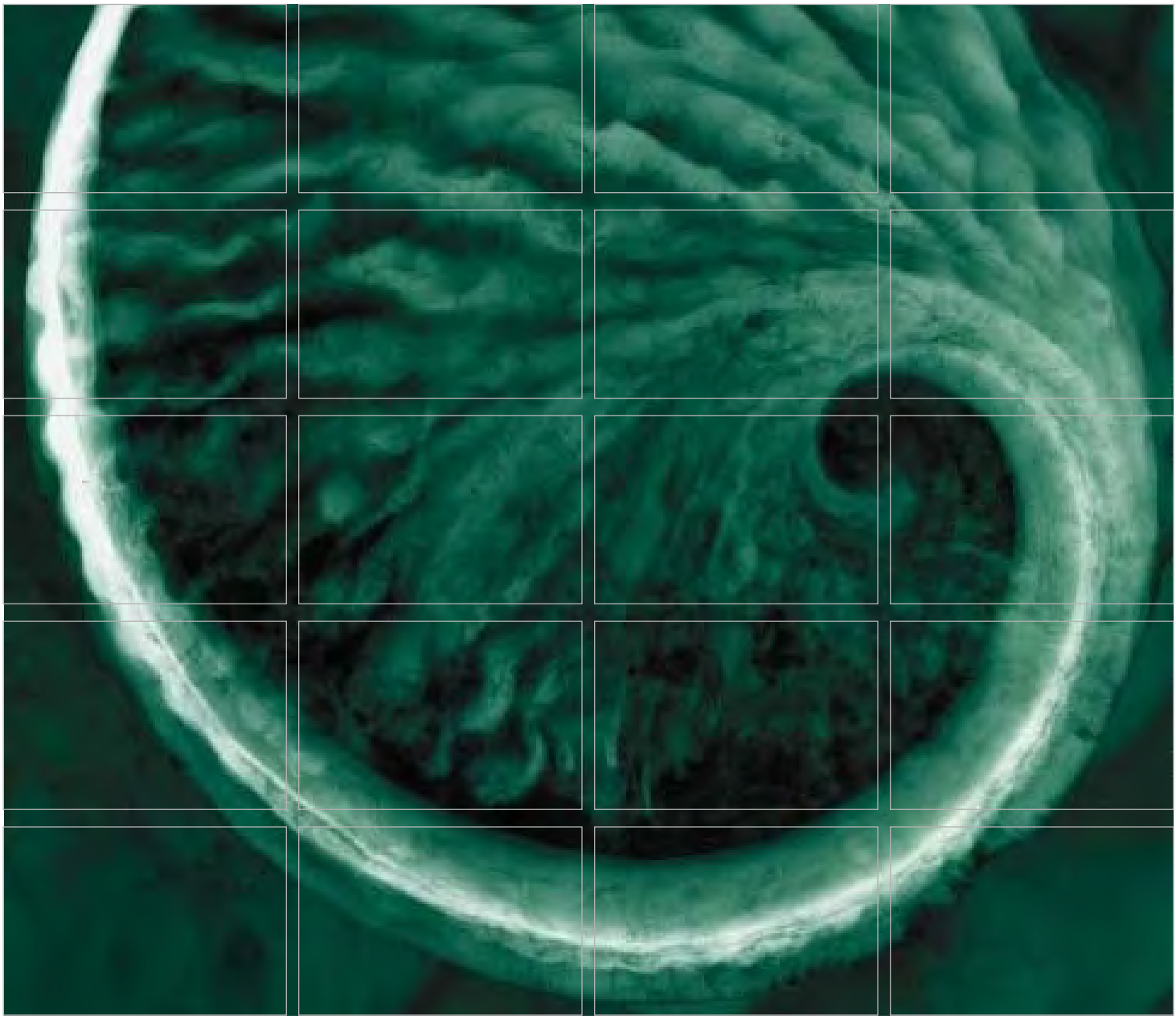

2009 Wetland Restoration Monitoring Report

Raytheon Company

Former Raytheon Facility
430 Boston Post Road
Wayland, Massachusetts

MassDEP File No. 322-0647

25 September 2009

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FINAL REPORT

Raytheon Company

2009 Wetland Restoration Monitoring Report

430 Boston Post Road

Wayland, Massachusetts

25 September 2009

MassDEP File #322-0647

ERM Reference: 0095922

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1.0 PROJECT OVERVIEW

On behalf of Raytheon Company (Raytheon), Environmental Resources Management (ERM) has prepared this 2009 Wetland Restoration Monitoring Report to present results of the second and final year of monitoring for the Northern Area wetland at the Former Raytheon Facility at 430 Boston Post Road in Wayland, Massachusetts (Site). These restoration and monitoring activities have been conducted as required by the Order of Conditions (OOC) issued by the Town of Wayland Conservation Commission (Commission) on 8 August 2006 (Commission, 2006) for DEP File No. 322-0647. A site locus map and site plan are provided as Figure 1 and Figure 2, respectively.

The project involved restoring an approximately 1,339 square foot (ft^2) area by re-establishing the hydrology, topography, and scrub-shrub plant community of this linear drainage feature disturbed by the excavation of volatile organic compound-impacted soils in the adjacent buffer zone (ERM, 2006a). While construction activities only impacted approximately 543 ft^2 of wetland, wetland impacts were mitigated through restoration at a 1:2.4 ratio, resulting in approximately 1,339 ft^2 of wetland restoration area (ERM, 2008). A Restoration Plan dated 14 June 2006 (ERM, 2006b) was submitted to the Commission to provide specifications for restoring the wetland and accepted through the issuance of the OOC. The construction and plant installation was completed on 4 October 2007.

The planting regime in the restored wetland area mimicked the pre-existing native vegetative cover in the disturbed wetland and the adjacent wetland area. No trees or saplings were present in the disturbed wetland; therefore, the restoration area was planted with a mix of four shrubs and an herbaceous layer of sensitive fern. Planted stock was purchased from Bigelow Nurseries of Northborough, Massachusetts. A summary of planted stock is provided in Table 1. The wetland restoration area was also seeded with a native seed mix, Wet Detention Basin and Moist Site Mix, prepared by New England Wetland Plants (NEWP). The buffer zone was seeded using NEWP New England Dry Site Mix.

In accordance with OOC, wetland monitoring was conducted for 2 years subsequent to the completion of construction; monitoring activities are now complete. The success standards established in the OOC have been met. This report summarizes the results of the monitoring conducted after two full growing seasons.

2.0 2009 MONITORING RESULTS

2.1 STANDARDS FOR SUCCESS

The OOC issued to conduct the remediation and restoration established standards for success to ensure that the project could be objectively evaluated to determine whether the restoration area was developing into the desired resource type and providing the expected functions. The OOC requires the survival of 90 percent of the planted stock in the restoration area after two full growing seasons. In addition, the Massachusetts Wetlands Protection Act (MWPA) requires at least 75 percent coverage of native wetland species after two growing seasons. Both the first and second year monitoring results indicate that 100 percent of the planted stock is thriving, the area is 100 percent vegetated, and the restoration area has become a functional scrub-shrub wetland that provides valuable wildlife habitat and flood storage (ERM, 2009).

2.2 2009 SUMMARY DATA

ERM wetland scientists conducted wetland monitoring on 3 June and 3 August during the 2009 growing season. Wetland monitoring involved conducting a survey of shrubs and herbaceous plants installed in 2007 as well as a meander survey to identify other plant species present in the restoration area. Photographs taken during monitoring are included as Appendix A.

2.2.1 *Hydrology*

Post-construction topographic elevations were surveyed by a Massachusetts Professional Land Surveyor and found to be generally consistent with the pre-existing wetland area. The restoration area was constructed to afford a subtle negative slope toward the adjacent wetland areas to recreate the pre-existing hydrology. Based on field observations during the growing season, hydrologic conditions indicate saturation ranging from 6 to 10 inches below ground surface depending on the location within the restoration area and seasonal precipitation cycles. In accordance with the Restoration Plan, a silt-clay confining layer was installed below the organic topsoil in the restoration area in order to reduce surface water infiltration. Based on the 2009 monitoring results,

the confining layer is effectively maintaining saturated conditions in the restoration area.

Current hydrologic conditions in the restoration area are consistent with adjacent/downstream wet meadow and scrub-shrub wetlands.

2.2.2 Soils

Post restoration soil profiles show the constructed soil surface layers to be approximately 16 inches in depth and consisting of at least 12 inches of sandy loam high in organic matter content. The remaining 4 inches consist of low-permeability silty-clay soil. The organic topsoil used in the restoration area was manufactured off Site by Newland Farm of Norton, Massachusetts to ensure the proper organic matter content and that the soil was free of seeds of exotic or invasive species.

Currently, soils in the restoration area are too young in the development of hydric soil morphology to show indicators. However, the frequently saturated nature of these soils during the growing season and high organic content is consistent with the definition of a hydric soil (New England Hydric Soils Technical Committee, 2004).

2.2.3 Vegetative Cover and Survival of Planted Stock

On 3 August 2009, ERM collected vegetation data from the restoration area. The 1,339 ft^2 restoration area is 100 percent vegetated with native, non-invasive species. The survivorship of planted herbaceous stock is 100 percent after two growing seasons. Table 1 presents a summary of the plants installed in 2007 and the results of the 2009 monitoring for survival of planted stock.

Monitoring events in 2009 also included meander surveys to identify additional plant species present in the restoration area but not specifically planted during the restoration in 2007. These plants are either from the seed mix planted in the restoration area or are native, early colonizers. Table 2 presents a summary of the meander survey results, excluding those species included in the survey of planted stock.

Five species were identified from the original seed mixes planted in the restoration area. Virginia wild rye (*Elymus virginicus*) had the highest areal coverage of this group. It is possible that other species from the seed mix not encountered during annual monitoring may be present at low population levels.

The restoration area exhibits a diversity of native plant species and the area is expected to continue to naturalize over time. An invasive species purple loosestrife (*Lythrum salicaria)* was present in the restoration area; however, only one individual plant was identified and the individual plant was removed during monitoring activities. This species is not currently considered a detriment to the diversity of native species in the restoration area.

3.0 2009 MONITORING CONCLUSIONS

The restoration area continues to meet the success criteria established by the OOC (90 percent survival of planted stock) and MWPA (75 percent coverage of native, wetland species). The hydrologic functions and values of this wetland have been restored. The restoration area exhibits a diversity of native plant species and the area is expected to continue to naturalize over time. No invasive species were present in significant numbers in the restoration area. The restoration area is providing valuable wildlife habitat as a scrub-shrub wetland. Based on the continued success of the restoration over two full growing seasons, the project is complete and no further monitoring is proposed.

The 2009 monitoring activities conclude the second year of the 2-year monitoring program. A request for Certificate of Compliance will be submitted to the Commission for concurrence on the completion of the wetlands restoration.

5.0 REFERENCES

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Tables

Table 1
Summary of Survival of Wetland Planted Stock
Former Raytheon Facility
Wayland, Massachusetts

Common Name	Scientific Name	Comments	Number Planted	Number Located in 2009
Planted Species				
Pussy Willow	*Salix discolor*	Planted as proposed, one plant noted as stressed	32	32
Meadowsweet	*Spiraea latifolia*	Planted in place of *Spirea tometosa*	32	32
Steeplebush	*Spiraea tomentosa*	Subsitution (*Spirea latifolia*)	0	0
Arrow wood	*Viburnum dentatum*	Planted as proposed	32	32
Silky Dogwood	*Cornus amomum*	Planted as proposed	32	32
Sensitive Fern	*Onoclea sensiblis*	Planted as proposed	350	350+

Seed Mix	Name	Application Rate
New England Wetland	Restoration Mix for Detention Basins and Moist Sites	1 lb/1,250 ft^2

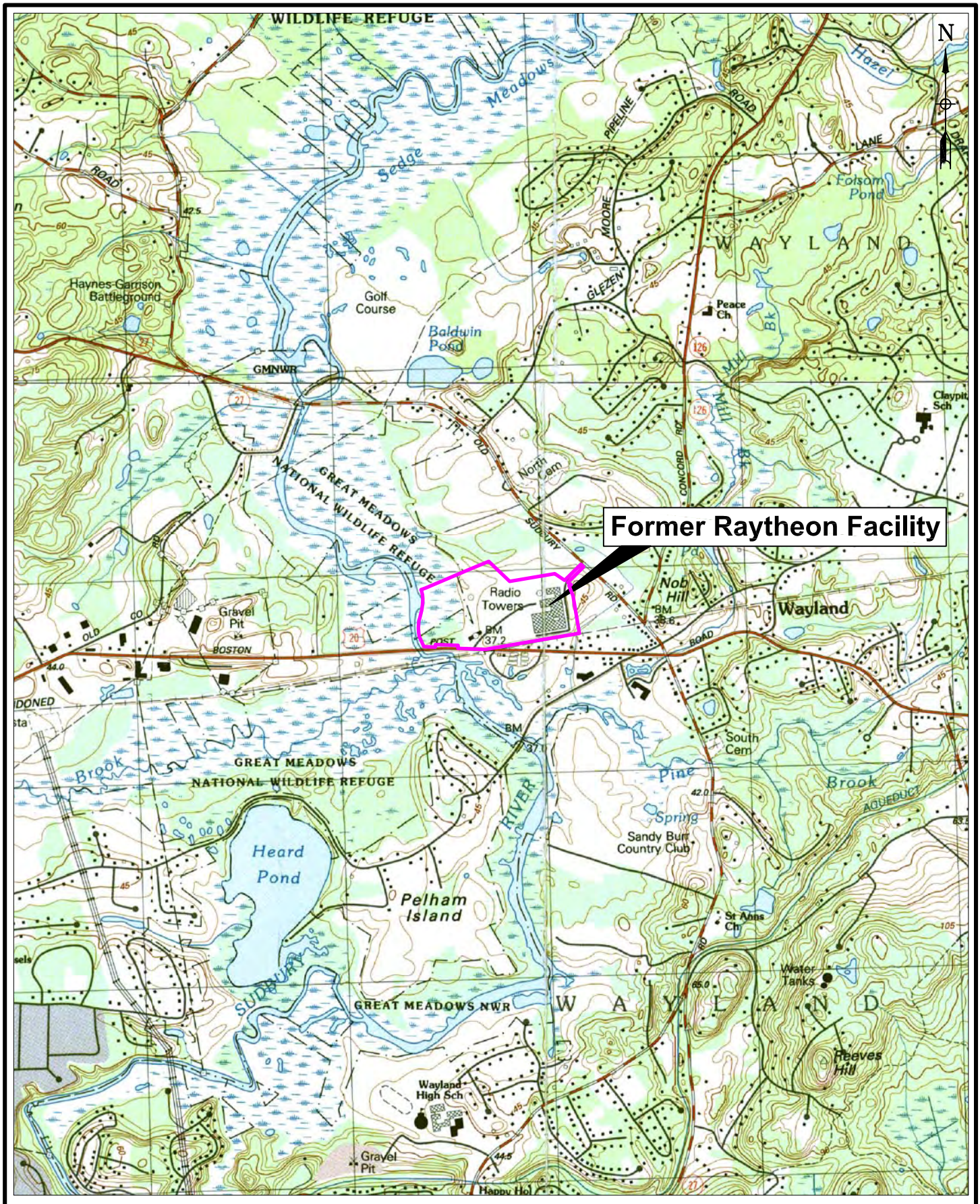
Notes:
All plants purchased from Bigelow Nurseries, Northborough, MA.
Steeplebush not available from Bigelow. Species substituted with Meadowsweet (*Spirea latifolia*).
lb = Pound.
ft^2 = Square feet.

Table 2
Summary of Plant Meander Surveys
Former Raytheon Facility
Wayland, Massachusetts

Scientific Name	Common Name	Origin
Panicum rigidulum	Red top	V
Eupatorium perfoliatum	Boneset	V
Elymus virginicus	Virginia wild rye	S
Solidago sp.	Goldenrod	V
Chamerion angustifolium	Fireweed	V
Polygonum persicaria	Lady's thumb	V
Euthamia graminifolia	Grass-leaved goldenrod	S
Verbena hastata	Blue vervain	S
Phleum pratense	Timothy grass	V
Cyperus eragrostis	Umbrella sedge	V
Polypogon sp.	Rabbit's foot	V
Bidens sp.	Beggar's tick	V
Carex vulpinoidea	Foxtail sedge	S

Notes:
S = Seeded.
V = Volunteer/native early colonizer.
All data collected by ERM on 3 August 2009.

Figures



Scale 1:25,000

0.5 km 0 500 m

0.5 mi 0 1,000 ft

Legend

Subject Property Line

Figure 1 - Site Locus Map
Former Raytheon Facility - Wayland, MA

ERM

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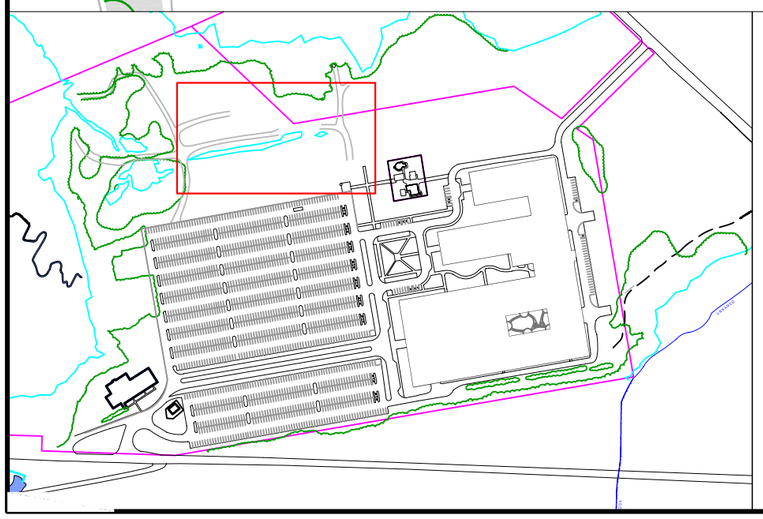
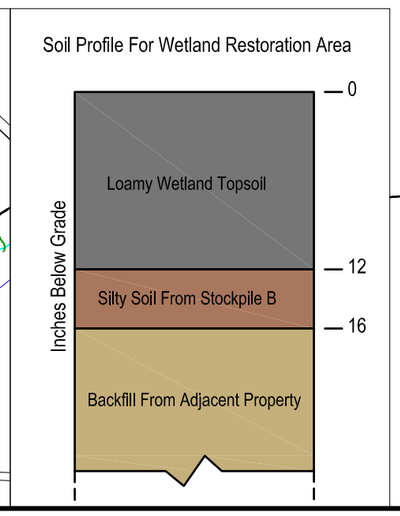
MW-265M
MW-265D
MW-265S
MW-553
MW-552
MW-261S
MW-551
Infiltration Gallery
MW-32
WLF
Existing Contour, Typ.
Area of Restoration (1,339 sf.)
Bordering Vegetated Wetland
100 ft Buffer Zone
N





Legend
- Property Line
- Delineated Wetland Boundary
- 100' Wetland Buffer Zone
- Treeline

Scale (1"=40')
20' 0 20' 40' 80'

Figure 2 -Wetland Restoration Area Site Plan
Former Raytheon Facility - Wayland, MA

ERM

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Appendix A
Photographs

Photograph 1 – Blue vervain in restoration area (3 August 2009)

Photograph 2 – Diversity of native species in restoration area (3 August 2009)

Photograph 3 – Restoration Area looking northwest (3 August 2009)

Photograph 4 – Restoration Area looking east (3 August 2009)

Photograph 5 – Restoration area with buffer zone in foreground (3 August 2009)

Photograph 6 – Restoration area looking northwest. Note black willow in foreground (3 August 2009)

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