch	UPL	t	
Spiraea tomentosa	Steeplebush	FACW	t	
Juncus effusus	Soft Rush	OBL	15	
Iris versicolor	Blue Flag Iris	OBL	1	
Aster sp.			t	
Aster sp.			t	
Vaccinium angustifolium	Lowbush Blueberry	FACU	t	
Total			140	

PLOT FO 3

Page 1

8/21/2015

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	PERCENT COVER	COMMENTS
<i>Agrostis alba</i>	Red Top	FACW	10	Dominant
<i>Symphytotrichum lateriflorum</i>	Farewell-Summer	FAC	t	
<i>Elymus glaucus</i>	Blue Wild Rye	FACU	10	Dominant
<i>Fragaria virginiana</i>	Virginia Strawberry	FACU	3	
<i>Juncus bufonius</i>	Toad Rush	FACW	t	
<i>Lysimachia terrestris</i>	Swamp Candle	OBL	10	Dominant
<i>Alopecurus pratensis</i>	Field Meadow-Foxtail	FAC	8	
<i>Poa palustris</i>	Fowl Bluegrass	FACW	15	Dominant
<i>Potentilla simplex</i>	Dwarf/common Cinquefoil	FACU	35	Dominant
<i>Rosa palustris</i>	Swamp Rose	OBL	5	
<i>Rubus flaeularis</i>	Whiplash Dewberry	FACU	3	
<i>Scirpus atrovirens</i>	Green Bulrush	OBL	5	
<i>Vicia cracca</i>	Cow Vetch	UPL	t	
<i>Juncus effusus</i>	Soft Rush	OBL	10	Dominant
<i>Carex scoparia</i>	Broom Sedge	FACW	6	
<i>Carex lurida</i>	Lurid Sedge	OBL	10	Dominant
<i>Spiraea latifolia</i>	Meadowsweet	FAC+	5	
<i>Solidago</i> sp.			15	Dominant
<i>Eleocharis</i> sp.			4	
Total			154	

PLOT FO 4

Page 1

8/21/2015

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	PERCENT COVER	COMMENTS
Agrostis alba	Red Top	FACW	5	
Alisma plantago-aquatica	Water Plantain	OBL	5	
Carex scoparia	Broom Sedge	FACW	35	Dominant
Eleocharis sp.	Spikerush		5	
Iris versicolor	Blue Flag Iris	OBL	t	
Juncus bufonius	Toad Rush	FACW	5	
Juncus effusus	Soft Rush	OBL	50	Dominant
Potentilla simplex	Dwarf/common Cinquefoil	FACU	t	
Scirpus atrovirens	Green Bulrush	OBL	15	
Solidago gigantea	Giant Goldenrod	FACW	t	
Scirpus cyperinus	Wool Grass	OBL	15	
Juncus effusus	Soft Rush	OBL	4	
Juncus canadensis	Canadian Rush	OBL	3	
Carex lurida	Lurid Sedge	OBL	40	Dominant
Eupatorium perfoliatum	Boneset	FACW	2	
Typha latifolia	Broad-Leaf Cat-Tail	OBL	t	
Rosa palustris	Swamp Rose	OBL	3	
Epilobium coloratum	Purple-Leaf Willowherb	OBL	t	
Lysimachia terrestris	Swampcandles	OBL	t	
Hypericum sp.				
Onoclea sensibilis	Sensitive Fern	FACW	t	
Carex vulpinoidea	Common Fox sedge	OBL	4	
Verbena hastata	Simpler's-joy	FACW	t	
Mimulus ringens	Allegheny Monkey-Flower	OBL	t	
Spiraea latifolia	Meadowsweet	FAC+	5	
Juncus sp.			t	
Scirpus sp.			t	
Total			196	

PLOT RI

Page 1

8/21/2015

SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS	PERCENT COVER	COMMENTS
Agrostis alba	Red Top	FACW	5	
Carex scoparia	Broom Sedge	FACW	15	Dominant
Calamagrostis canadensis	Blue-joint Reedgrass	OBL	25	Dominant
Juncus canadensis	Canadian Rush	OBL	4	
Glyceria canadensis	Canada Manna Grass	OBL	10	
Iris versicolor	Blue Flag Iris	OBL	3	
Juncus bufonius	Toad Rush	FACW	5	
Juncus effusus	Soft Rush	OBL	10	
Lysimachia terrestris	Swamp Candle	OBL	15	Dominant
Poa palustris	Bluegrass	FACW	20	Dominant
Potentilla simplex	Dwarf/common Cinquefoil	FACU	5	
Scirpus cyperinus	Wool Grass	OBL	5	
Spartina pectinata	Freshwater Cord Grass	FACW	10	
Symphotrichum lateriflorum	Farewell-Summer	FAC	5	
Symphotrichum novi-belgii	New Belgium American-Aster	FACW	3	
Carex crinita	Fringed Sedge	OBL	15	Dominant
Solidago gigantea	Giant Goldenrod	FACW	t	
Vicia cracca	Cow Vetch	UPL	t	
Carex intumescens	Greater Bladder Sedge	FACW	5	
Epilobium coloratum	Purple-Leaf Willowherb	OBL	8	
Spiraea latifolia	Meadowsweet	FAC+	4	
Juncus sp.			t	
leersia oryzoides	Rice Cut Grass	OBL	5	
Mimulus ringens	Allegheny Monkey-Flower	OBL	t	
Lycopus virginicus	Virginia Water-Horehound	OBL	3	
Carex gynocrates	Nodding Sedge	OBL	t	
Total			180	

APPENDIX C  
Photographs from Site and Monitoring Stations



**Forested Station 1 – view east**



**Forested Station 2 – view east**



**Forested Station 3 – view east**



**Forested Station 4 – view northeast**



**Riparian Station – view southeast**



**Northern vernal pool – view to northeast**



Site where Reed Canary Grass (*Phalaris arundinacea*) was remediated in 2013 still showing a few remaining plants.



Site where single Purple Loosestrife (*Lythrum salicaria*) plant was found near Forested Station 1.



**Bush Brook in vicinity of Riparian Station – view south**



**Site overview near southern end of site – view northeast.**



**Landowner access road through the site - view northeast.**

APPENDIX D  
Forested Plot 1 Soil Pit Profile



### Soil Pit Located at Forested Plot 1

