

Annual Monitoring of Wetland Enhancement & Wetland Replacement Sites



Department of the Army Permit No. CENAE-2004-488

Connecticut DEP, WQC - 20050280 (PGP)

**Town of Enfield Inland Wetlands & Watercourses Agency
Wetland Permit IW#444, 444.02, 444.03**

**Benderson Development Company, Inc.
570 Delaware Avenue
Buffalo, NY 14202**

**GZA GeoEnvironmental, Inc.
(formerly Baystate Environmental Consultants, Inc.)
1350 Main Street, Suite 1400
Springfield, MA 01103**

December 31, 2011



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Project Information

Project Summary: The project is a Hampton Inn and restaurant complex located at the intersection of Route 190 & Phoenix Avenue, Enfield CT. The Hampton Inn has been constructed although the restaurant construction continues to be pending at this time, but is entirely within the built parking lot and other infrastructure as part of the existing constructed site.

The construction of the site involved the direct utilization of about $2.5\pm$ acres of the 18.7 acre parcel. Of this area, $2.1\pm$ acres were constructed in uplands and $0.43\pm$ acres were constructed in wetlands. The wetlands impacted for purposes of site development were the northern-most wetlands that evidenced disturbed characteristics; historic fill, *Phragmites* and other invasive species growth. Principal functional values for these wetlands were limited to acting as marginal wetlands wildlife habitat and some sedimentation/nutrient control and retention.

Long-term mitigation of impacts to wetlands required by the wetland permits included the following:

1. Revegetation of disturbed portions of the buffer zone following grading;
2. Stormwater management basin controls with enlarged natural culvert bottom to enhance connectivity between wetlands on either side of access road;
3. Control of invasive species;
4. Enhancement of *Phragmites* impacted wetlands by removal of *Phragmites* (Site A. $0.37\pm$ acres; location 41 59'17.43" N, 72 35'10.97" W).
5. Construction of replacement wetlands at the southerly extreme of the parcel (Site B. $0.42\pm$ acres; location 41 59'11.83" N, 72 35'06.54" W).

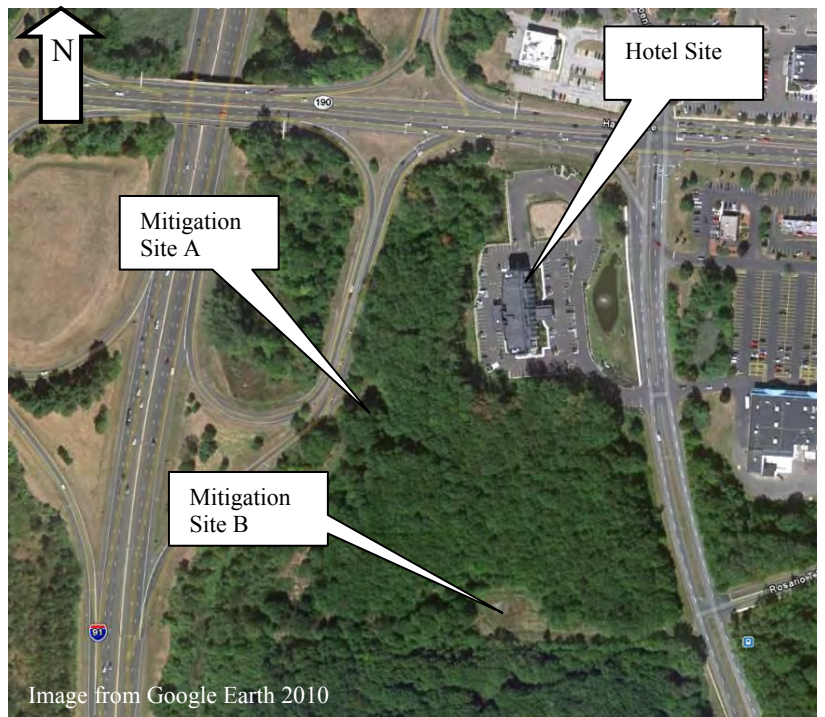
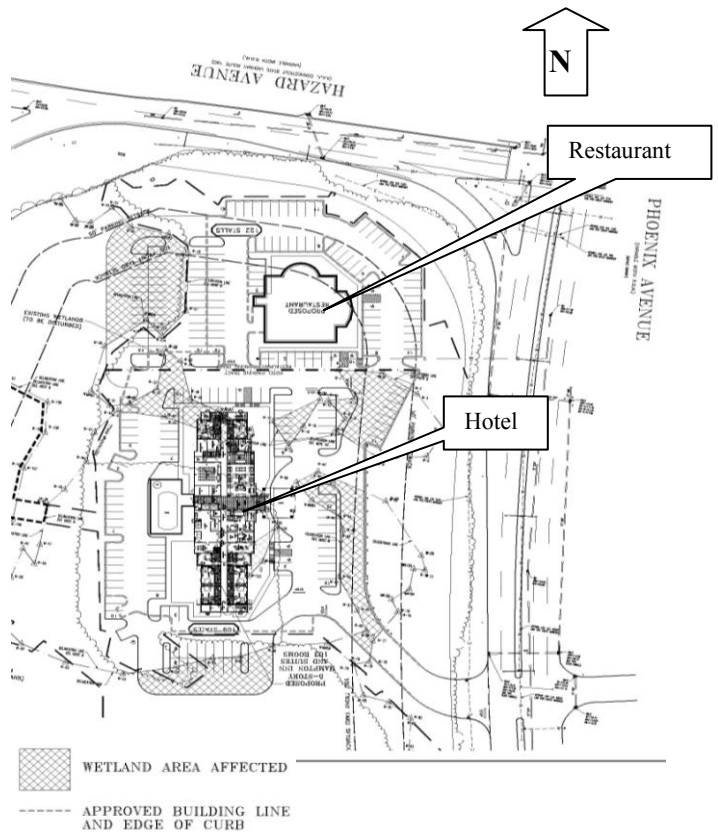


Image from Google Earth 2010

This report focuses primarily upon the status and successful implementation of items 4 & 5 above (Mitigation Sites A & B)

Construction History: Overall site construction was initiated in 2007, with permission, to pre-load the site for geotechnical stability. The construction site was cleared and stabilized with erosion controls. However, the long-term mitigation measures were delayed until early 2008 for construction. Construction of the mitigation sites was completed in August of that year, making 2009 the first full growing season since construction. A progress report was provided in February 2009, which included the documentation of seed and purchased/planted herbaceous plugs, trees and shrubs.

Construction Status Summary Table – Wetland Mitigation at Hampton Inn, Enfield CT				
	Mitigation Site A	Mitigation Site B	Stormwater Basin	Buffer Zone
Type	Enhancement	Replacement	Wetland basin	Enhancement /restoration
Size (acres)	0.37	0.42	0.4	
Features	<i>Phragmites</i> removal; stream restoration; emergent (0.12± ac.), shrub & tree planted wetlands (0.25± ac.)	Intermittent open water/emergent (12± ac.); shrub & tree planted wetlands (0.3 ± ac.)	Emergent & shrub planted wetland treatment basin	Shrub & tree plantings
Pre-Construction Meeting	3-25-08	3-25-08	3-25-08	3-25-08
Project Start	3-26-08	3-28-08	11-2007	11-2007
Rough Grading	4-16-08	4-3-08	11-2007	11-2007
Wetland Soil Addition	5-2-08	4-23-08	5-7-08	9-18-08
Plantings	5-22-08	4-30-08	6-2-08	9-18-08
Coarse woody debris	5-22-08	5-22-08	NA	NA
Invasive Species Control	8-1-08 removal of <i>Phragmites</i> , cattail & loosestrife flowers/seed heads. Herbicide treatment by All-Habitat October 2008, June 2009	Herbicide treatment by All-Habitat October 2008, January & June 2009	Herbicide treatment by All-Habitat October 2008	Herbicide treatment by All-Habitat October 2008, January & July 2009
Additional work	Additional shrub and tree plantings in disturbed access road (June 2008)	8-22-08 Pool outlet channel formed to lower pooling water 1 ft depth; workers widened channel 9-5-08 to make permanent feature		

Monitoring Activity to Date: During the 2008 construction year, the mitigation sites were monitored on 39 occasions between March and October. These results were reported in the



February 2009 update report for this project. As per the monitoring requirements for the project, the site was monitored on two occasions in 2009, occurring in late spring/early summer and late summer/early fall. The first formal progress report for Year 1 was dated December 15, 2009 and was submitted to CT DEP, the Army Corps of Engineers and the Town of Enfield Inland Wetlands and Watercourses Commission. The twice seasonal monitoring was initiated in 2010 and a report issued at the end of that calendar year (). This same program was conducted in 2011 and the monitoring dates occurred on June 30th and September 27th. This report summarizes the results of the 2011 monitoring.

Success Standard Questions

Standards of Success from Mitigation Checklist: The project monitoring requirements are referenced to the 6/15/2004 Mitigation Plan Checklist of the Army Corps of Engineers New England District. As per the monitoring protocols under this checklist, the following questions are to be addressed relative to successful establishment of the wetland mitigation sites.

Response to Success Standard Questions: These questions are briefly answered for each of the two mitigation sites in the table below and the backup documentation is provided in the following narrative description and site specific monitoring data.

Success Standard Summary	Site A	Site B
1. Does the site have at least 500 trees/shrubs per acre..... • 350/ac in proposed forested zones • 18" tall • 75% coverage in each planned zone • Minimum of 6 volunteer/planted species at 50/ac	Yes No Yes Yes Yes	No No Yes Yes Yes
2. Aerial Cover • Minimum 80% cover by non-invasive species • Emergent areas have minimum 80% cover by noninvasive hydrophytes • 60% non-invasive in shrub and forested cover • 15% woody species	Yes Yes Yes Yes	Yes Yes Yes No
3. Common reed (<i>Phragmites australis</i>), Purple loosestrife (<i>Lythrum salicaria</i>), Russian and Autumn olive (<i>Elaeagnus</i> spp.), Buckthorn (<i>Rhamnus</i> spp.), Japanese knotweed (<i>Polygonum cuspidatum</i>), and/or Multiflora rose (<i>Rosa multiflora</i>) plants at the mitigation site(s) are being controlled.	Yes	Yes
4. All slopes, soils, substrates, and constructed features within and adjacent to the mitigation site(s) are stable	Yes	Yes

Problems Needing Immediate Attention: At this point, neither of the wetland mitigation sites appear to need immediate remedial attention. Woody species growth is still repressed due to early herbivory during the planting year (Sites A & B) and some initial high water levels due to beavers (Site A) and need to adjust outlet flow grades slightly (Site B). Subsequently, thick and



tall growth of the herbaceous species has repressed recovery of the woody species, although the 2011 observations show progress in this regard. Currently,

- There is no evidence of excess herbivory,
- There appeared to be no significant beaver induced flooding in Site A in 2010 or 2011, and
- Invasive species treatment is ongoing annually for the entire site as well as the wetland mitigation areas.
- The recovery growth and new recruitment of woody species is ongoing, providing a reasonable ecological trajectory for the expansion of woody growth in each of the sites.

Each of these situations is discussed in more detail in the Narrative sections below.

Narrative

Stormwater Basin & Buffer Zone Plantings

Description and Activity to Date: The stormwater basin was planted as a wetland basin with wetland shrubs and herbaceous plants (0.15± acres). A box culvert with natural bottom was also provided beneath the access



Stormwater Basin, Spring 2010

**Buffer Zone Planting
South of Parking Area**



buffer zone plantings to restore the newly graded areas within proximity to wetland areas to provide a natural stable buffer between the wetlands and the development.

drive to provide better connectivity between the replanted wetlands downgradient of the stormwater management area and the wetlands to the south. Along the margins of the developed site, there were additional

**Buffer Zone Planting
West of Parking Area**



Status of Vegetation Growth and Wildlife

Habitat: These planted stormwater wetlands and buffer zone areas have developed well, and some of the buffer areas have dominant wetland plants and developing hydric soils, perhaps responding to local changes in hydrology. The stormwater basin is managed as an aesthetic

feature of the hotel complex but continues to provide the vegetative stormwater remediation function. While no detailed census of the planted wetland shrubs within the stormwater management basin and buffer zone was required or performed, shrubs and herbaceous vegetation have a readily apparent good health with vigorous growth. The basin appears to be operating appropriately as a stormwater management feature. A decorative fountain was added in 2010 presumably as an aesthetic feature, but which also has a potential benefit to water quality treatment. While not designed specifically for the benefit of wildlife habitat, the stormwater basin continues to be supportive of some amphibians, odonates, and waterfowl, all of which were in abundant evidence in the 2011 season.

Recommended Remedial Actions: None recommended at this time and not likely in future.

Mitigation Site A. Wetland Enhancement

Description and Activity to Date: The wetland enhancement site is located adjacent in the I-91 northbound off-ramp on the west side of the parcel, and west of the developed portion of the site. It was selected for enhancement due its overwhelming dominance by the invasive plant species, common reed (*Phragmites australis*). The wetland enhancement plan targeted the creation of marsh and wooded wetland with a restored intermittent stream channel (plan sheets 13 to 16). The mitigation plan included the following specific elements:



Site A, Pre-Construction, 2008. View to East

1. Removal of invasive *Phragmites* by excavation of plant roots and enhancement of vegetative diversity of the site.
2. A 16,100± SF revegetated wetland with 3 planting zones.
 - a. Planting Zones 1 & 2: PFO/PSS wetland, 11,000± SF.
 - b. Planting Zone 3: PEM, Emergent Wetland 5100± SF.
3. The restoration of an intermittent stream channel (110± lf).
4. The creation of an emergent/herbaceous vegetation dominated margin along the stream (part of Zone 3).
5. Restoration of a temporarily disturbed access way for construction equipment (600± SF).

The target Reference Site for the area was identified as the immediately upgradient wooded wetland that is contiguous to the site.

The existing soils for the wetland restoration site were excavated to a depth of 3 feet, or just



Site A Reference Wetland. View to East, 2011.



Site A. View to East. Fall 2011

remain stable and in-place with little, if any, post-construction compaction and subsidence. Organic topsoil depths exceed 2.5 feet except along the immediate margins of the site.

Status of Vegetation Growth: The vegetation plantings included woody and herbaceous species, as well as wetland seed mixes, and based upon 2011 observations, the site continues to have a mix of both planted and recruited herbaceous and woody stem species (see Appendix 3). The number of shrubs planted, exceeded a density

beyond the observed depth of the *Phragmites* roots. This excavation was completed in late April 2008. The replacement soils were high-organic, fine sandy loams, formulated for the site by Agresource to help ensure the absence of invasive species. Site planting, placement of coarse woody debris, and stream reformation occurred through late May 2008, with restoration of the site access road continuing until mid-June.

Status of Wetland Soils: The high organic topsoils overlying the glacio-lacustrine silts and clays continue to

Mitigation Site A. Fall 2011. View to Northwest along stream channel



Mitigation Site A. View to South. Fall 2011



of 500 per acre (see Appendix 2). The target number of woody species in the enhancement area was 127 trees and shrubs.

This target is marginally met for Site A based upon the total number of larger woody stem individual, viable trees and shrubs present within the wetland site. However, this number is more than met if including the abundant first and second year growth of the seedling red maple, pin oak and cottonwood trees. It is unlikely that all of these individuals will survive until shrub height,

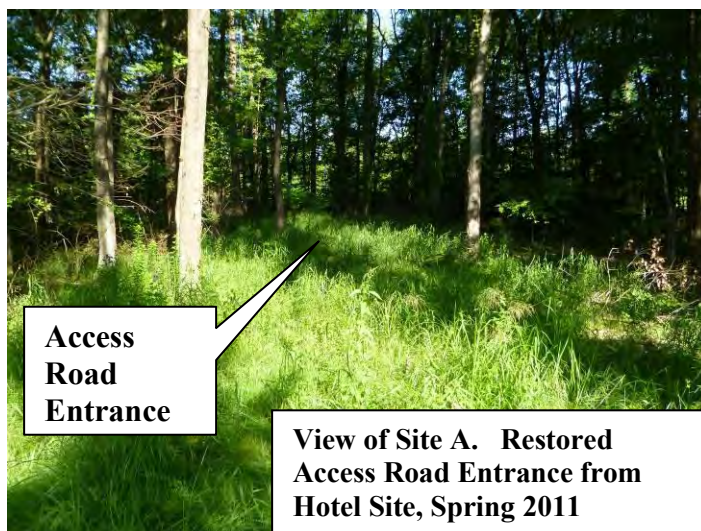
but it is anticipated that many individuals will persist. Due to the initial dieback of trees and shrubs during the construction year flooding event, the overall average height of the woody stem species is probably only about 2 feet (see 2009 report). Herbaceous individuals planted along the wetland swale/intermittent stream and within the adjoining wetland are maintaining vigorous growth. Several new species of herbaceous wetland plant species were added to the inventory in 2011. The relatively lush and diverse herbaceous growth of wetland species continues to be repressing the shorter, but present and viable, woody stem growth. Variable counts of larger trees and shrubs are attributable to the dense and tall herbaceous growth which has made census of the shorter shrubs and trees difficult and less accurate. It will still be several years before the planted and volunteer shrubs and trees become more visibly dominant within the wetland, although positive change in that direction was observed between 2010 and 2011.

Invasive Species: Cattails continue to be present along the I-91 perimeter of the site, and with some limited purple loosestrife and *Phragmites* along the periphery, in very low numbers of individual plants. Seed heads for all of these species were removed upon inspection in 2011. These species are also subject to continuing treatment by the herbicide contractor (see subsection below on invasive species control efforts). Diligence will be needed in the near future to control additional invasion into this mitigation area.

Restoration of Construction Access:

Construction of the site required temporary access across a narrow area of wetland and uplands. Herbaceous and woody stem growth along the access road is at 100% and no problems were noted.

Status of Wildlife Habitat: Use of the wetland mitigation site by wildlife was noted on all monitoring occasions. As observed in 2009 and 2010, dragonfly, wetland and woodland associated birds, and green frog continued to be present (see list of wildlife observed).



Recommended Remedial Actions: Wetland Mitigation Site A is 100% stable and roughly 99% established with native, non-invasive vegetation. However, the targeted growth of significant shrubs and trees continues to be delayed as a result of the previous flooding shortly after planting, which killed the above ground growth for many of the shrubs and trees. Most of the stock recovered from viable roots, but the sizes of the shrubs and trees are significantly less as a result. While the site lacks significant coverage by woody stem foliage, the number of viable species is still appropriate for the site, and there is significant new growth from both the planted and recruited species. Therefore, no additional plantings are recommended at this time since the ecological trajectory of woody stem growth seems appropriate for the site. It is likely that these viable individuals will provide the desired species numbers and diversity over the next years of

the monitoring period. However, should monitoring in 2012 show a stagnation or reversal in woody stem growth, additional plantings should be considered at that time. While not a problem in 2010 or 2011, the site should be monitored for beaver or other flooding and blockage of the drainage beneath I-91, which can negatively affect the hydrologic regimes designed for the wetland mitigation site. Continued aggressive treatment of the nearby invasive species is necessary and specific targeting of the cattails, *Phragmites*, and purple loose strife along the I-91 ROW is highly desirable.

Mitigation Site B. Wetland Replacement

Description and Activity to Date: The wetland enhancement site is located adjacent along the southern-most extreme of the $18.7 \pm$ acre parcel boundary, about mid-way between Phoenix Ave. and I-91, immediately north of an east to west flowing channelized perennial stream. The stream is on the adjacent Town owned land. The original topography of the land immediately to the north of the stream was elevated by 1 to 3 feet above the wooded red maple swamp to the north, presumably being created by the placement of excavated



**Site B. Pre-Construction 2008.
View to West.**



**Mitigation Site B. Spring
2011. View to West.**

materials from the channelized stream. The area was vegetated with early growth successional trees and other upland shrubs, including the invasive autumn olive and Tartarian honeysuckle, dominant in this localized area. This is in comparison to the adjacent, mature wooded swamp, which has dominant red maples, with a size ranging from 5" DBH to over 18" DBH, and providing a near 100% continuous canopy. This red maple swamp is the target reference site for Mitigation Site B.

The wetland replacement plan was designed for a mixed wooded/shrub wetland with an emergent marsh and intermittent pooling wetland within the center of the area. The proposed mitigation plan included the following specific elements:

1. An $18,400 \pm$ SF ($0.42 \pm$ acre) vegetated wetland with woody, emergent & open water areas.
2. Planting Zones 1 & 2: PFO/PSS forested wetland, $13,040 \pm$ SF.
3. Planting Zones 3 & 4: PEM/POW, $5360 \pm$ SF.



Site B Reference Wetland. Spring 2011.

The topography for the wetland was set approximately at the elevation of existing wetlands to the north (elevations 111 to 113 ft), with one major depression to allow seasonal pooling of water to help ensure micro-habitat diversity, as well as several areas of microtopography. The soils for the proposed wetland replacement area consisted of 12 inches of the Agresource high organic fine sandy loams.

After preliminary monitoring of the mitigation site during July and August of 2008, the

depression appeared to be retaining a higher level of surface water than anticipated for the summer season. Therefore, a high flow, overflow swale was hand dug to a width of 5 feet from the edge of the pooling area to the wetlands to the north, reducing the maximum pool height by approximately 12 inches. The swale was seeded with the locally produced wetland grass seeds that had already formed in the area. This area was totally revegetated by early 2009 and continues to function well in controlling water height within the pool area. The depression contained continuous pool of standing water at less



Mitigation Site B. Spring 2011. View to East.



Mitigation Site B. Fall 2011. View to East

than 2 foot depth throughout the summer months of 2008 and 2009 and supported aquatic plants including pond weed, duck weed and water meal. The site was fully stable at the end of 2009. In 2010, the same stable site conditions prevailed. However, due to a low rainfall summer, the pooling area dried and was dry in the fall monitoring. During 2011, the pool maintained shallow surface waters in both the June and September monitoring periods, indicating a stable and appropriate on-site wetland hydrology.

Status Wetland Soils: The high organic topsoils overlying the glacio-lacustrine silts and clays remain stable and in-place. There was some minimal compaction and potentially some minor subsidence post-construction based upon inspection. However, the topsoil depths continue to exceed 8 inches at all locations inspected except along the immediate margins of the site. No further significant changes to the topsoil conditions are likely throughout the anticipated period of monitoring.



Status of Vegetation Growth: Following 2008 and 2009, which experienced significant reduction in plant viability due to deer browse and excessive pooling, the site has become stabilized and the planted shrubs and trees are continuing to recover. The woody planted vegetation in the wetland area included various wetland trees and shrubs planted at a density exceeding 500 per acre, generally done in a random manner to avoid any obvious patterning within the wetland area. For the size of the tree and shrub area, the target number of woody plants was 150. Herbaceous

plants were planted at about 1 plant per 4 square feet. The area was seeded with a mix of wetland grasses and wild flowers. For all seeds, herbaceous plants, and shrubs/trees, only native or noninvasive naturalized species was used. Coarse woody debris was placed throughout the wetland enhancement/restoration area after final grading in order to provide structural diversity within the wetland area.

Presently, the wetland mitigation site shows 100% growth of dominant wetland species, with herbaceous growth prevailing throughout the wetland. The herbaceous species include seeded, planted and recruited species. Several new species of herbaceous wetland plant species were added to the inventory in 2011. Shrub and tree counts continue to show about 100 larger shrubs and trees viable within the wetland mitigation site (67% of the targeted density), with numerous first and second year growth of seedling red maple, pin oak and cottonwood seedlings (see Appendix 3 for vegetation observations). As with Mitigation Site A, the emerging woody stem growth is encompassed by the relatively lush and diverse herbaceous growth of wetland species, which is shading the woody stem growth from available light. Variable counts of larger trees and shrubs are attributable to the dense and tall herbaceous growth which has made an accurate census of the shorter shrubs and trees all but impossible. The dense herbaceous growth will likely continue to repress the growth rate of the trees and shrubs for several years before the planted and volunteer shrubs and trees grow above height of the competing herbaceous layer and become more visibly dominant within the wetland.

Invasive Species: Because all invasive species within the localized area were removed with the excavation of the soils, no additional invasive species control was necessary in this area during construction. Since that time, there has been some minor re-establishment of *Phragmites*, cattails and purple loosestrife that has been controlled with the ongoing invasive species management

efforts. As with 2009 and 2010, cattail seed heads found in close proximity to the mitigation site in 2011 were removed and disposed of outside of the area. There was substantially less presence of common cattail in Site B in 2011 than in 2010.

Construction Access: Construction of the site required temporary access along the upland berm from Phoenix Ave to the mitigation site. At the completion of construction, the area was regraded, loamed and seeded and planted. The temporary road has achieved 100 vegetation growth and remains stable. Boulders were placed at the entrance of the site to prevent unauthorized vehicle access, and there was no evidence or vehicular access in 2011.

Status of Wildlife Habitat: Use of the wetland mitigation site by wildlife was noted on all monitoring occasions. Several wetland species were observed utilizing the habitat including several species of butterfly and dragonfly, aquatic insects and snails wood frog, green frog, bullfrog, red-winged blackbird, mallard duck, and great blue heron. The area of pooling appears to have potential for supporting vernal pool species, and the presence of wood frog suggests habitat use in this capacity. However, the duration of flooding was reduced in 2010 and the time for amphibian maturation for outmigration was reduced.

Recommended Remedial Actions: As with Wetland Mitigation Site A, the Site B Wetland Mitigation Site continues to be 100% stable and roughly 99% established with native, non-invasive vegetation. There is good diversity and establishment of herbaceous vegetation. However, the targeted growth of significant shrubs and trees was set back considerably due to previous flooding shortly after planting and deer browse during the first growing season. While the site lacks significant coverage by woody stem foliage, the targeted number of viable woody stem individuals remain on-site, in large measure associated with seedlings of dogwood, cottonwood, and red maple. Furthermore, there has been significant regrowth and second year growth of woody stem individual plants. Therefore, the site appears to be on the correct ecological trajectory relative to woody stem growth, and no additional plantings are recommended at this time. However, should monitoring in 2012 show a stagnation or reversal in woody stem growth, additional plantings should be considered at that time. There appears to be less need for aggressive herbicide treatment in Site B than in Site A. However, treatment of the nearby and within site invasive species should be continued.

Invasive Species Control

Progress to Date: Benderson Development has delegated control of the site to Buffalo Lodging, who has contracted with All Habitat Inc. for treatment and management of invasive species throughout the site. Work was initiated in October of 2008 and additional cutting of invasive shrubs was done in January of 2009. On July 6, 2009, the aquatic herbicide Habitat® (imazapyr) was applied to the Phragmites and cattail throughout the mitigated wetlands immediately surrounding the hotel and also to the retention pond. All other invasives such as multiflora rose, bittersweet, barberry, and winged euonymus were treated using Garlon 3A® (triclopyr). These herbicides were selectively applied by technicians utilizing backpack sprayers in areas with high levels of desirable vegetation. Some areas had higher densities of invasive regrowth and these were treated with a broadcast application of Garlon 3A® on July 27, 2009. Triclopyr was used as it is selective to woody and broadleaf vegetation thus leaving interspersed grasses and



monocots unharmed from the application. Additional invasive species control via mechanical removal occurred in the winter, focusing on the cutting of *Phragmites*, Japanese barberry and multiflora rose. In 2010 and 2011, herbicide treatment occurred in the winter and summer. Significant reduction and mortality of multiflora rose, autumn olive, Japanese barberry, and winged euonymus was noted throughout the site, as well as cattails and *Phragmites* within the mitigation area.

Recommended Remedial Actions: Continued treatment within mitigation areas and adjoining areas is important to continued site success.



Appendices

**Appendix 1. Permit Special Conditions & Summary of
Mitigation Goals**

Appendix 2. As Built Plans for Wetland Mitigation Areas

Appendix 3. Vegetation Species List & Wildlife Observations

Appendix 4. Photographs



Appendix 1

Permit Special Conditions & Summary of Mitigation Goals



General Permit (PGP). This work must be performed in accordance with the terms and conditions of the PGP and also in compliance with the following special conditions:

1. Mitigation shall be performed in accordance with a final mitigation plan which shall be submitted to the Project Manager identified below at 696 Virginia Road, Concord, MA 01742-2751 within 90 days of permit issuance and which shall not be implemented until the Corps of Engineers approves it in writing. The final mitigation plan shall be based on the draft mitigation plan entitled, "COMPENSATORY WETLANDS MITIGATION PLAN FOR PROPOSED HOTEL/RESTAURANT FACILITY, BENDERSON DEVELOPMENT COMPANIES, INC" and dated "April 11, 2006, except where modified by permit special condition numbers 4 and 5 below and inclusive of the request for additional information provided to your authorized agent, Mr. Paul Davis in a letter dated June 7, 2006." The compensatory mitigation prescribed by this plan shall be undertaken concurrently with, or in advance of, the start of the construction of the authorized/permitted activity. In no case shall initiation of the construction of compensatory mitigation be delayed beyond the commencement of construction, and the compensatory mitigation shall be completed no later than termination of construction of the authorized/permitted activity.
2. To provide a permanent record of the completed mitigation work, you shall provide two complete sets of as-builts of the completed work undertaken within the on-site mitigation and preservation areas to the Corps of Engineers. The as-builts shall indicate changes made from

the original plans in indelible red ink. These as-builts shall be provided to this office no later than 60 days after the completion of construction of the mitigation area wetlands.

Special Condition 3:

The time limit to provide documentation of a written agreement with the property owner, the Town of Enfield, Connecticut, to allow for the long term protection of the compensatory mitigation areas and the ecological integrity of the landscape in which they will reside (Assessor's Map 45 Lot 12 and Assessor's Map 46 Lot 35) has been extended to March 4, 2007.

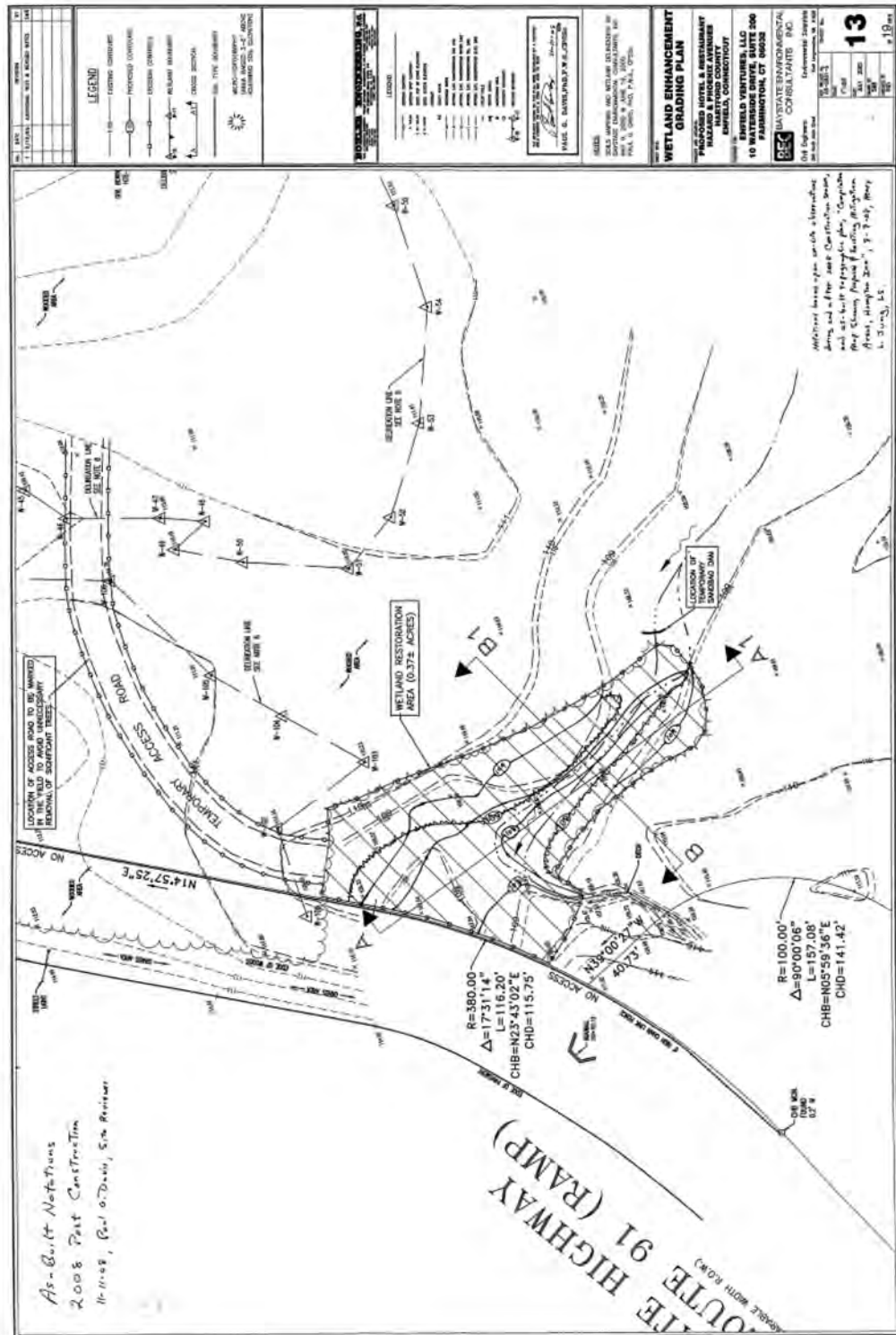
4. Within 90 days of the permit's issuance (September 8, 2006), the permittee shall submit for Corps review and approval a detailed plan to allow for a minimum of 10 years of control and management of invasive plant species as defined on Table 4 of the June 15, 2005 New England District Mitigation Guidance for New England District Mitigation Plan Checklist, on the naturally vegetated areas of the subject permit review area, defined as Assessor's Map 45 Lot 12 and Assessor's Map 46 Lot 35.
5. The permittee shall submit a completed copy of the attached Mitigation Work Start Notification Form at least two weeks before the mitigation work commences.

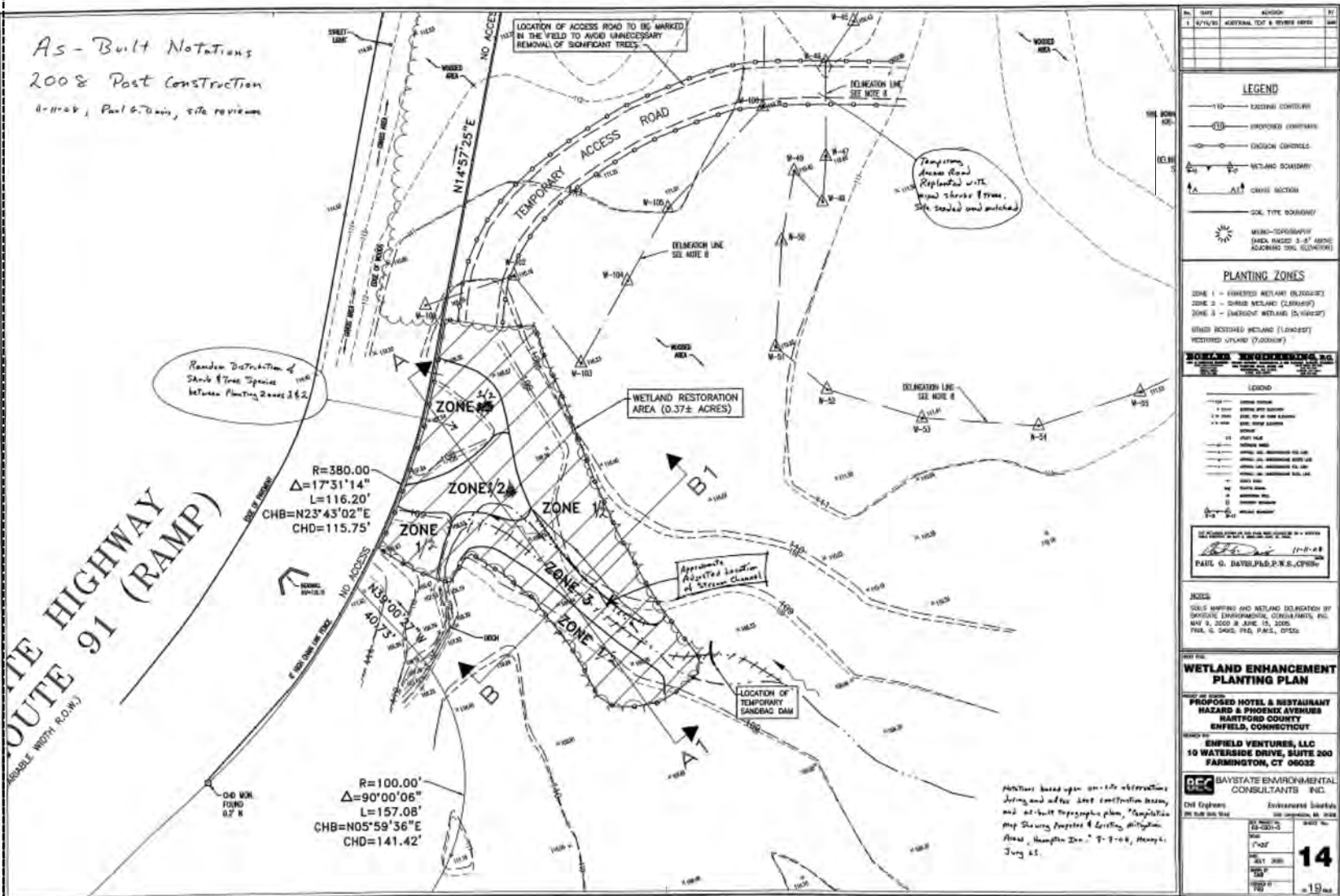
Appendix 2

As Built Plans for Wetland Mitigation Areas



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Appendix 3

Vegetation Species Lists



**Wetland Enhancement Mitigation Area A
Plant Viability Assessment 2010 & 2011 - Woody Stem**

Type	Common Name	Scientific Name	Number of Plants		
			# planted	2010	2011
Trees	Red Maple	<i>Acer rubrum</i>	12	2	4
	Yellow Birch	<i>Betula allegheniensis</i>	10	3	2
	Green Ash	<i>Fraxinus pennsylvanica</i>	12	8	7
	Black Tupelo	<i>Nyssa sylvatica</i>	12	1	2
	Pin Oak	<i>Quercus palustris</i>	12	2	2
	Black Willow	<i>Salix nigra</i>	12	2	2
	Pin oak seedlings	<i>Quercus palustris</i>		TMTC	TMTC
	Red oak seedlings	<i>Quercus rubra</i>		TMTC	TMTC
	cottonwood s'dlngs	<i>Populus deltoides</i>		>20	>20
		<i>totals</i>	70	18+	19+
Shrubs	Winterberry	<i>Ilex verticillata</i>	10	10	10
	Highbush Blueberry	<i>Vaccinium corymbosum</i>	10	1	7
	Spicebush	<i>Lindera benzoin</i>	10	7	3
	Swamp Azalea	<i>Rhododendron viscosum</i>	10	7	2
	Sweet pepperbush	<i>Clethra alnifolia</i>	10	4	2
	Arrowwood	<i>Viburnum dentatum</i>	10	6	9
	Red Chokeberry	<i>Aronia arbutifolia</i>	10	4	3
	Silky Dogwood	<i>Cornus amomum</i>	10	10	14
	Red-Osier Dogwood	<i>Cornus stolonifera</i>	10	10	16
	Meadowsweet	<i>Spiraea alba</i>	56	43	36
	Shadbush	<i>Amelanchier canadensis</i> or <i>A. laevis</i>	10	8	5
	Poison Ivy	<i>Toxicodendron radicans</i>			1
	Mapleleaf Viburnum	<i>Viburnum acerifolius</i>			1
	Multiflora rose (invasive)	<i>Rosa multiflora</i>			<1
		<i>totals</i>	156	110	107
Lianas	Riverbank Grape	<i>Vitis riparia</i>			1

TMTC = too many to count



Wetland Enhancement Mitigation Area A
Plant Viability Assessment 2010 & 2011 – Herbaceous Species

Type	Common Name	Scientific Name	Number of Plants	
			2010	2011
Herbaceous	Soft Rush	<i>Juncus effuses</i>	5	5
	Wool Grass	<i>Scirpus cyperinus</i>	5	10
	Tussock Sedge	<i>Carex stricta</i>	1-5	5
	Fowl Manna Grass	<i>Glyceria canadensis</i>	1-10	5
	Blue flag Iris	<i>Iris versicolor</i>	1-20	10
	Fringed Sedge	<i>Carex crinita</i>	1-5	5
	Lurid Sedge	<i>Carex lurida</i>	1-5	5
	Barnyard grass	<i>Echinochloa crus-galli</i>	1-5	3
	nodding smartweed	<i>Polygonum lapathifolium</i>	1-5	3
	swamp beggartick	<i>Bidens cernua</i>	1-10	5
	jewell weed	<i>Impatiens capensis</i>	3-10	5
	clear weed	<i>Pilea pumila</i>	1-5	5-10
	giant bulrush	<i>Scirpus validus</i>	1-30	10
	water plantain	<i>Alisma triviale</i>	1-10	5-20
	water smartweed	<i>Polygonum amphibium</i>	1-5	3
	Lady's tearthumb	<i>Persicaria maculosa</i>	1-2	3
	Curly dock	<i>Rumex crispus</i>	1-3	1
	Stinging nettle	<i>Urtica dioica</i>	1-5	10
	umbrella sedge	<i>Cyperinus strigosus</i>	2-10	5
	Rough stem g'rod	<i>Solidago patula</i>		1
	Narrow leaf g'rod	<i>Euthamia galetorum</i>		1
	Grass-leave g'rod	<i>Euthamia graminifolia</i>		1
	Common arrowhead	<i>Sagittaria latifolia</i>		1
	Small white aster	<i>Aster vimineus</i>		1
	Spotted joe pye weed	<i>Eupatorium maculatum</i>		1
	Water Starwort	<i>Callitriche sp.</i>		1
	Narrow leaf milkweed	<i>Asclepias incarnata</i>		2
Invasives	purple loosestrife	<i>Lythrum salicaria</i>	<1	<1
	Common cattail	<i>Typha angustifolia</i>	<1	<1
	common reed	<i>Phragmites communis</i>	<1	<1
	Reed canary grass	<i>Phalaris arundinacea</i>		<1

TMTC = too many to count



Wetland Enhancement Mitigation Area B Plant Viability Assessment, Spring & Fall 2011 – Woody Species					
Type	Common Name	Scientific Name	Number of Plants		
			# planted	2010	2011
Trees	Red Maple	<i>Acer rubrum</i>	12	2	4
	Yellow Birch	<i>Betula allegheniensis</i>	10	3	3
	Green Ash	<i>Fraxinus pennsylvanica</i>	12	8	8
	Pin Oak	<i>Quercus palustris</i>	12	3	3
	Black Willow	<i>Salix nigra</i>	24	20	15
	Pin oak seedlings	<i>Quercus palustris</i>		10+	TMTC
	cottonwood s'dlngs	<i>Populus deltoids</i>		>20	TMTC
	Red maple s'dlngs	<i>Acer rubrum</i>			TMTC
		<i>totals</i>	70	36+	33+
Shrubs	Winterberry	<i>Ilex verticillata</i>	10	7	6
	Highbush Blueberry	<i>Vaccinium corymbosum</i>	10	6	6
	Spicebush	<i>Lindera benzoin</i>	10	5	3
	Swamp Azalea	<i>Rhododendron viscosum</i>	10	5	3
	Sweet pepperbush	<i>Clethra alnifolia</i>	10	5	1
	Arrowwood	<i>Viburnum dentatum</i>	10	7	11
	Red Chokeberry	<i>Aronia arbutifolia</i>	10	5	3
	Silky Dogwood	<i>Cornus amomum</i>	10	10	8
	Red-Osier Dogwood	<i>Cornus stolonifera</i>	10	10	10
	Shadbush	<i>Amelanchier canadensis</i> or <i>A. laevis</i>	10	5	5
	American Cranberry	<i>Viburnum trilobum</i>	5	2	4
	Black Raspberry	<i>Rubus alleghaniensis</i>	5	3	5
		<i>totals</i>	110	72	65

TMTC – too many to count



Wetland Enhancement Mitigation Area B Plant Viability Assessment, 2010 & 2011 – Herbaceous Species			
Common Name	Species Name	Percent Cover	
		2010	2011
Soft Rush	<i>Juncus effusus</i>	1-5	1-10
Wool Grass	<i>Scirpus cyperinus</i>	1-5	1-10
Tussock Sedge	<i>Carex stricta</i>	1-5	1-5
Fringed Sedge	<i>Carex crinita</i>	1-5	1-5
Lurid Sedge	<i>Carex lurida</i>	1-5	1-5
Barnyard grass	<i>Echinochloa crus-galli</i>	1-5	1-5
nodding smartweed	<i>Polygonum lapathifolium</i>	1-10	1-10
swamp beggartick	<i>Bidens cernua</i>	5-10	5-15
jewel weed	<i>Impatiens capensis</i>	5-10	5-20
giant bulrush	<i>Scirpus validus</i>	0-80	0-80
water plantain	<i>Alisma triviale</i>	0-100	0-100
water smartweed	<i>Polygonum amphibium</i>	1-5	1
purple clover	<i>Trifolium repens</i>	1-5	1
white clover	<i>Trifolium pratense</i>	1-5	1
alsike clover	<i>Trifolium hybridum</i>	1-5	1
spotted joe pyeweed	<i>Eupatorium maculatum</i>	1-5	1-5
New England aster	<i>Symphotrichum novae-angliae</i>	1-5	1-5
small white aster	<i>Aster vimineus</i>	1-5	1-5
boneset	<i>Eupatorium perfoliatum</i>	1-5	1-5
black eyed susan	<i>Rudbeckia hirta</i>	1-5	1
ragweed	<i>Ambrosia artemisiifolia</i>	1-5	1
narrow leaf goldenrod	<i>Solidago graminifolia</i>	1-5	1-10
grass leaved goldenrod	<i>Euthamia graminifolia</i>	1-5	1-5
late goldenrod	<i>Solidago canadensis</i>	1-5	1
swamp milkweed	<i>Asclepias incarnata</i>	1-5	1-10
evening primrose	<i>Oenothera biennis</i>	<1	<1
Cow vetch	<i>Vicia cracca</i>	1-2	1
Boneset	<i>Eupatorium perfoliatum</i>	1-3	1-5
Butter & eggs	<i>Linaria vulgaris</i>	<1	<1
pond weed	<i>Potamogeton pusillus</i> spp. <i>gemmae</i>	0-1	0-1
duckweed	<i>Lemna minor</i>	<1	<1
water meal	<i>Wolffia</i> sp.	<1	<1
filamentous green algae	<i>Chlorophyceae</i>	<1	<1
umbrella sedge	<i>Cyperinus strigosus</i>	1-10	1-10
Halberd leaved tearthumb	<i>Polygonum arifolium</i>		1
Queen anne's lace	<i>Daucus carota</i>		1
Invasive Species			
purple loosestrife	<i>Lythrum salicaria</i>	<1	<1
common cattail	<i>Typha latifolia</i>	1-3 (treated)	1-3 (treated)
reed canary grass	<i>Phalaris arundinacea</i>	<1	<1
common reed	<i>Phragmites communis</i>	0	0

Wildlife Observation in Immediate Vicinity of Mitigation Sites 2011				
Wildlife Group	Common Name	Scientific Name/Group	Site A	Site B
Invertebrates	Meadowhawk dragonfly	<i>Sympetrum sp.</i>	+	+
	Widow Skimmer Dragonfly	<i>Libellula luctuosa.</i>		
	Common Whitetail Dragonfly	<i>Libellula lydia</i>	+	+
	Monarch Butterfly	<i>Danaus plexippus</i>	+	+
	Pearl Crescent Butterfly	<i>Phyciodes tharos</i>		+
	Snail	<i>Amnicola limosa</i>	+	+
	Water Boatman	<i>Corixa sp.</i>	+	+
Amphibians & Reptiles	Water Striders	<i>Gerridae sp.</i>	+	+
	Bull Frog	<i>Rana catesbeiana</i>	+	+
	American Toad	<i>Bufo americanus</i>	+	+
	Wood Frog	<i>Rana sylvatica</i>		+
	Green Frog	<i>Rana calmitans melanota</i>	+	+
	Gray treefrog	<i>Hyla versicolor</i>	+	
	Garter snake	<i>Thamnophis sirtalis</i>		+
Birds	Painted Turtle	<i>Chrysemys picta</i>		+
	American Crow	<i>Corvus brachyrhynchos</i>	+	+
	Canada Goose	<i>Branta bernicla</i>		+
	Great Blue Heron	<i>Ardea herodias</i>		+
	Mallard Ducks	<i>Anas platyrhynchos</i>		+
	Song Sparrow	<i>Melospiza melodia</i>	+	+
	Northern mockingbird	<i>Mimus polyglottus</i>	+	+
	Grey catbird	<i>Dumetella carolinensis</i>	+	+
	Mourning Dove	<i>Zenaida macroura</i>		+
	Black-capped Chickadee	<i>Poecile atricapillus</i>		
	Tufted Titmouse	<i>Beolophus bicolor</i>		
	Gray Catbird	<i>Dumetella carolinensis</i>	+	+
	Cooper's Hawk	<i>Accipiter cooperii</i>		+
	European Starling	<i>Sturnus vulgaris</i>	+	+
	House Sparrow	<i>Passer domesticus</i>	+	+
	Blue Jay	<i>Cyanositta cristata</i>	+	+
	Eastern Phoebe	<i>Sayornis phoebe</i>		+
	Common yellowthroat	<i>Geothlypis trichas</i>		+
	American robin	<i>Turdus migratorius</i>	+	+
	Redwing Blackbird	<i>Agelaius phoeniceus</i>		+
Mammals	Eastern Cottontail	<i>Sylvilagus floridanus</i>	+	+
	Gray Squirrel	<i>Sciurus carolinensis</i>		+
	House mouse	<i>Mus musculus</i>		+
	Meadow Vole	<i>Microtus pennsylvanicus</i>		+
	White-tail Deer	<i>Odocoileus virginianus</i>	+	+
	Common Raccoon	<i>Procyon lotor</i>	+	+

Appendix 4

Additional Photographs
Wetland Mitigation Sites A & B
2010





Mitigation Site A. View to South, towards wetland outflow.



Mitigation Site A. View to East Along Intermittent Stream Swale.



Mitigation Site A. Overall View to East.



Mitigation Site B. View to East.



Mitigation Site B. View to West.



Mitigation Site B. View to West from Mid-site



Mitigation Site B. View to East from Mid-Site.