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FINAL AREA A WETLAND AND SITE 2B RESTORATION PLAN WITH TRANSMITTAL NSB
NEW LONDON CT
11/26/2012
RESOLUTION CONSULTANTS

Sent via email and hardcopy

November 26, 2012

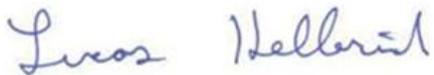
Ms. Kymberlee Keckler
Federal Facilities Superfund Section
United States Environmental Protection Agency (USEPA), Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Subject: Final Area A Wetland Site 2B Restoration Plan
NSB New London, CT
Contract No. N62470-11-8013, CTO WE13

Dear Ms. Keckler:

Per your email approval on November 21, 2012, and on behalf of the Navy, Resolution Consultants is providing the enclosed Final Area A Wetland Site 2B Restoration Plan. This document represents addendums to the remedial design and remedial action work plan for the Area A Wetland Site 2B remediation. This plan will be attached to the post-construction remediation action report. This plan incorporates USEPA's comments transmitted to the Navy on October 31, 2012, November 12, 2012, and November 20, 2012, and USFWS's comments transmitted to the Navy on November 2, 2012 and November 9, 2012.

Sincerely,



Lucas Hellerich, PhD, PE, LEP
Activity Coordinator, NSB NLON

w/Attachment

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FINAL AREA A WETLAND SITE 2B
RESTORATION PLAN
Navy Submarine Base
New London, CT

Prepared for:



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Norfolk, VA 23511-3095

Comprehensive Long-Term Environmental Action Navy
Contract Number N62470-11-D-8013

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November 26, 2012

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1.0 GENERAL INFORMATION AND PROJECT DESCRIPTION

This Wetland Restoration Plan (WRP) has been developed on behalf of the United States Department of the Navy under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract as part of the Removal Action Plan for the proposed restoration of impacted wetlands at the Naval Submarine Base in New London, Connecticut as a means to restore previously impacted wetland resources. The impacts to wetland areas are the result of historical releases. Existing remedial activities to mitigate these impacts include excavation of the soils to meet project action limits as well as site restoration.

The Naval Submarine Base-New London (NSB-NLON) site is bounded on the east by Connecticut Route 12, on the south by Crystal Lake Road, and on the west by the Thames River. The northern border is a low ridge that trends approximately east-southeast from the Thames River to Baldwin Hill. NSB-NLON currently provides a base command for submarine activities in the Atlantic Ocean. It also provides housing for Navy personnel and their families, support submarine training facilities, military offices, medical facilities, and facilities for submarine maintenance, repair, and overhaul.

The wetland restoration plan includes restoring impacted areas by backfilling excavated areas with clean soils, planting of native species, and adding topographic relief to increase habitat heterogeneity within the relatively flat wetland.

1.1 Area A Wetland Site 2B Description

Area A Wetland is approximately 19-acres in size and situated within the Thames River watershed in the northeast portion of the Naval Submarine Base. The Wetland is bounded by a large parking lot to the south, a storage facility to the north, Route 12 and an access road to the north and east.

The Area A Wetland is a relatively flat-lying, swampy, vegetated area with areas of open water (generally shallow) scattered across the wetland area. The largest section of continuous open water is a small pond located on the southern portion of the wetland characterized by depths of 1 to 3 feet (ft). The soft organic sediments that characterize this wetland supports a monospecific community consisting of only the invasive common reed (*Phragmites australis*). Wetland A is underlain by dredge spoils that consist of silt and clay with traces of fine sand and shell fragments. The thickness of dredge spoils ranges from 25 to 35 feet on the southern side of the wetland, adjacent to the landfill, and from 10 to 15 feet on the northeastern side of the wetland. The total volume of dredged material previously disposed in the wetland is approximately 1.2 million cubic yards.

2.0 Restoration Areas

The Navy proposes to restore impacts to Area A Wetland caused by excavation associated with the remedial actions conducted in the wetland to remove previously contaminated soils. The Navy implemented invasive species control, in cooperation with the CTDEEP Wetlands habitat and Mosquito Management Program's Phragmites Control Team, initiated the a phragmites program in 2010 to control the phragmites within the wetland. The agreement between the Navy and CT DEEP ended at the end of 2011. The activities conducted under the invasive species control program are described in Section 6.0

2.1 Proposed Restoration

This WRP provides restoration measures designed to restore and improve wetland functions and values, including habitat value that may be affected following excavation efforts. Restoration will include native tree, shrub, and seed mix installation to control erosion as well as the creation of topographic relief whose design incorporates construction of forested and shrub-shrub (woody), emergent, and stream channels throughout restoration areas. With the addition of the woody areas and stream channels the wetland will gain bank resource and promote edge habitat improvements. These improvements include construction of approximately 36,400 square feet (sf) of woody areas. These improvements will result in a contiguous system that is influenced by surface water and will be supplemented by a seed installation program in the remaining restoration areas and maintained according to the ongoing invasive species control program. The plan is provided in Appendix A.

2.2 Restoration Sequence

The restoration will be conducted in the following sequence:

1. Construct slightly elevated woody areas/channels (Fall 2012)
2. Plant trees and shrubs (Fall 2012)
3. Mow Phragmites and apply winter rye mix (Fall 2012)
4. Apply herbicide treatment for Phragmites (late Spring 2013)
5. Apply wetland seed mix (Spring 2013, approximately 3 to 4 weeks after herbicide treatment)
6. Monitor restoration performance.

3.0 Grading Plan

The grading plan includes five restoration areas within Area A Wetland that will be graded to original pre-excavation elevations by backfilling the areas with clean soil to match pre-excavation conditions, between elevations 65 ft and 71 ft. Within the restoration areas eight or more woody areas will be constructed to elevations 1 to 2 ft above original pre-excavation grade, which can vary between each restoration area (see Plan attached). Four or more proposed stream channels will be graded to 6 to 8 inches below original elevation and to a width of approximately 5 to 6 ft.

4.0 Planting Plan

The planting plan includes a variety of woody species and seed mixes to enhance vegetation diversity within the wetland. This will also stabilize disturbed and/or exposed soil in a timely fashion and direct and ensure the establishment of a variety of wetland plant communities within each Restoration Areas (see Plan attached). It is anticipated that at the time of final grading, soil temperature and site conditions may not be appropriate for transplantation and seed germination. Therefore, the restoration areas will be stabilized with an approved winter rye seed mix, with approximately 1 inch of straw mulch, and subsequently planted at a more appropriate time. Late fall and early winter dormant seeding require an increase in the seeding rate. Due to cooler fall temperatures it is suggested that all areas including seeded areas should be mulched to protect against frost. Planting and seeding should not be conducted in standing water. Spring sowing of wetland seed mix will be conducted at 2 lbs/acre, with light mulching (approximately 1/2 inch).

The elevated areas, approximately eight, will be constructed and planted with a variety of woody species within the wetland restoration areas. Trees and shrubs proposed for each restoration area were selected based on current hydrologic regime and existing plant communities as well as their compatibility with the local environment including adjacent woodlands. Commercially available plants and seeds grown from certified native wetland suppliers will be utilized to accomplish this goal. The planting plan has been designed to provide a variety of wetland plant species to promote species richness, enhance wildlife edge habitat, and improve the aesthetics and functionality of the wetland system.

The table at the end of this section provides the composition of the proposed wetland seed mixes that are to be applied within the restoration areas. Only plant materials native and indigenous to the region will be used. Species not specified in this restoration plan will not be used without written approval from a wetland scientist. No cultivars or hybrids of native species shall be used. Quantities of each type may increase or decrease pending availability. Also, sizes may vary such that some types may not be available in 4-6 ft and a 3-4 ft size may be needed.

The following notes further clarify the proposed planting programs:

Wetland Restoration Areas

1. A wetland seed mix will be hand broadcast or hydro-seeded at appropriate rates throughout all areas of the wetland restoration areas to create an herbaceous groundcover. Acceptable wetland seed mixes include the Northeast Wetland Diversity Mix as shown in Table 1 below as

an approved wetland seed mix for the wetland areas. Comparable alternative sources may be approved by the wetland scientist. Following seeding, mulch will be evenly dispersed over the graded areas as a loose layer of straw approximately 1 inch or less in thickness. In addition to herbaceous seeding referenced above, woody plantings proposed will be planted at a cumulative density resulting from trees spaced at 10 ft apart and shrubs spaced at shrubs at 5 to 8 ft apart. Woody species were selected based on wetland indicators, facultative (FAC) (50/50%) or facultative wetland (FACW) (>67%) which indicate the probability/ability of the plant species to exist in the wetland. These plantings are shown on Table 2 below. Mulch will be used around woody plantings in an 18 inch diameter circle approximately 2 inches deep. Weed suppression mats around the plantings will be used.

2. The survival standard is >75% survival for trees and >75% survival for shrubs. The survival standard will be in place for two years.

During planting, a qualified professional may relocate up to 50% of the plantings if as-built conditions would pose an unreasonable threat to the survival of plantings installed according to the restoration plan. Regulatory consultation will be conducted if more than 20% of the plantings are to be relocated. To reduce the immediate threat and minimize the long-term potential of degradation, the species included on the "Invasive and Other Unacceptable Plant Species" list of the New England District Mitigation Plan Guidance shall not be included as planting stock in the overall Project (United States Army Corps of Engineers – New England District, January 2007). Only plant materials native and indigenous to the region shall be used.

5.0 Erosion Control

Implementation of erosion control measures will be initiated in compliance with the construction restoration measures. During the construction process the erosion control barriers will be maintained on a regular basis and remain in place until the disturbed area is stabilized. Erosion control barriers will also be installed along wetland restoration boundaries until the grading and plantings within the areas are complete. Extra erosion control materials will be kept on-site to be used for any maintenance of the installed erosion control barriers. These erosion control materials will also be available on an as needed and/or emergency basis to prevent unanticipated erosion and sedimentation that may occur.

Temporary devices and structures to control erosion and sedimentation in and around restoration areas will be properly maintained at all times. These devices and structures will be disassembled and properly disposed of as soon as the site is stable.

6.0 Maintenance and Monitoring for Invasive and Noxious Species

It is acknowledged that soils and sediments disturbed by projects are very susceptible to undesirable species recruitment. Because of the nature of the work, there is a higher risk of invasive and noxious species infiltration particularly since phragmites already inhabits the adjacent areas and Area A wetlands. A *Phragmites* control plan was established for the site and included biannual mowing (spring 2010 and winter 2010/2011) followed by herbicide application (summer 2010 and summer 2011). The initial mowing and herbicide treatment were completed in 2010. The second mowing was completed in February 2011 and the second herbicide treatment was completed in October 2011. After the *Phragmites* has been removed and the area shows signs of recovery, the Navy will work with MIDLANT and the regulatory agencies to assess natural recruitment and coordinate potential future restoration measures.

It is suggests that established herbicide maintenance protocols continue following restoration to retard future *Phragmites* regrowth. This will include mowing and herbicide applications outside of the woody species clusters located within the planted forested/scrub-shrub areas. Other invasive species that have the potential of occupying the site wetlands and should be monitored include Purple Loosestrife (*Lythrum salicaria*) and Reed Canary Grass (*Phalaris arundinacea*), both of which to date have not occurred in the wetland or anywhere else at SUBASENLON.

The Navy and its designee will monitor the on-site restoration areas and invasive species control for a period of three years. The sites shall be monitored for the growing season of years 1, 2, and 3 following plantings of the restoration areas. Observations will occur at least two times during the growing season - in late spring/early summer and again in late summer/early fall.

Remedial measures will be implemented - one year prior to the completion of the monitoring period - to attain the success standards described below within two growing seasons after completion of construction of the restoration site(s). Should measures be required prior to the end of the original monitoring period, the monitoring period will be extended to ensure two years of monitoring after the remedial work is completed. Measures requiring earth movement or changes in hydrology will not be implemented without written approval from the USEPA.

At least one reference site adjacent to or near the restoration sites will be described and shown on a locus map.

Performance Standards

- 1) Target hydroperiod, patterns of inundation and drawdown based on, and corresponding to, similar conditions found in adjacent wetlands, must be met, within two weeks at the beginning and end of the growing season. Hydrologic conditions within the restoration areas will be monitored to ensure the objectives of the plan are met. It is acknowledged that hydrologic regimes will vary within the restoration areas; for instance, tree and shrub plantings, in higher elevations, will have slightly different hydrological conditions (presumably a lower water table and shorter hydroperiod) than the lower-lying portions of the restoration areas. Measuring hydrologic conditions will be conducted by collecting hydrologic data at designated sample points within the restoration areas and the adjacent wetland for reference. One sample point will be located within each restoration area and two reference sample points will be located in the adjacent wetland. The restoration sample location points should include at least three restoration/enhancement woody areas. These location points shall be designated by a wetland scientist and identified on the appropriate plan, again using stratified random location procedures. Sample location determination will be based on field conditions and on the objectives of the plan (e.g., near planting areas and/or areas that provide an average representation of hydrologic condition in a given restoration area).

Hydrologic data will be collected from these same locations during each monitoring event. Soil saturation or inundation should be present within 12 inches of the surface for at least 2 consecutive weeks of the growing season in years when there is no recorded drought. Soil saturation can be measured directly or based on observable attributes that indicate the site meets the project goals and objectives. Soil saturation, within enhancement areas, can be measured directly by digging soil pits, or using a hand held auger, and measuring the distance between soil saturation and soil surface. The reference sample in the adjacent wetland should be located at elevations similar to the sample location within the restoration areas (elevations are depicted on the site plan). Hydrology data shall be recorded on the Army Corps of Engineers' wetland data forms or similar form. Hydric soil indicators should be recorded on the forms as well. If the hydroperiod is not met, engineering controls will be implemented, e.g. altering the weir height. Supplemental watering will be required or other modifications to the plan may be warranted to establish wetland hydrology if draught conditions occur.

- 2) The proposed vegetation diversity and/or density goals for woody plants from the plan are met as specified on the planting schedule. At least 75% survival for all planted shrubs and 75% survival of all planted trees of each planned woody zone. Volunteer species should

support functions consistent with design goals. To count a species, it should be at least 24 inches in height. The performance standards for density can be assessed using either total inventory or quadrant sampling methods, depending upon the size and complexity of the site.

- 3) The planned scrub-shrub and forested cover types shall have at least 60% cover by non-invasive hydrophytes, including at least 15% cover by woody species. To document that the vegetation planting plan is achieving the success rate objective, the monitoring program will include vegetation plot surveys and data collection. Vegetation survey plots will be designated throughout the restoration areas based on planting locations that will be finalized in the field by the direction of a wetland scientist. Survey locations shall include areas of forested/scrub-shrub plant clusters as well as seeded areas. It is proposed that survey plots be established in at least two locations for each restoration area, one within the forested/scrub-shrub planted portion of the areas and the second within the lower elevations. Designated locations and number of plots will be determined by a wetland scientist using stratified random location procedures and identified on the appropriate plan. Data will be collected from the same location during each monitoring event.

During each monitoring event survey plots will be photographed facing west whenever possible. Aerial percent cover for each plant species as well as bare ground percentage shall be collected and recorded. The 1987 Corps of Engineers Wetland Delineation Manual and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: North central and Northeast Region criteria and wetland data forms can be used to record data during each event; the form used shall be consistent for each event. Plot size shall be one square meter, or a measured size that will be determined in field during the first monitoring survey and can be replicated during each event. It is acknowledge that plot size may vary in each restoration area due to site conditions; however each plot specifications shall be recorded in such a way it can be easily duplicated during the each monitoring event. In the event vegetation mortality exceeds the 25% threshold, additional plantings will be required. The restoration areas shall have at least 50 percent vegetative cover rate of hydrophytic plants (regional indicator status of FAC, FACW, or OBL) and at least 95% areal cover by native species. Until canopy coverage exceeds 30%, the average height of all woody stems of tree species including volunteers, must increase by not less than an average of 10% per year by the third (Year 3 following construction) monitoring year. Typically, planned scrub-shrub and forested cover type standards require at least

60% cover by non-invasive hydrophytes, including at least 15% cover by woody species (Army Corps of Engineers, Northeast Region).

- 4) The third year (Year 3) monitoring report shall contain documentation that all vegetation within the restoration areas are healthy and thriving and the average tree height of all established and surviving trees is at least 4 feet in height.
- 5) Other invasive species that have the potential of occupying the site are:
 - Purple loosestrife (*Lythrum salicaria*)
 - Reed Canary Grass (*Phalaris arundinacea*)
 - Common reed (*Phragmites australis*)

For this standard, small patches must be eliminated during the entire monitoring period. Large patches must be aggressively treated and the treatment documented. All invasive species (combined) will contribute less than 15% of the total plant cover and will be monitored during the monitoring events.

- 6) All slopes, soils, substrates, and constructed features within and adjacent to the restoration site(s) shall be stable. These features will be monitored and documented during each monitoring event. Evidence of erosion will be documented, photographed, and located on the site plan. If features continue to erode or require immediate repair further stabilized with appropriate methods and material shall be performed. Stabilizing measures can include seeding exposed soil, stabilizing slopes with approved geotech fabrics or similar material, stream channel stabilization with the use of coir rolls or mats. All additional efforts conducted to stabilize the restoration sites will be included in the monitoring report.

Monitoring Reports

Monitoring reports should generally include the following format:

- 1) *Project Overview (1 page)*

Highlighted summary of problems which need immediate attention (e.g., problem with hydrology, severe invasive species problem, serious erosion, major losses from herbivory, etc.). This should be at the beginning of the report.

2) Requirements

List all restoration-related requirements as specified in this plan.

3) Summary Data

Summary data that substantiates the success and/or potential challenges associated with the restoration project should be provided. Photo documentation should be provided to support the findings and recommendations, and placed in the Appendix.

- Address performance standards achievement and/or measures to attain the standards.
- Describe the monitoring inspections, and provide their dates, that occurred since the last report.
- Concisely describe remedial actions done during the monitoring year to meet the performance or success standards – actions such as replanting, controlling invasive plant species (with biological, herbicidal, or mechanical methods), regrading the site, applying additional topsoil or soil amendments, adjusting site hydrology, etc. Also describe any other remedial actions done at the site.
- Report the status of all erosion control measures on the compensation site(s).

Are they in place and functioning? If temporary measures are no longer needed, have they been removed?
- Give visual estimates of
 - (1) percent vegetative cover for each restoration site and
 - (2) percent cover of the invasive species listed under Performance Standard Nos. (5) above, in each restoration area.
- Identify what wildlife uses the site and what the uses are (nesting, feeding,

shelter, etc).

- By species planted, describe the general health and vigor of the surviving plants the prognosis for their future survival, and a diagnosis of the cause(s) of morbidity or mortality.

4) Maps/Plans

Maps can be provided to show the location of the restoration site relative to other landscape features, habitat types, locations of photographic reference points, transects, sampling data points, and/or other features pertinent to the restoration plan. In addition, the submitted maps/plans must clearly delineate the restoration site boundaries to assist in proper locations for subsequent site visits.

5) Conclusions

A general statement describing the conditions of the restoration project. If performance or success standards are not being met, a brief discussion of the difficulties and potential remedial actions proposed, including a timetable, can be provided.

6) Monitoring Report Appendices

Appendix A -- An as-built plan showing topography to 1-foot contours, any inlet/outlet structures and the location and extent of the designed plant community types (e.g., forested, scrub-shrub, emergent, open water). Within each community type the plan shall show the species planted—but it is not necessary to illustrate the precise location of each individual plant. There can also be a soil profile description and the actual measured organic content of the topsoil. This can be included in the first monitoring report unless there is grading or soil modifications or additional plantings of different species in subsequent years.

Appendix B – A vegetative species list in each plant community type. The species list should, at a minimum, include those that cover at least 5% of their vegetative layer.

Appendix C -- Representative photos of each restoration area taken from the same locations for each monitoring event. Photos should be dated and clearly labeled with the direction from which the photo was taken. The photo sites must also be identified on the appropriate maps.

7.0 Post Construction Assessment

Annual monitoring of the restoration area will be conducted, which will include a quantitative survey of woody planting survival (preferably beginning and end of the growing season), semi-quantitative evaluation of herbaceous groundcover, and presence of invasive species. Annual reports will be produced with action items addressed within 3-6 months of documentation.

A post-construction assessment of the condition of the restoration areas shall be performed following the third growing season after completion of the restoration area construction, or by the end of the monitoring period, whichever is later. "Growing season" in this context begins no later than May 31st. The assessment report shall be submitted to the USEPA by December 15 of the year the assessment is conducted.

The post-construction assessment shall include the assessment appendices listed below and shall:

- Summarize the location and extent of the designed plant community types on an as-built plan. The as-built with topography to 1-foot contours, will show any inlet/outlet structures and the location and extent of the designed plant community types. Soil profile descriptions and actual measure organic content of the topsoil will be included in the first monitoring report unless grading or soil modifications or additional plantings of different species in subsequent years. An as-built plan
- Provide a vegetation species list in each plant community type, include those that cover at least 5% of their vegetative layer.
- Provide representative photos of each restoration areas taken from the same location for each monitoring event. Photos should be dated and clearly labeled with the direction from which the photo was taken. The photo sites must also be identified on the appropriate maps.

ASSESSMENT APPENDICES:

Appendix A -- Summary of the results of a functions and values assessment of the restoration site(s), using the same methodology used to determine the functions and values of the impacted wetlands.

Appendix B -- Calculation of the area by type (e.g., wetlands, vernal pools) of aquatic resources in each restoration site. Wetlands should be identified and delineated using the Corps Wetlands Delineation Manual and approved regional supplements. Supporting documents shall include (1) a scaled drawing showing the aquatic resource boundaries and representative data plots and (2) datasheets for the corresponding data plots.

Appendix C -- Comparison of the area and extent of delineated constructed aquatic resources (from Appendix B) with the area and extent of created aquatic resources proposed in the restoration plan. This comparison shall be made on a scaled drawing or as an overlay on the as-built plan. This plan shall also show any major vegetation community types.

Appendix D -- Photos of each restoration area will be taken from the same locations as the monitoring photos.

Table 1

Wetland Seed Mix

Botanical Name	Common Name	Wetland Indicator	Percent of Seeds by Weight
<i>Scirpus atrovirens</i>	Green Bulrush	OBL	28.82%
<i>Juncus effuses</i>	Soft Rush	FACW	13.05%
<i>Mimulus ringens</i>	Monkey Flower	OBL	12.01%
<i>Carex vulpinoidea</i>	Fox Sedge	OBL	8.35%
<i>Penthorum sedoides</i>	Ditch Stone Crop	OBL	7.83%
<i>Glyceria grandis</i>	Reed Meadowgrass	NL	6.68%
<i>Scirpus cyperinus</i>	Wool Grass	FACW	5.22%
<i>Verbena hastate</i>	Blue Vervain	FACW	4.18%
<i>Eupatorium perfoliatum</i>	Boneset	FACW	2.09%
<i>Leersia oryzoides</i>	Rice Cut Grass	OBL	1.57%
<i>Helenium autumnale</i>	Common Sneezeweed	FACW	1.48%
<i>Glyceria canadensis</i>	Canada Mannagrass	OBL	1.36%
<i>Eupatorium maculatum</i>	Spotted Joe Pye Weed	FACW	0.89%
<i>Aster novae-angliae</i>	New England Aster	FAC	0.73%
<i>Alisma plantago-aquatica</i>	Mud Plantain	OBL	0.52%
<i>Euthamia graminifolia</i> (Solidago g.)	Grass Leaved Goldenrod	FAC	0.47%
<i>Solidago rugosa</i>	Wrinkled Goldenrod	FAC	0.47%
<i>Cyperus strigosus</i>	Straw Colored Flatsedge	FACW	0.47%
<i>Aster puniceus</i>	Purple Stemmed Aster	OBL	0.42%
<i>Cephalanthus occidentalis</i>	Buttonbush	OBL	0.38%
<i>Scirpus tabernaemontanii</i>	Soft Stem Bulrush	OBL	0.36%
<i>Aster umbellatus</i>	Flat-Top White Aster	FACW	0.35%
<i>Carex comosa</i>	Bearded Sedge	OBL	0.31%
<i>Carex crinita</i>	Fringed Sedge (Nodding)	OBL	0.26%
<i>Solidago gigantean</i>	Giant Goldenrod	FACW	0.24%
<i>Panicum clandestinum</i>	Deer Tongue	FAC	0.24%
<i>Bidens cernua</i>	Nodding Bur Marigold	OBL	0.22%
<i>Sium suave</i>	Water Parsnip	OBL	0.21%
<i>Scirpus microcarpus</i>	Small Fruited Bulrush	OBL	0.18%
<i>Cicuta maculate</i>	Water Hemlock	OBL	0.16%
<i>Elymus canadensis</i>	Wild Rye	FACW	0.10%
<i>Bidens frondosa</i>	Devil's Beggar-Ticks	FACW	0.08%
<i>Angelica atropurpurea</i>	Purple-Stem Angleica	OBL	0.06%
<i>Rumex verticillatus</i>	Water Dock	OBL	0.05%
<i>Carex lurida</i>	Lurid Sedge (Shallow)	OBL	0.05%
<i>Polygonum pensylvanicum</i>	Pennsylvania Smartweed	FACW	0.04%
<i>Asclepias incarnata</i>	Swamp Milkweed	OBL	0.04%
<i>Elymus riparius</i>	Riverbank Wild Rye	FACW	0.03%
<i>Carex lupulina</i>	Hop Sedge	OBL	0.02%
<i>Iris versicolor</i>	Blue Flag	OBL	0.01%

OBL	Obligate Wetland	Occurs almost always (estimated probability 99%) under natural conditions in wetlands.
FACW	Facultative Wetland	Usually occurs in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
FACU	Facultative Upland	Usually occurs in non-wetlands (estimated probability 67%-99%), but occasionally found on wetlands (estimated probability 1%-33%).
UPL	Obligate Upland	Occurs in wetlands in another region, but occurs almost always (estimated probability 99%) under natural conditions in non-wetlands in the regions specified. If a species does not occur in wetlands in any region, it is not on the National List.

Table 2

Woody Species Plantings

Cover type	Scientific Name	Common Name	Wetland Indicator	Size	¹ Total Quantity
Trees	<i>Acer rubrum</i>	Red Maple	FAC	3 to 4 feet	30
	<i>Quercus bicolor</i>	Swamp White Oak	FACW	3 to 4 feet	30
	<i>Salix nigra</i>	Black Willow	FACW	3 to 4 feet	35
	<i>Betula nigra</i>	River Birch	FACW	3 to 4 feet	35
	<i>Platanus occidentalis</i>	Sycamore	FACW	3 to 4 feet	40
	<i>Acer saccharinum</i>	Silver Maple	FACW	3 to 4 feet	30
	<i>Populus deltoides</i>	Cottonwood	FACW	3 to 4 feet	8
					Total Trees
² Shrubs	<i>Alnus incana</i>	Speckled Alder	FACW	18 to 24 inches	75
	<i>Spiraea alba</i>	Meadow Sweet	FAC	18 to 24 inches	75
	<i>Salix discolor</i>	Pussy Willow	FACW	18 to 24 inches	75
	<i>Morella pensylvanica</i>	Northern Bayberry	FAC	18 to 24 inches	75
					Total Shrubs
				<i>Total Woody Species</i>	508

Note 1: Quantities are based on woody species being planted at 500/acre, at 10 feet (trees) and 5 to 8 feet (shrubs) in clusters.

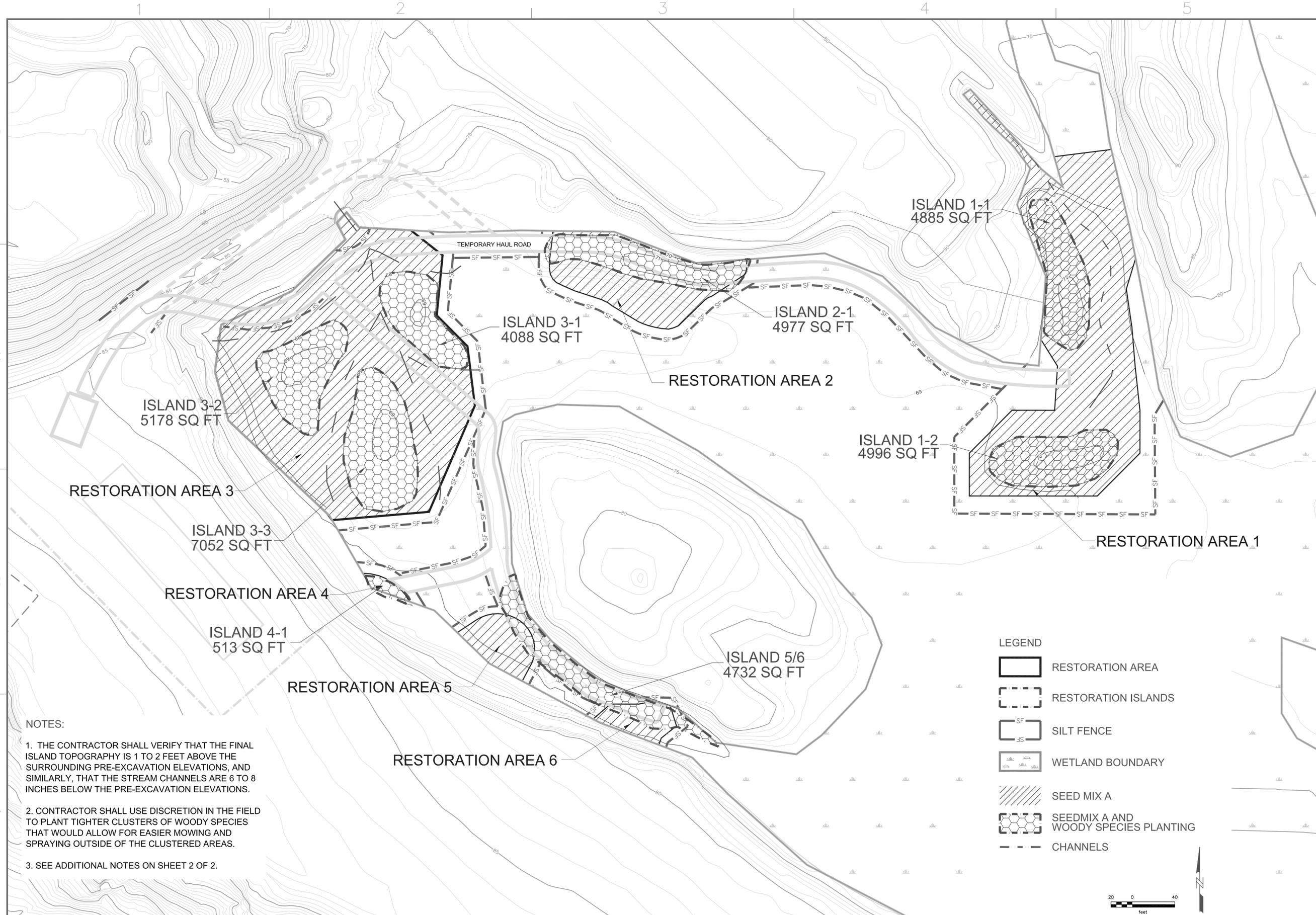
Note 2: Redosier dogwood (*Cornus sericea*) (FACW) can be used as an alternative shrub species.

OBL	Obligate Wetland	Occurs almost always (estimated probability 99%) under natural conditions in wetlands.
FACW	Facultative Wetland	Usually occurs in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands.
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%).
FACU	Facultative Upland	Usually occurs in non-wetlands (estimated probability 67%-99%), but occasionally found on wetlands (estimated probability 1%-33%).
UPL	Obligate Upland	Occurs in wetlands in another region, but occurs almost always (estimated probability 99%) under natural conditions in non-wetlands in the regions specified. If a species does not occur in wetlands in any region, it is not on the National List.

Appendix A

Restoration Plan Figure

FILE NAME: W:\Gov\Projects\Wetland Restoration\Wetland_Restoration_Plan_2B.dwg LAYOUT NAME: Layout1 PLOTTED: Friday, November 16, 2012 - 1:27pm USER: sanchetaz



- NOTES:**
1. THE CONTRACTOR SHALL VERIFY THAT THE FINAL ISLAND TOPOGRAPHY IS 1 TO 2 FEET ABOVE THE SURROUNDING PRE-EXCAVATION ELEVATIONS, AND SIMILARLY, THAT THE STREAM-EXCAVATION CHANNELS ARE 6 TO 8 INCHES BELOW THE PRE-EXCAVATION ELEVATIONS.
 2. CONTRACTOR SHALL USE DISCRETION IN THE FIELD TO PLANT TIGHTER CLUSTERS OF WOODY SPECIES THAT WOULD ALLOW FOR EASIER MOWING AND SPRAYING OUTSIDE OF THE CLUSTERED AREAS.
 3. SEE ADDITIONAL NOTES ON SHEET 2 OF 2.

- LEGEND**
- RESTORATION AREA
 - RESTORATION ISLANDS
 - SILT FENCE
 - WETLAND BOUNDARY
 - SEED MIX A
 - SEEDMIX A AND WOODY SPECIES PLANTING
 - CHANNELS



APPROVED	A/E INFO
FOR COMMANDER NAVFAC	
ACTIVITY	
SATISFACTORY TO DATE	11/16/2012
DES	AES
DRW	AES
CHK	JS/LH
<<PM/DM>>	LH
BRANCH MANAGER	XX
CHIEF ENGINEER	XXX
<<XX>>	

DEPARTMENT OF THE NAVY
 NAVAL FACILITIES ENGINEERING COMMAND ~ AECOM
 NEW LONDON, CT
AREA A WETLAND SITE 2B
 WETLAND RESTORATION PLAN

SCALE:	1:40
PROJECT NO.:	
CONSTR. CONTR. NO.:	
NAVFAC DRAWING NO.:	
SHEET	1 OF 2

DATE PLOTTED: 11/16/2012 1:27 PM

Table 1: Wetland Seed Mix

Botanical Name	Common Name	Wetland Indicator	Percent of Seeds by Weight
Scirpus atrovirens	Green Bulrush	OBL	28.82%
Juncus effuses	Soft Rush	FACW	13.05%
Mimulus ringens	Monkey Flower	OBL	12.01%
Carex vulpinoidea	Fox Sedge	OBL	8.35%
Pentstemon sedoides	Ditch Stone Crop	OBL	7.83%
Glyceria grandis	Reed Meadowgrass	NL	6.68%
Scirpus cyperinus	Wool Grass	FACW	5.22%
Verbena hastata	Blue Vervain	FACW	4.18%
Eupatorium perfoliatum	Boneset	FACW	2.09%
Leersia oryzoides	Rice Cut Grass	OBL	1.57%
Helenium autumnale	Common Sneezeweed	FACW	1.48%
Glyceria canadensis	Canada Mannagrass	OBL	1.36%
Eupatorium maculatum	Spotted Joe Pye Weed	FACW	0.89%
Aster novae-angliae	New England Aster	FAC	0.73%
Ailisma plantago-aquatica	Mud Plantain	OBL	0.52%
Euthamia graminifolia (Solidago g.)	Grass Leaved Goldenrod	FAC	0.47%
Solidago rugosa	Wrinkled Goldenrod	FAC	0.47%
Cyperus strigosus	Straw Colored Flatsedge	FACW	0.47%
Aster puniceus	Purple Stemmed Aster	OBL	0.42%
Cephalanthus occidentalis	Buttonbush	OBL	0.38%
Scirpus tabernaemontanii	Soft Stem Bulrush	OBL	0.36%
Aster umbellatus	Flat-Top White Aster	FACW	0.35%
Carex comosa	Bearded Sedge	OBL	0.31%
Carex crinita	Fringed Sedge (Nodding)	OBL	0.26%
Solidago gigantea	Giant Goldenrod	FACW	0.24%
Panicum clandestinum	Deer Tongue	FAC	0.24%
Bidens cernua	Nodding Bur Marigold	OBL	0.22%
Sium suave	Water Parsnip	OBL	0.21%
Scirpus microcarpus	Small Fruited Bulrush	OBL	0.18%
Cicuta maculata	Water Hemlock	OBL	0.16%
Elymus canadensis	Wild Rye	FACW	0.10%
Bidens frondosa	Devil's Beggar-Ticks	FACW	0.08%
Angelica atropurpurea	Purple-Stem Anglica	OBL	0.06%
Rumex verticillatus	Water Dock	OBL	0.05%
Carex lurida	Lurid Sedge (Shallow)	OBL	0.05%
Polygonum pensylvanicum	Pennsylvania Smartweed	FACW	0.04%
Asclepias incarnata	Swamp Milkweed	OBL	0.04%
Elymus riparius	Riverbank Wild Rye	FACW	0.03%
Carex lupulina	Hop Sedge	OBL	0.02%
Iris versicolor	Blue Flag	OBL	0.01%

This mix is intended to enhance diversity of wetland plantings. There are seeds of 40 species included, over one third of which are not ordinarily available as either plants or seeds for wetland restoration in the northeast. The mix is produced using hand collected seed from western New York and northwestern Pennsylvania; only a limited amount is available. It is intended that this mix will be most valuable when used as a supplement to planting of whole plants. Spring sowing of wetland seed mix will be conducted at 2 lbs/acre, with light mulching (approximately 1/2 inch). The seed will not germinate under water and is best sown in drawdown areas.

Planting Notes

Site preparation notes:

- Construction of the wetland restoration areas and restoration islands will be limited to the work areas defined on the site plans. All activities will be carried out in compliance with the work described on the plan. All work will follow the construction sequence which includes direct site supervision by a designated wetland scientist and follow-up monitoring of the plantings proposed in the plan.
- Prior to the start of construction, Agencies will be provided with a list of the names, addresses, and telephone numbers for the project supervisor and all of the individuals responsible for the supervision of the wetland mitigation work and the landscaping and planting program.
- Prior to the start of site preparation work, all sedimentation and erosion control fencing will be installed by the Contractor as shown on the site plans and approved by the wetlands scientist. Straw bales or other erosion control devices will be staked with wooden stakes as shown on the site plan details. Additional erosion control fencing or staked straw bales will be installed at the direction of the wetland scientist or Agent to minimize the threat of adverse impact during the construction process. An adequate supply of replacement erosion control fencing and hay bales will be available on-site for emergency purposes. Erosion control structures will be inspected on a regular basis and maintained in good order until all exposed soils are vegetated and stable. Plants will not be planted in standing water conditions. Inspections after storm events will be performed in accordance with the plan.
- The wetland restoration areas previously excavated will be backfilled to within 8-12 inches of the proposed final grade; the final grade of the restoration areas is intended to match that of pre-excavation elevation as well as match the immediate surround wetland. Clean topsoil will be transported into the restoration areas to bring the grades to the final elevations shown on the plan. Soil in the wetland restoration areas will be finished with a light-tracked vehicle and the soil prepared with a shallow rake pulled over the soil surface and prepared for plantings and seed mixtures.
- Dewatering operations may be employed during topsoil placement and shall be done with the use of perforated PVC pipes in rock-lined sumps (or via a comparable means designed to reduce sediment in the pumped waters); water pumped from the sumps will be directed to a sedimentation basin or other temporary sediment trap such as sedimentation filter bag.
- Wetland seed mix will be broadcast at appropriate rates throughout the wetland restoration areas to create an herbaceous groundcover layer. Late fall and winter dormant seeding require an increase in the seeding rate as dictated by Wetland Scientist. The seed mix will include Northeast Wetland Diversity Mix (Southern Tier Consulting, Inc., West Clarksville, NY), or comparable mixes as appropriate. Comparable alternative sources may be approved by the wetland scientist. Following seeding, mulch will be evenly dispersed over the graded areas as a loose layer of straw approximately 1 inch in thickness. Spring sowing of wetland seed mix will be conducted at 2 lbs/acre, with light mulching (approximately 1/2 inch).
- Restoration Areas will be seeded with Seed Mix A, see tables.

Tree and shrub planting notes:

- Trees and shrubs will be planted within the vegetated islands as listed in the table. The table includes a quantity of each species per island. The species should be randomly planted in clusters on the islands at roughly 10-foot spacing for trees and roughly 5 to 8 foot spacing for shrubs. The wetland scientist will direct the actual locations of all plantings.
- Shrub and tree plantings in Restoration Areas (1, 2, 3, 4, 5, and 6) will be conducted by first raking the surface to break-up and aerate topsoil. Planting holes must be dug no deeper than the root ball as measured from the trunk flare to the bottom of the ball or as deep as the root system, but not much deeper. Planting holes dug deeper than the root ball often result in the settling of the plant above the trunk flare and structural roots which can result in the root ball being planted too deep. Research shows that the fibrous or absorbing roots of most woody plants are usually found within the top 6 to 12 inches of soil, and since root development often extends beyond the canopy or drip line, it is now recommended that the plant area be loosened and aerated at 3 to 5 times the diameter of the root ball. Plants will not be planted in standing water conditions.
- Planting containerized stock, dig the hole before removing shrub from containers. Thoroughly water the containerized plant. Remove metal or plastic containers completely. Before putting root ball in the prepared hole, cut any long roots that completely encircle the root ball. Gently pull other roots away from the ball and spread them out. Backfill soil directly around roots. Mulch and fertilizes as described by provider.
- If the planting areas consist of excessively sandy or light soil backfill with one part organic rich soil to two parts original soil. Dig the hole larger than generally recommended, but set the plant no deeper than root ball as measured from the trunk flare to the bottom of the ball or as deep as the root system. Backfill with the prepared mix and add at least 3-inch layer of mulch outward from the trunk to a point 6 inches beyond the width of the planting hole. Water thoroughly once a week in the summer and fall. Water-soluble fertilizer can be used in the first watering and again once or twice during the first season.
- If necessary, topsoil will be placed over the restoration area to form at least a 6-inch layer of adequate top soils. Additional organic matter such as well-decomposed clean leaf compost or other soil amendments (if more readily available than clean leaf compost) will be used for the appropriate percent organic carbon content.
- When topsoil must be stockpiled on the site, the following guidelines will be followed to maintain moisture in the soil: Approval for location of stockpile material will be provided by owner/engineer; avoid stockpiling compost organics in piles over 4 feet in height; protect stockpiles from surface water flow and contain them with straw bales and/or silt fence; cover stockpiles with a material that prevents erosion (tarps, erosion control mat, straw and temporary seed, depending on size and duration of storage); inspect and repair protection measures listed above regularly (weekly), as well as prior to (to the extent possible) and after storm events; and maintain moisture in the soils during droughty periods.
- The Speckled Alder (*Alnus incana*) tree should be selected and checked to ensure that a different variety of alder is not used.

Table 2:Woody Species Plantings

Cover type	Scientific Name	Common Name	Wetland Indicator	Size	Total Quantity
Trees	<i>Acer rubrum</i>	Red Maple	FAC	3 to 4 feet	30
	<i>Quercus bicolor</i>	Swamp White Oak	FACW	3 to 4 feet	30
	<i>Salix nigra</i>	Black Willow	FACW	3 to 4 feet	35
	<i>Betula nigra</i>	River Birch	FACW	3 to 4 feet	35
	<i>Platanus occidentalis</i>	Sycamore	FACW	3 to 4 feet	40
	<i>Acer saccharinum</i>	Silver Maple	FACW	3 to 4 feet	30
	<i>Populus deltoides</i>	Cottonwood	FACW	3 to 4 feet	8
		Total Trees			208
Shrubs	<i>Alnus incana</i>	Speckled Alder	FACW	18 to 24 inches	75
	<i>Spiraea alba</i>	Meadow Sweet	FAC	18 to 24 inches	75
	<i>Salix discolor</i>	Pussy Willow	FACW	18 to 24 inches	75
	<i>Morella pensylvanica</i>	Northern Bayberry	FAC	18 to 24 inches	75
		Total Shrubs			300
	Total Woody Species			508	

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DEPARTMENT OF THE NAVY
 NAVAL FACILITIES ENGINEERING COMMAND - AECOM
 NEW LONDON, CT

AREA A WETLAND SITE 2B
 PLANTING DETAILS

SCALE: XX
 EPROJECT NO.:
 CONSTR. CONTR. NO.:
 NAVFAC DRAWING NO.:
 SHEET 2 OF 2