Applied Ecological Services, Inc.
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Specialists in Environmental Research, Planning, Construction and Management

Phase I Work Plan
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

January 30, 2010

I. Introduction

The Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan (restoration plan) has been created pursuant to NYSDEC, USACE, and USFWS permit requirements associated with the expansion of the City of Albany Rapp Road Landfill. The NYSDEC Permit #4-0101-00171/00011 requires the City's restoration Consultant to prepare an annual draft work plan compliant with the restoration plan to be submitted by January 30 of each program year to an Interagency Habitat Management Team (IHMT) comprised of agents of the NYSDEC and Albany Pine Bush Commission for review and comment. Upon reaching consensus on work plan refinements following one or more collaborative meetings of the IHMT and the project management team (City and Consultants), the Consultant shall submit a final work plan to the IHMT for final approval and sign-off.

The 2010 work plan schedule identifies tasks to be performed in 2010 and continued through 2011. Due to the pending issuance of the USACE permit which includes consultation by the USFWS for the Karner blue butterfly, activities to be undertaken in wetland settings or involving planting of wild lupine will be postponed until the permit is issued.

The purpose of the annual work plan is not to reiterate the project goals, plans, and specifications presented in the permitted restoration plan. Rather, the purpose of the work plan is to:

- Identify specific work tasks to be undertaken within each project phase (see Phase I and Pre-Construction Activities locations in Attachment A) and within an annual timeframe in the form of a work schedule (Attachment B).
- Define and refine as necessary each task in greater technical detail in the form of task work plans, e.g. test plot plan, nursery plan, seed collection plan, etc. (Attachments C-J).
- Submit draft work plans to the IHMT and project management team for review, discussions, revision, consensus, and final approval (NYSDEC) to ensure project success and regulatory compliance.

This collaborative approach organized around the annual work plan will be supported by:

- Regularly scheduled (weekly) management team meetings and weekly work reports and schedule notifications provided to the IHMT and project management team members to

ensure all participants are kept abreast of the status of restoration work and to allow participants an opportunity to address unforeseen issues in a timely way.

- Annual monitoring data that will inform the IHMT and project management team of restoration responses that may trigger consideration of adaptive management adjustments to the upcoming work schedule and work plans.

Documents that are important for viewing the work plan within the context of the larger restoration program include:

- NYSDEC Permit #4-0101-00171/00011: includes requirements, stipulated conditions, roles and responsibilities, performance requirements and outcomes to guide the permittee.
- Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan: describes the target restoration zones, technical specifications, and ecological monitoring and performance measures.
- Plan set drawings: provide the location of the primary restoration and management treatment zones, grading limits, and phasing plans, as well as critical features related to the landfill construction plans.
- Integrated Pest and Invasive Species Management Plan (IPM Plan): provides strategies and techniques for controlling and managing invasive plant and animal species known to occur or that could potentially occur in the project area

II. Overview of the Phase I Work Plan

The Phase I Work Plan consists of two principle components: the annual work schedule and map highlighting the Phase I and Pre-Construction Activities areas where restoration work is to be undertaken, and the technical work plans for individual tasks. These components are presented in a series of attachments (A-J), each of which is described below.

Phase I Context Plan and Phase I Work Plan Schedule

Attachment A. Phase I Context Plan—The Phase I restoration construction area includes the sand depth test plots to be installed on the GAL and installation of the onsite native plant nursery beds in a portion of the Fox Run Trailer Park. This area totals 9.55 acres and is depicted as the red hatched area in Attachment A. Additional work to be undertaken in 2010 will include portions of the entire project area where preliminary site preparation, and pre-construction survey and salvage work will be carried out. These activities will include clearing of the Trailer Park by the City, invasive species control, faunal surveys, herbaceous plant salvage, and understory brush clearing.

Attachment B. Phase I Work Plan Schedule—The work schedule includes Phase I tasks to be conducted during 2010 (the first full year of Phase I restoration), including some tasks that were initiated in 2009 and will be continued in 2010, such as invasive species control, seed collection, pre-construction baseline faunal surveys, and soils testing and analysis. The schedule timeline also projects the current work activity into 2011.

Technical Work Plans

Attachment C. Nursery Construction and Operations—includes guidelines, methods, and operational needs for establishing an onsite native plant nursery for seed production of target host and nectar species for Karner blue butterflies and other Lepidoptera, as well as characteristic pitch pine-scrub oak barrens (PP-SOB) species with scarce seed supply. A working list of appropriate nursery species has been developed with APBPC staff based on need and availability of seed via commercial sources and hand collections from the Preserve and other approved sites.

Attachment D. Seed/Plant Collection and Acquisition—includes working species lists that have been reviewed, revised, and approved by APBPC staff for all restoration planting zones within each phase of the project. Further refinement of seed mixes will occur as we assess seed quantity and availability following initial seed collection efforts (fall 2009 and spring/summer 2010) in the Preserve and in approved locations within the 50-mile geographic radius and seed availability from approved commercial sources.

Attachment E. Test Plot Program—the test plot plan identifies the location, layout, and installation and monitoring protocols for testing and evaluating target sand depths and sand quality needed to ensure the successful establishment of PP-SOB plant communities on the closed landfill surface.

Attachment F. Invasive Plant Management—identifies target species to be controlled and managed prior to construction activities in 2011, including follow-up treatments to Phragmites initiated in late summer 2009.

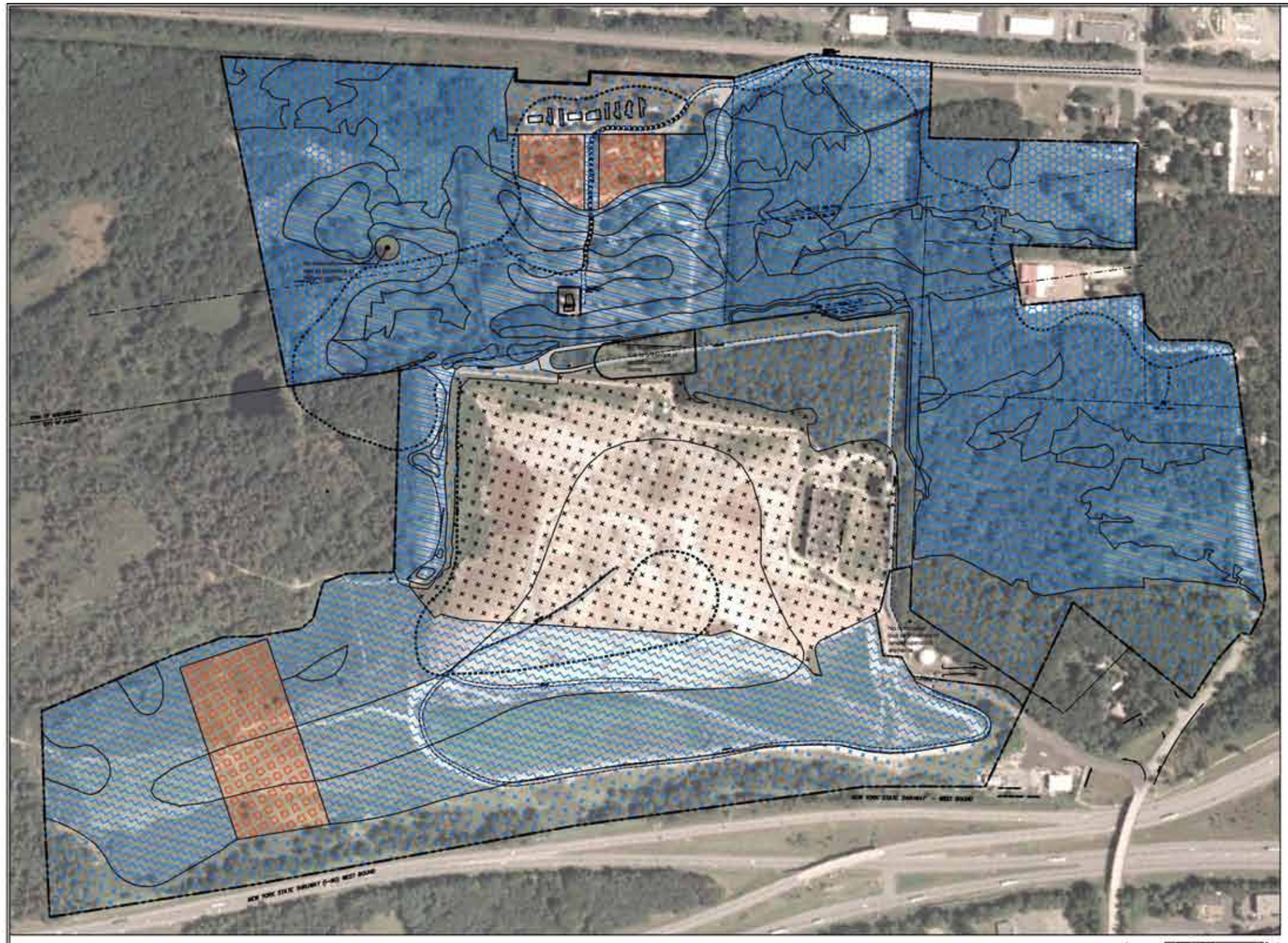
Attachment G. Salvage of Selected Plants and Animals—identifies pre-construction salvage activities including rescue of selected native plants from the landfill expansion area for translocation and temporary storage and propagation in the onsite nursery, in addition to field locating, marking, and accounting for salvageable tree, shrub, and soil materials that will be rescued and relocated during Phase II restoration construction.

Attachment H. Soil and Water Quality Control Analysis—identifies a strategy for determining the need and feasibility for amending sand soils for use in the nursery and capping sands. A summary report of the results of recent soil sampling is included in this section.

Attachment I. Pre-Construction Monitoring and Faunal Survey—presents protocols and methods for conducting pre-construction baseline faunal monitoring of butterflies, moths, mammals, reptiles, amphibians, and migratory birds which will be implemented during 2010 to complete the baseline surveys. Selected 2006 baseline vegetation study transects are identified for re-sampling.

Attachment J. Log Vane and Grade Control Structures—describes planned improvements to the existing stream including installation of three log vane grade control structures in the stream channel at specific locations upstream from Rapp Road and downstream of the construction. Installation of these structures in 2010 is anticipated to assure they are in place before the upstream restoration grading and stream replacement is undertaken in 2011.

Attachment A. Phase I Context Plan (includes areas beyond Phase I where pre-construction activities will occur).



Attachment B. Phase I Work Plan Schedule for 2010, and Draft Work Plan for 2011
Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan

Due Dates	General Task/ Specific Task (Year)		2010													2011													Roles/ Responsiblities	Task specific Information can be found in…			
	(Planning Month)		4	5	6	7	8	9	10	11	12	13	14	1		2	3	4	5	6	7	8	9	10	11	12	13					
	(Calendar Month)		J	F	M	A	M	J	J	A	S	O	N	D		J	F	M	A	M	J	J	A	S	O	N	D			Restoration Plan	Construction Documents Plan Set	Invasive Species and Pest Management Plan	Probability of Use by Protected Species
	1. Annual Work Plan																															
1/30/2010	a. Prepare and submit Annual Work Plan		x											x		x	x										x		AES/CH team	98		16	
2/30/2010	b. Request TRP approval			x													x												AES				
	c. Coordinate and attend Interagency Habitat Mgt Team (Steering Committee) meetings for review/approval of annual work plan			x													x												AES/CH team				
	2. Trailer Park Cleanup																																
	a. Negotiate trailer relocations		x	x	x																								City/CH team		P.0		
	b. Apply for SWPP five-acre waiver				x																								City/CH team				
	c. Install orange construction fence on City property to protect nearby offsite lupine population.					x																							AES/CH/APB				
	d. Erect silt fencing prior to surface disturbance according to SWPP Plan					x																							Contractor				
	e. Conduct trailer park cleanup (demolish abandoned pads, remove utilities, abandon wells, remove trees and soil stockpiles)						x	x	x																				City/CH team	37			
	f. Apply cover crop to soil disturbance areas using annual rye (10 lbs/ac), oats (25 lbs/ac), and barley (15 lbs/ac).						x																						AES	25, 65			
	g. Map and protect selected mature pitch pine trees prior to trailer park cleanup.			x	x																								AES/CH/APB				
	3. Nursery Construction and Operations																																
	a. Finalize and gain approval/consensus for nursery plan and target species list		x	x																									AES				
	b. Nursery site preparation						x	x											x										AES	20-21	R.3	18	
	c. Land survey and stake out nursery perimeter					x	x											x											AES/CH team	25, 35	P.0		
	d. Install orange construction fence on City property to protect nearby offsite lupine population.						x																						Contractor				
	e. Erect silt fencing prior to surface disturbance according to SWPP Plan						x																						Contractor				
	f. Finalize grading and construct herbivory fence						x																						Contractor				
	g. Soil chemistry amendments						x	x																									
	h. Propagate nursery plant materials			x	x	x	x										x	x	x	x							x		AES				
	i. Install plant plugs in nursery beds and transplant salvage material						x	x			x	x								x	x			x	x				AES	62, 150			
	j. Conduct seed harvest, processing, and reporting									x	x	x	x							x	x	x	x	x	x	x			AES	149			
	k. Conduct nursery maintenance (watering, weeding, and cultivating)						x	x	x	x	x	x								x	x	x	x	x	x				AES				
	4. Test Plot Program																																

	a. Finalize test plot plan			x																								AES				
	b. Conduct test plot surveying and staking						x																					AES/CH team				
	c. Erect silt fencing prior to soil disturbance per SWPP plan						x																					Contractor				
	d. Install spec sand top dressing per test plot design						x																					Contractor				
	e. Install test plot seeding, cover crop and mulch						x	x																				AES				
	f. Install electric fencing around test plots to discourage deer herbivory.						x	x																								
	g. Conduct test plot maintenance (mowing, weed control)							x	x	x	x																	AES				
	h. Conduct annual performance monitoring and reporting							x			x		x	x								x						AES				
	5. Seed/Plant Collection and Acquisition																													Page #	Sheet #	Page #	Page #
	a. Continue to develop and update seed collection plan		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x		AES	8	P.0	11, 18	1-2
	b. Acquire additional collection permits			x	x	x	x																					AES				
	c. Conduct scouting for approved off-site seed collection sources					x	x	x	x	x	x	x	x						x	x	x	x	x	x	x	x			AES				
	d. Conduct hand seed collections within APBP and 50-mile radius						x	x	x	x	x	x																AES			43	
	e. Clean, process, and store seed									x	x	x	x	x		x	x	x						x	x	x	x	AES	39-41		30,35,37,43-48	
	f. Identify and purchase commercially available seed, plants and woody material			x	x							x	x	x		x	x	x										AES				
	6. Invasive Plant Management																													Page #	Sheet #	Page #	Page #
	a. Treat herbaceous species in Phase I and selected areas (e.g. trailer park, vernal pond, forested wetlands, and all targeted salvage areas)					x	x	x			x	x							x	x	x			x	x			AES	8	P.0	11, 18	1-2
	b. Conduct Phragmites follow-up control (entire site)									x	x	x											x	x	x			AES			43	
	c. Conduct woody control in forested wetland enhancement areas & GAL perimeter									x	x	x	x	x		x	x	x						x	x	x	x	AES	39-41		30,35,37,43-48	
	d. Conduct oriental bittersweet control (entire site)									x	x	x	x	x		x	x	x					x	x	x	x	x	AES				
	7. Salvage of Selected Plants and Animals																																
	a. Finalize salvage plan for Phase I and II construction areas		x	x			x	x			x	x				x	x	x		x								AES	6	C.0 ?		
	b. Salvage and translocate plant materials to nursery beds (ferns and other herbaceous species)						x	x			x	x								x	x		x	x				AES		C.0, R.3	14	
	c. Conduct field survey, locate, and flag salvageable plant, tree, shrub and soil materials						x	x			x	x								x	x							AES				
	d. Refine planting/installation plans for areas to receive salvaged trees and soils										x	x				x	x											AES		R.0-R.7, P.0		
	8. Plans, Specifications, and Bid Process																																
	a. Prepare construction specifications for nursery, test plots, and sand acquisition: materials and supplies, SWPP installation, grading, and herbivory fencing		x	x																								AES/CH team				
	b. Advertise bid opportunities			x	x																							City				
	c. Conduct bid review and contractor selection					x																						AES/City				
	d. Coordinate and attend pre-construction					x																						AES/Contractor				

	meetings																														
	e. Prepare construction specifications for following year: materials and supplies, and SWPP plan								x	x	x	x	x	x			x	x	x									AES/CH team				
	f. Affirm acreages and as-built construction drawings		x	x								x	x														x	x		AES/CH team				

	9. Soil & Water QC Analysis																														
	a. Finalize Soil Analysis Report		x	x																								AES				
	b. Soil bench test			x	x																							AES				
	c. Quality control testing (Soil and water as needed)					x	x	x	x	x	x	x	x						x	x	x	x	x	x	x	x		AES				
	d. Oversee SWPP inspections and compliance					x	x	x	x	x	x	x							x	x	x	x	x	x	x			AES/CH team				
	e. Continue hydrologic monitoring as required				x	x	x	x	x	x	x	x	x					x	x	x	x	x	x	x	x	x			AES/CH team				
	10. Construction Management / Construction Administration																														
	a. Conduct construction management / administration		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	AES				
	b. Conduct weekly management team meetings		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	AES				
	c. Attend weekly landfill operations meetings		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	AES				
12/1/2010	d. Prepare and submit Annual Compliance Report										x	x	x												x	x	x		AES/CH team				
	e. Attend on-site meetings and compliance inspections as needed		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	AES				
	f. Coordinate and conduct annual public meeting/field day tour.								x														x						AES				
	g. Coordinate and attend Interagency Habitat Management Committee (Steering Committee) meetings as needed to approve changes to work plan						x			x		x								x			x			x			AES				
	h. Affirm plant product needs		x	x	x							x	x	x			x	x	x							x	x	x		AES				
	i. Affirm sand quantities for purchase and salvage		x	x	x							x	x	x			x	x	x							x	x	x		AES/CH team				
	11. Pre-Construction Monitoring and Faunal Survey																														
	a. Re-sample selected 2006 baseline vegetation study transects in old-fields west of trailer park								x	x																		AES/CH team	23, 105, 113, 119	M.0	129	
	b. Install permanent monitoring system for each restoration phase							x												x								AES/CH team	104		133	
	c. Conduct pre-construction baseline faunal surveys in the restoration project area				x	x	x	x																				AES/CH team	111	R.0-R.3	139	2
	d. Trap and relocate turtles, toads, etc. from the landfill expansion and restoration construction area				x	x	x	x											x	x	x	x						AES/CH team				
	e. Conduct Breeding and Migratory Bird surveys in landfill expansion and restoration areas						x	x			x	x								x	x			x	x			AES/CH team	107		135	
	f. Conduct nectary plant surveys in expansion and restoration areas							x	x	x											x	x	x					AES/CH team	110		138	
5/1/2010	g. Prepare and submit annual monitoring reports				x	x	x						x	x					x	x	x					x	x	AES/CH team	98			
	12. Weekly Management Team Meetings																														

	a. Conduct weekly management team		x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x					

	meetings																														
	b. Weekly notifications and reporting					**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**		**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**					
	13. Log Vane Grade Control Structures																														
	a. Install log vane grade control structures in existing stream										**x**	**x**																AES				

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Attachment C. Nursery Construction and Operations
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

I. Planning

a. Production has been planned and sited based upon estimated needs, available seed stock and other propagules, and site restrictions.
b. Fields should be relatively flat, near a water-source and easily accessible by truck and tractor.
c. Fields should also contain soils appropriate to the selected plant list for the project.
d. Based on 2009 seed collections an estimated 2 acres of seed production space will be installed in 2010. An additional estimated 0.34 acres is reserved for live plant rescues and mother stock. The remaining 0.57 acres of the 2.91-acre nursery is devoted to non-production areas for tractor and implement access and turn-around lanes.
e. A portable reel irrigation system is planned for watering seed production fields during establishment. The water source will be routed from a source within the trailer park to the nursery location.
f. A building suitable for the longer-term operation must be located near-by, or a facility constructed. It is anticipated that the Rapp Road property referred to as the "horse farm" might be available for this purpose. The facility will need a small office space including plumbing and electrical. It must have a temperature-controlled space minimally the size of a 3-car garage with cement floors and additional covered space capable of holding a tractor, and 4-5 mid-sized farm implements.
g. Execution Areas selected for nursery production will be treated with herbicide as needed following trailer park cleanup and application of 12 inches of clean sand and planted to a cover-crop. An initial herbicide treatment in March and a follow up prior to planting will ensure a good kill of weeds present. Proper site-prep is a key to successful field development and weed control.
h. Clean fields should be well-tilled resulting in a smooth bed, then treated with Round-up or similar herbicide if needed to kill the flush of weeds to follow.
i. If high Ph sand from the stockpile is used for the nursery beds, sand will be amended appropriately to maximize seed productivity.
j. Quarter-acre beds (fields) will be established. A 3-acre nursery could cost-effectively and efficiently produce 10-15 species.
k. Species that are relatively good competitors in the field and produce ample amounts of seed should be row-cropped. Weeds will be controlled primarily with a mechanical cultivator and application of pre-emergent herbicides. Fields (beds) can be mechanically or hand harvested as appropriate. The following species have been chosen to put into field production at approximately ¼ acre each: *Ionectis linarifolius,*

Symphytotrichum patens, Helianthemum canadense, Helianthus divaricatus, Ceanothus americanus, Asclepias tuberosa. A ½ acre bed of *Lupinus perennis* will be established due to its importance in the project success.

l. Fields will be row-cropped by setting live plants. Species with similar herbicide tolerances should be planted adjacent to one another. Live plants will be set with a mechanical transplanter, or plant-setter, such as used in the vegetable and tobacco industries. Row spacing and distance between plants will be 24"; however, spacing can be adjusted as needed. Our nurseries transplant live plants in 128's (128 cells per 10"x20" tray). If full beds of each species cannot be established due to a shortage of propagation seed they will be filled the following year.

m. To minimize herbivory damage to plantings, an electric fence suitable for excluding deer will be constructed around the nursery beds on each side of the roadway, creating two separate gated exclosures.

n. Beds are generally treated with a pre-emergent herbicide a few days after transplanting, once the plants have established new roots. Follow the label for rates and appropriate application. Herbicide application is not recommended during flowering and seed-set. Mints and members of the Scrophularia family are not tolerant of PE herbicides. Pre-emergent herbicides will usually suppress weeds sufficiently for good establishment; however, control varies by crop and the length of its effectiveness is dependent upon rainfall and soil-type. Additional weeding and cultivation will be necessary.

o. Row-cropped fields can be cultivated with a mechanical cultivator, such as is used in the vegetable and tobacco industries. Cultivating can be done until flowering for most species.

p. As weed competition moves in, selective herbicides and hand-weeding can be utilized. This is generally effective for 3-4 years. Most fields planted with live plants produce little to no seed in year-1 and achieve peak production in years 2 and 3. Around the age of five the weed pressure in most fields will become too great the bed will need to be replaced.

q. At the current planned size of the nursery, 2.91 acres, hand collection is still a reasonable method. However, if the nursery is expanded a mechanical method will be needed such as a tractor bucket-mounted seed-sweeper, or seed-stripper will be required.

II. Harvest Estimates

a. Based on the proposed model, the nursery should be able to produce approximately 100 lbs of cleaned seed per production acre / year (excluding walkways and non-producing areas). The blended average yield of moderately producing seed crops is 100 lbs / acre. The numbers may seem low, but they are balanced with the reality that beds are constantly turning over and have different longevities, at no one time are all beds producing their peak yields.

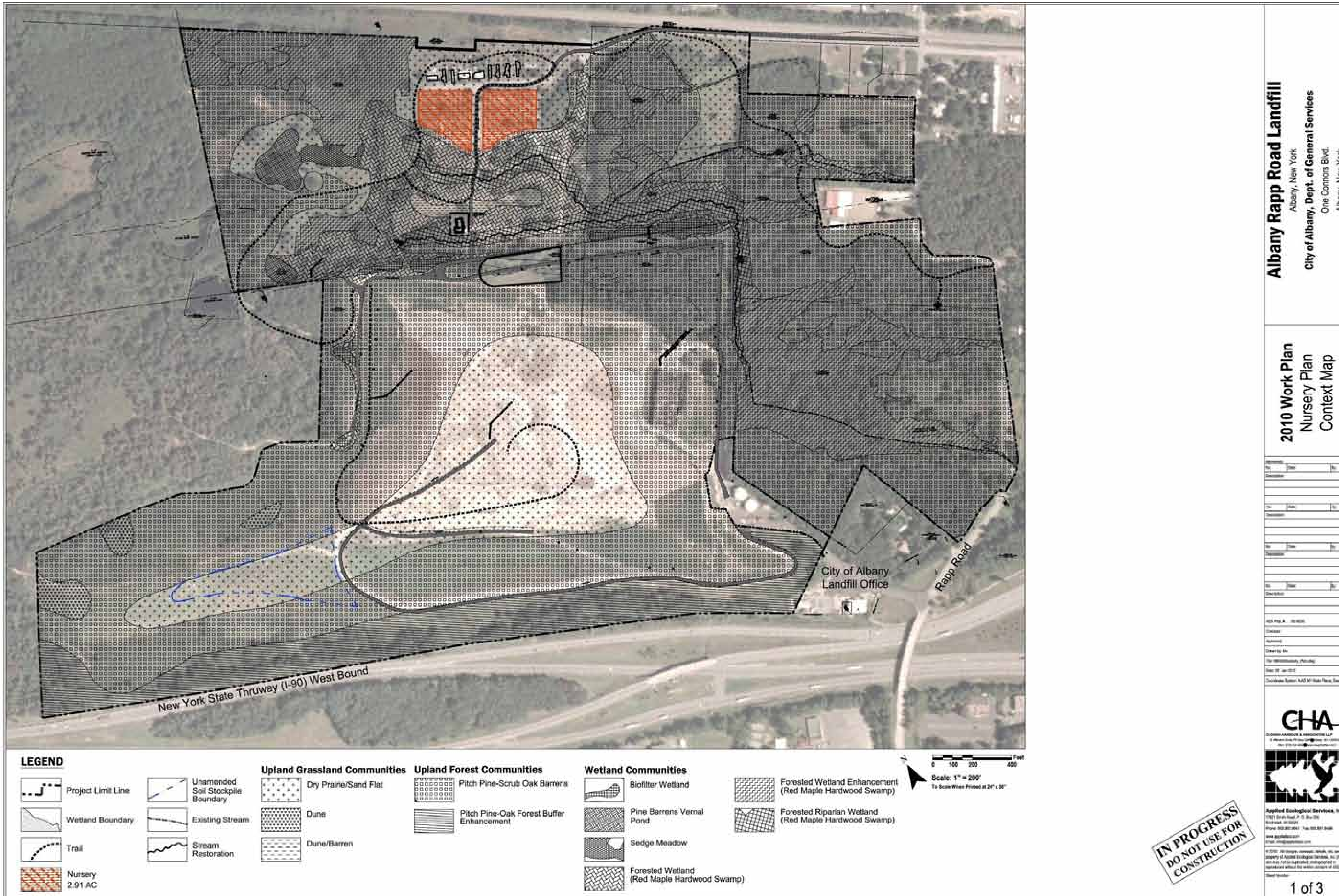
b. These are the numbers we use in estimating production yields in our specialty locations. Much greater yields are found in commercially abundant crops such as Sorghastrum nutans, Monarda fistulosa, Lupinus perennis, Carex vulpinoidea and others; however, these are not the kinds of species often targeted for highly sensitive restorations.*(3 acres) x (100 lbs/ac) = 300 lbs annual nursery seed production at peak production. A conservative yield may be roughly* ***150-200 lbs*** *annually for the planned operation*

III. Additional resources needed for semi-permanent operation

a. Building facility as described in I.f.
b. 2-row mechanical transplanter
c. 3 point mount hooded sprayer (to prevent herbicide over-spray)
d. Cultivator tractor - newer model with PTO and 3-point hitch to pull mower and sprayer
e. Seed-sweeper style harvester – needed if acreage is expanded
f. Mower
g. Tiller
h. Larger tractor for tilling
i. Additional higher volume fanning mill
j. Irrigation unit
k. Location appropriate for herbicide storage

Proposed Schedule for Initial Nursery Establishment and Seed Collection

January 1. 2010	Contingency agreement due date for bed development species to Green house for propagation
February 15, 2010	Germination of starter plants Apply for Saratoga National Park Collection Permit
March 15, 2010	Balance of acquired seed refined and ready for delivery per restoration schedule. Areas selected for Nursery Establishment prepared for nursery and treated with appropriate herbicide
April 2010	Nursery field prepped; irrigation installed and tested. Spring ephemeral seed collection
May 2010	Preferred time of plant delivery and installation; cover crop of unplanted nursery areas; management schedule for growing season per methods described and / or per improved methods discovered and site / project specific needs. Pre-emergent herbicide applied to planted beds.
June 2010	Summer seed collections of species required in progress Weed control in production beds if required
Late August 2010	Contingency late planting date, requires plant mulching Late summer and fall collections in progress
September 2010	Begin thrashing and refining of late summer harvest
December 2010	2010 collections complete and refining process beginning
2011	First year of seed harvest from production fields per a May 2010 planting, full facilities established; or Contingency plan – minimal harvest in 2010
2011	First year of seed harvest per contingency plan
2012 – 2014	Peak seed harvest years in production beds
2015	First rotation of weakening fields


Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York
2010 Work Plan
Nursery Plan
Context Map
City of Albany
Landfill Office
Rapp Road
New York State Thruway (I-90) West Bound
LEGEND
Project Limit Line
Wetland Boundary
Trail
Nursery
2.91 AC
Unamended
Soil Stockpile
Boundary
Existing Stream
Stream
Restoration
Upland Grassland Communities
Dry Prairie/Sand Flat
Dune
Dune/Barren
Upland Forest Communities
Pitch Pine-Scrub Oak Barrens
Pitch Pine-Oak Forest Buffer
Enhancement
Wetland Communities
Biofilter Wetland
Pine Barrens Vernal
Pond
Sedge Meadow
Forested Wetland
(Red Maple Hardwood Swamp)
Forested Wetland Enhancement
(Red Maple Hardwood Swamp)
Forested Riparian Wetland
(Red Maple Hardwood Swamp)
Scale: 1" = 200'
Feet
0 100 200 400
IN PROGRESS
DO NOT USE FOR
CONSTRUCTION
CHA
1 of 3

LEGEND

- Project Limit Line
- Wetland Boundary
- Nursery 2.91 AC
- Access Road

Upland Grassland Communities

- Dry Prairie/Sand Flat
- Dune
- Dune/Barren

Upland Forest Communities

- Pitch Pine-Scrub Oak Barrens
- Pitch Pine-Oak Forest Buffer Enhancement

Wetland Communities

- Biofilter Wetland
- Pine Barrens Vernal Pond
- Sedge Meadow
- Forested Wetland (Red Maple Hardwood Swamp)
- Forested Wetland Enhancement (Red Maple Hardwood Swamp)
- Forested Riparian Wetland (Red Maple Hardwood Swamp)

N

0 15 30 60 Feet

Scale: 1" = 30'

To Scale When Printed at 24" x 36"

FOR REVIEW
DO NOT USE FOR CONSTRUCTION

Albany Rapp Road Landfill

Albany, New York

City of Albany, Dept. of General Services

One Connors Blvd.

Albany, New York

2010 Work Plan

Nursery Plan

CHA

Applied Ecological Services, Inc.

2 of 3

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Notes:

1. The nursery electric fencing will be added by others to control deer damage.
2. The nursery is within the trailer court cleanup boundary. Silt fencing and orange construction fencing will be located around the perimeter of the cleanup area.
3. A red oak tree located within the nursery boundary will be removed during cleanup activities on the trailer court.
4. Existing infrastructure and roadways no longer required for the trailer court will be removed during cleanup. The disturbed cleanup area will be leveled under the nursery prior to covering the area with 1 foot of sand.
5. The nursery plots will be covered with 1 foot of sand specified for the nursery. The nursery will be almost flat with a crown in the center to direct any runoff toward the edge.

LEGEND

- Project Limit Line
- Access Road
- Existing 2' Contours
- Existing 10' Contours
- Priority Clean-up Area
- Nursery Fence
- Nursery Gate
- 2" Water System Outlet Riser
- Red Oak Tree
- Surface Drainage

N

0 15 30 60 Feet

Scale: 1" = 30'
To Scale When Printed at 24" x 36"

FOR REVIEW
DO NOT USE FOR CONSTRUCTION

Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York

2010 Work Plan
Nursery Plan

CHA

Applied Ecological Services, Inc.

3 of 3

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Specialists in Environmental Research, Planning, Construction and Management

Attachment D. Seed/Plant Collection & Acquisition
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

I. Planning
   a. An experienced AES seed collector/ nursery manager will relocate to Albany to manage collections in the region for the project.
   b. 2010 collections will focus on the zones and acreages to be planted in 2011, per the updated schedule. The majority of collections will focus on species in the Forested Wetland Zone.
   c. Scouting for additional seed collection locations will occur throughout the growing season in conjunction with seed collection efforts.
   d. Collected species will be based on the approved species lists that have been created by Applied Ecological Services in collaboration with APBPC staff and approved by the Interagency Habitat Management Team.
   e. Sites will be harvested on private land only after permission is given by land owners and in accordance with local, state and federal laws.
   f. The collection of native seed from Albany Pine Bush Preserve Commission lands will not be conducted until a new temporary restricted permit (TRP) has been received.
   g. Any necessary permitting (such as for protected species, etc.) will be obtained prior to commencement of collection.
   h. A new application for a collection permit at Saratoga National Park will be submitted for 2010 collections.
   i. The current permit for collecting along Hwy 88 is valid until early November 2010.
   j. An office/shop near the project site will be acquired to store, dry, and begin processing the harvested seed. Outbuildings located on the Rapp Road horse farm are anticipated to be available for use.

II. Execution
   a. The nursery will staff at least three full time seed collectors and hire on more staff when required. According to 2009 collection hours it will take approximately 4,000 labor hours to collect the seed required in 2011.
   b. Locally sourced seed already available from vendors and groups, including the Preserve, will be obtained pending approval.
   c. Material that cannot be obtained from existing (commercial) seed stocks will be targeted for collection. No more than 1/3 of any standing conservative population will be collected during the season to protect the habitat and ensure the population

will not be decimated. More vigorous species may be harvested up to 2/3. Areas that are scheduled for demolition will be completely collected.

d. Collection techniques will include hand-stripping, use of hand tools such as scissors or snips, and if deemed non-detrimental to the site and population, mechanical methods such as brush saws or strippers. It should be assumed that collectors will not drive across remnant areas, and that they shall access properties in such a way as to minimize disturbance to the site. Where appropriate and approved plant material will include stem and root cuttings.
e. Plants will not be collected unless they require rescue from a scheduled demolition area.
f. Preparation of the seed will include rack drying if appropriate with ambient air and/or forced-air, or soaking, prior to processing and storage.
g. Species collected will be tagged and catalogued by proper scientific name with the origin site listed, and stored as appropriate to maximize shelf life and future germination.
h. After drying, or other species-appropriate treatment, materials will be shipped via private carrier to the corporate nursery headquarter for refining and controlled storage. Materials will be held in our storage facility until called for by the project.
i. Starter plant-material will be grown in 128's at the corporate headquarters, or with a local nursery partner, for seed production field development. **Species Lists, quantities and approval must be in place by Nov. 1, prior to a spring planting. A contingency due date is January 1 and would result in a late August planting**.

III. 2010 Minimum Resources List:
   a. A building with electrical, lighting, ventilation and cement floors, suitable for storage, seed drying and limited processing.
   b. Pick-up with topper
   c. Drying racks and blowers
   d. Poles, lines, pallets and shelving for storage
   e. Technology needs: Laptop, printer, GPS, cell phone
   f. Collection forms, tags and journal
   g. Poly-bags and paper bags, drying bags, rough-thrashing screens, 2 saw horses, broom, dust pan, shovel, hedge-trimmer, rake, bag-stand, hanging scale, clothes-line, tarps, twine, bag-stitcher, shears, clippers and first-aid kit.
   h. Electrically powered seed thrasher
   i. 2B fanning mill and screens
   j. Freezer for storage of hydrophilic species
IV. Project specific requirements
   a. Albany Rapp Road Landfill.
      i. Refer to Native Seed Collection 32 92 of the Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan.

Part Three – Proposed Schedule for Initial Nursery Establishment and Seed Collection

January 1. 2010	Contingency agreement due date for bed development species to greenhouse for propagation
February 15, 2010	Germination of starter plants Apply for Saratoga National Park Collection Permit

March 15, 2010	Balance of acquired seed refined and ready for delivery per restoration schedule. Areas selected for Nursery Establishment prepared for nursery and treated with appropriate herbicide
April 2010	Nursery field prepped; irrigation installed and tested. Spring ephemeral seed collection
May 2010	Preferred time of plant delivery and installation; cover crop of unplanted nursery areas; management schedule for growing season per methods described and / or per improved methods discovered and site / project specific needs. Pre-emergent herbicide applied to planted beds.
June 2010	Summer seed collections of species required in progress Weed control in production beds if required
Late August 2010	Contingency late planting date, requires plant mulching Late summer and fall collections in progress
September 2010	Begin thrashing and refining of late summer harvest
December 2010	2010 collections complete and refining process beginning
2011	First year of seed harvest from production fields per a May 2010 planting, full facilities established; or Contingency plan – minimal harvest in 2010
2011	First year of seed harvest per contingency plan
2012 – 2014	Peak seed harvest years in production beds
2015	First rotation of weakening fields

Attachment B: **Albany Landfill Proposed Seed Mixes**

Dry Prairie / Sand Flat (43.45 ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Andropogon gerardii	Big bluestem grass	x	x	x		**P1 4.98 ac**	
Carex brevior	Shortbeak sedge			x		**P2 1.46 ac**	
Danthonia spicata	Poverty-grass			x		**P3 4.56 ac**	
Elymus canadensis	Canada wild rye			x		**P4 12.67 ac**	
Schizachyrium scoparium	Little bluestem grass	x	x			**P5 19.78 ac**	
Sorghastrum nutans	Indian grass	x		x			
Forbs							
Botanical Name	Common Name						
Anaphalis margaritacea	Pearly everlasting			x			
Anemone cylindrica	Thimbleweed			x			
Apocynum androsaemifolium	Spreading dogbane	x		x			
Apocynum cannabinum	Indian hemp			x			
Apocynum sibiricum	Prairie Indian hemp			x			
Artemisia caudata	Beach blue mound			x			
Asclepias amplexicaulis	Blunt-leaf milkweed			x			
Asclepias syriaca	Common milkweed			x			
Asclepias tuberosa	Butterfly milkweed	x	x	x	x		
Aster ericoides	Heath aster			x			
Aster laevis	Smooth blue aster	x	x	x			
Aster linariifolius	Flax-leaved aster	x		x	x		
Aster patens	Late purple aster	x		x	x		
Aster novi-belgii	New York aster	x	x				
Aster pilosus	Frost aster			x			
Ceanothus americanus	New Jersey tea	x	x		x		
Comandra umbellata	Bastard-toadflax			x			
Desmodium canadense	Showy tick trefoil			x			
Euphorbia corollata	Flowering spurge			x			
Fragaria virginiana	Wild strawberry			x			
Gnaphalium obtusifolium	Rabbit tobacco			x			
Helianthemum canadense	Longbranch frostweed			x	x		
Helianthus divaricatus	Woodland sunflower			x	x		
Lespedeza capitata	Round-headed bush clover	x	x	x			
Lupinus perennis	Wild lupine	x		x	x		
Lysimachia quadrifolia	Whorled loosestrife			x			Abundant per Jesse H

Monarda fistulosa	Wild bergamot			x			
Monarda punctata	Dotted Horsemint	x	x	x			
Oenothera biennis	Common evening primrose			x			
Potentilla arguta	Prairie cinquefoil			x			
Pycnanthemum virginianum	Common mountain mint			x			
Ratibida pinnata	Yellow coneflower			x			
Rosa carolina							
Rudbeckia hirta	Black-eyed Susan	x		x			
Solidago nemoralis	Old-field goldenrod						
Solidago rugosa	Rough-stemmed goldenrod			x			
Solidago speciosa	Showy goldenrod						
Tephrosia virginiana	Goat's Rue	x		x			
Viola pedata	Bird's foot violet			x			
Viola lanceolata	Lance-leaf violet			x			

Trees and Shrubs

Botanical Name	Common Name
Aronia melanocarpa	Black chokeberry
Corylus americana	Hazelnut
Gaylussacia baccata	Black huckleberry
Pinus rigida	Pitch Pine
Prunus pumila	Sandcherry
Quercus ilicifolia	Scrub oak
Quercus prinoides	Dwarf chinkapin oak
Salix humilis	Dune willow
Vaccinium pallidum	Hillside blueberry

Dune and Dune Barren (4.34 ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Botanical Name	Common Name					**P1 0 ac**	
Andropogon gerardii	Big bluestem grass	x	x	x		**P2 2.42 ac**	
Danthonia spicata	Poverty-grass			x		**P3 0 ac**	
Elymus canadensis	Canada wild rye			x		**P4 1.92 ac**	
Schizachyrium scoparium	Little bluestem grass	x	x			**P5 O ac**	
Sorghastrum nutans	Indian grass	x		x			

Forbs

Botanical Name	Common Name
Apocynum sibiricum	Indian hemp
Artemisia caudata	Beach blue mound

Asclepias syriaca	Common milkweed			x	
Asclepias tuberosa	Butterfly milkweed	x		x	x
Aster ericoides	Heath aster	x		x	
Aster laevis	Smooth blue aster		x	x	
Aster linariifolius	Flax-leaved aster			x	x
Aster patens	Late purple aster	x		x	x
Aster pilosus	Frost aster	x		x	
Ceanothus americanus	New Jersey tea	x	x	x	x
Euphorbia corollata	Flowering spurge			x	
Fragaria virginiana	Wild strawberry			x	
Gnaphalium obtusifolium	Rabbit tobacco			x	
Helianthemum canadense	Longbranch frostweed			x	x
Lespedeza capitata	Round-headed bush clover	x	x	x	
Lupinus perennis	Wild lupine	x		x	x
Lysimachia terrestris	Swamp candles			x	
Monarda fistulosa	Wild bergamot	x		x	
Monarda punctata	Dotted Horsemint	x	x		
Oenothera biennis	Common evening primrose			x	
Phlox pilosa	Downy phlox			x	
Potentilla arguta	Prairie cinquefoil			x	
Pycnanthemum virginianum	Common mountain mint			x	
Ratibida pinnata	Yellow coneflower			x	
Rudbeckia hirta	Black-eyed Susan			x	
Solidago nemoralis	Old-field goldenrod			x	
Solidago rugosa	Rough-stemmed goldenrod			x	
Solidago speciosa	Showy goldenrod			x	

Plants

Botanical Name	Common Name
Anemone cylindrica	Thimbleweed
Asclepias tuberosa	Butterfly milkweed
Euphorbia corollata	Flowering spurge
Fragaria virginiana	Wild strawberry

Trees and Shrubs

Botanical Name	Common Name
Aronia melanocarpa	Black chokeberry
Corylus americana	Hazelnut
Gaylussacia baccata	Black huckleberry
Pinus rigida	Pitch Pine
Prunus pumila	Sandcherry

Quercus ilicifolia	Scrub oak
Quercus prinoides	Dwarf chinkapin oak
Salix humilis	Dune willow
Vaccinium pallidum	Hillside blueberry

Pitch Pine / Scrub Oak Barrens (125.56 ac)		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Grasses, sedges, etc.						**P1 4.82 ac**	
Botanical Name	Common Name					**P2 5.67 ac**	
Agrostis perrenas	Autumn bentgrass			x		**P3 35.64 ac**	
Andropogon gerardii	Big bluestem grass	x		x		**P4 34.59 ac**	
Bromus purgans	Hairy wood chess			x		**P5 44.84 ac**	
Carex bicknellii	Bicknell's/Prairie sedge			x			
Carex pensylvanica	Pennsylvania sedge			x			
Carex spargaonides	Burreed sedge			x			
Cyperus schweinitzii	Sand flat sedge			x			
Elymus canadensis	Canada wild rye			x			
Schizachyrium scoparium	Little bluestem grass	x					
Sorghastrum nutans	Indian grass	x		x			
Forbs							
Botanical Name	Common Name						
Apocynum sibricum	Indian hemp			x			
Arabis glabra	Tower mustard			x			
Artemisia caudata	Beach blue mound			x			
Asclepias syriaca	Common milkweed			x			
Asclepias tuberosa	Butterfly milkweed	x		x	x		
Aster linariifolius	Flax-leaved aster	x		x	x		
Aster macrophyllus	Large-leaf aster			x			
Aster patens	Late purple aster	x		x	x		
Aster pilosus	Frost aster			x			
Brachyelytrum erectum	Long awned wood grass			x			
Desmodium canadense	Showy tick trefoil			x			
Desmodium glutinosum	Pointed-leaved tick trefoil			x			
Eupatorium rugosum	White snakeroot			x			
Fragaria virginiana	Wild strawberry			x			
Galium boreale	Northern bedstraw			x			
Gnaphalium obtusifolium	Rabbit tobacco			x			
Helianthemum canadense	Longbranch frostweed			x	x		
Helianthus divaricatus	Woodland sunflower			x	x		
Heliopsis helianthoides	Ox-eye/false sunflower			x			
Lespedeza capitata	Round-headed bush clover	x	x				

Monarda fistulosa	Wild bergamot		x
Oenothera biennis	Common evening primrose		x
Penstemon digitalis	Foxglove beard tongue		x
Pteridium aquilinum var. latiusculum	Bracken fern		x
Rudbeckia hirta	Black-eyed Susan	x	x
Smilacina racemosa	Feathery false Solomon's seal		x
Smilacina stellata	Starry false Solomon's seal		x
Solidago flexicaulis	Zig-zag goldenrod		x
Solidago juncea	Early goldenrod		x
Solidago nemoralis	Old-field goldenrod		x
Solidago rigida	Stiff goldenrod		x
Solidago speciosa	Showy goldenrod		x
Tephrosia virginiana	Goat's rue/Hoary pea	x	x
Viola pedata	Bird's foot violet		x

Plants

Botanical Name	Common Name
Pteridium aquilinum var. latiusculum	Bracken fern
Smilacina racemosa	Feathery false Solomon's seal
Smilacina stellata	Starry false Solomon's seal
Tephrosia virginiana	Goat's rue/Hoary pea
Carex pensylvanica	Pennsylvania sedge

Trees and Shrubs

Botanical Name	Common Name
Ceanothus americanus	New Jersey tea
Corylus americana	Hazelnut
Crataegus sp	Hawthorn
Gaylussacia baccata	Black huckleberry
Pinus rigida	Pitch pine
Prunus pumila	Sandcherry
Quercus ilicifolia	Scrub oak
Quercus prinoides	Dwarf chinkapin oak
Salix humilis	Dune willow
Vaccinium pallidum	Hillside blueberry

Pitch Pine / Oak Forest Buffer Enhancement (18.09 ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Botanical Name	Common Name			x		**P1 0 ac**	
Carex blanda	Wood sedge			x		**P2 0 ac**	
Carex grayi	Gray's/Bur sedge			x		**P3 0 ac**	
Carex pensylvanica	Pennsylvania sedge			x		**P4 0 ac**	
Elymus canadensis	Canada wild rye			x		**P5 18.09 ac**	
Schizachyrium scoparium	Little bluestem grass	x	x	x			
Forbs							
Botanical Name	Common Name						
Arisaema triphyllum	Jack-in-the-pulpit			x			
Asarum canadense	Wild ginger			x			
Aster cordifolius	Heart leaved blue wood aster			x			
Aster laevis	Smooth blue aster		x	x			
Aster lowreanicum	Flax-leaved aster			x			
Aster macrophyllus	Large-leaf aster			x			
Aster novea-beligii	New York aster	x	x				
Brachyelytrum erectum	Long awned wood grass			x			
Clematis virginiana	Virgin's bower			x			
Desmodium glutinosum	Pointed-leaved tick trefoil			x			
Dryopteris marginalis	Leatherwood fern			x			
Eupatorium rugosum	White snakeroot			x			
Geranium maculatum	Wild geranium			x			
Helianthus strumosus	Woodland sunflower			x			
Lobelia inflata	Indian tobacco			x			
Lysimachia ciliata	Fringed loosestrife			x			
Maianthemum canadense-interius	False lily-of-the-valley			x			
Podophyllum peltatum	May apple			x			
Polygonum virginiana	Woodland knotweed			x			
Polystichum acrostichoides	Christmas fern			x			
Pteridium aquilinum	Bracken fern			x			
Pyrola rotundifolia	French grass			x			
Smilacina racemosa	Feathery false Solomon’s seal			x			
Solidago flexicaulis	Zig-zag goldenrod			x			
Stretopus roseus	Rose mandarin			x			
Uvularia grandiflora	Bellwort			x			
Plants							
Botanical Name	Common Name						

Arisaema triphyllum	Jack-in-the-pulpit
Asarum canadense	Wild ginger
Dryopteris marginalis	Leatherwood fern
Helianthus strumosus	Woodland sunflower
Maianthemum canadense-interius	False lily-of-the-valley
Podophyllum peltatum	May apple
Polygonum virginiana	Woodland knotweed
Polystichum acrostichoides	Christmas fern
Pteridium aquilinum	Bracken fern
Pyrola rotundifolia	French grass
Smilacina racemosa	Feathery false Solomon's seal
Stretopus roseus	Rose mandarin
Uvularia grandiflora	Bellwort
Carex grayi	Gray's/Bur sedge
Carex pensylvanica	Pennsylvania sedge

Trees and Shrubs

Botanical Name	Common Name
Betula papyrifera	Paper birch
Corylus americana	Hazelnut
Gaylussacia baccata	Black huckleberry
Pinus rigida	Pitch Pine
Quercus alba	White oak
Quercus rubra	Red oak
Sorbus americana	Mountain ash
Vaccinium pallidum	Hillside blueberry
Vibernum dentatum	Arrowleaf viburnum

Biofilter Wetland (1.41 ac)		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Grasses, sedges, etc.						**P1 1.41 ac**	
Botanical Name	Common Name					**P2 0 ac**	
Carex hystricina	Bottlebrush/Porcupine sedge					**P3 0 ac**	
Carex lanuginosa (pellita)	Wooly sedge					**P4 0 ac**	
Carex scoparia	Pointed broom sedge					**P5 0 ac**	
Carex stipata	Awl-fruited sedge						
Glyceria canadensis	Rattlesnake grass			x			Abundant per Jesse H.
Juncus effusus	Common/soft rush			x			
Leersia oryzoides	Rice cut grass			x			
Scirpus acutus	Hard-stemmed bulrush						
Scirpus americanus	Chair makers/true 3-sq bulrush						

Scirpus cyperinus	Wool grass	x
Scirpus fluviatilis	River bulrush	

Forbs

Botanical Name	Common Name	
Alisma subcordatum	Mud/Water plantain	x
Asclepias incarnata	Swamp/Marsh milkweed	x
Aster simplex	Marsh/Panicled aster	x
Blephilia hirsuta	Wood mint	x
Epilobium coloratum	Cinnamon willow herb	x
Mimulus ringens	Monkey flower	x
Penthorum sedoides	Ditch stone crop	x
Sagittaria latifolia	Arrowhead	x
Solidago gigantea	Tall goldenrod	x
Solidago graminifolia	Grass-leaved goldenrod	x

Plants

Botanical Name	Common Name
Alisma subcordatum	Mud/Water plantain
Iris virginica shrevei	Wild blue iris
Sagittaria latifolia	Arrowhead
Scirpus acutus	Hard-stemmed bulrush
Scirpus americanus	Chair makers/true 3-sq bulrush

Pine Barrens Vernal Pond (1.48ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Botanical Name	Common Name					**P1 1.12 ac**	
Calamagrostis canadensis	Blue joint grass			x		**P2 .36 ac**	Abundant per Jesse H
Carex bebbii	Bebb's sedge			x		**P3 0 ac**	
Carex lanuginosa	Wooly sedge			x		**P4 0 ac**	
Carex stipata	Awl-fruited sedge			x		**P5 0 ac**	
Carex stricta	Tussock sedge			x			
Carex trisperma	Three-seed sedge			x			
Cyperus strigosus	Galingale			x			
Dulichium arundinacea	Three-way sedge			x			
Eleocharis acicularis	Spike rush			x			
Eleocharis obtusa	Blunt spike rush			x			
Eriophorum aungustifolium	Tall cottongrass			x			
Frimbristylis autumnalis	Fimbry			x			
Glyceria grandis	Reed manna grass			x			Abundant per Jesse H

Juncus tenuis	Slender/Path rush	x	Abundant per Jesse H
Leersia oryzoides	Rice cut grass	x	
Rhychospora alba	White beakgrass	x	
Rhychospora capitellata	brownish beakgrass	x	
Scirpus atrovirens	Dark green bulrush	x	
Scirpus cyperinus	Wool grass	x	
Scirpus (Scheonplectus tabernaemontanii)	Great/soft stem bulrush	x	

Forbs

Botanical Name	Common Name	
Drosera intermidia	Sundew	x
Drosea rotundifolia	Round-leaf sundew	x
Epilobium coloratum	Cinnamon willow herb	x
Hypericum boreale	Northern dwarf St. John's wort	x
Lobelia siphilitica	Great blue lobelia	x
Ludwigia palustris	Water purslane	x
Lycopus americanus	Water horehound/bugle weed	x
Lycopus virginiana	Virginia water horehound	x
Lysimachia quadriflora	Narrow-leaved loosestrife	x
Lysimachia terrestris	Swamp candles	x
Menyanthes trifoliata var minor	Buckbean	x
Osmunda cinnamomea	Cinnamon fern	x
Osmunda regalis var spectablis	Royal fern	x
Penthorum sedoides	Ditch stone crop	x
Pogonia ophioglossoides	Rose pagonia	x
Pontederia cordata	Pickerelweed	x
Potentilla palustris	Marsh cinquefoil	x
Proserpinaca palustris	Glaucous white lettuce	x
Ranunculus flabellaris	Yellow crowfoot	x
Rorippa paulstris	Marsh watercress	x
Sagittaria latifolia	Arrowhead	x
Sarracenia purpurea	Pitcher plant	x
Scutellaria lateriflora	Mad dog skullcap	x
Sium suave	Tall water parsnip	x
Thelypteris noveboracensis	New York fern	x
Thelypteris palustris var pubescens	Marsh fern	x
Triadenum fraseri	Marsh St. John's wort	x
Viola lanceolata	Lance-leaved violet	x

Plants

Botanical Name	Common Name
Drosera intermedia	Sundew
Drosea rotundifolia	Round-leaf sundew
Epilobium coloratum	Cinnamon willow herb
Hypericum boreale	Northern dwarf St. John's wort
Lippa lanceolata	Northern fogfruit
Lobelia siphilitica	Great blue lobelia
Ludwigia palustris	Water purslane
Lycopus americanus	Water horehound/bugle weed
Lycopus virginiana	Virginia water horehound
Lysimachia quadriflora	Narrow-leaved loosestrife
Lysimachia terrestris	Swamp candles
Menyanthes trifoliata var minor	Buckbean
Osmunda cinnamomea	Cinnamon fern
Osmunda regalis var spectabilis	Royal fern
Penthorum sedoides	Ditch stone crop
Pogonia ophioglossoides	Rose pagonia
Pontederia cordata	Pickerelweed
Potentilla palustris	Marsh cinquefoil
Proserpinaca palustris	Glaucous white lettuce
Ranunculus flabellaris	Yellow crowfoot
Rorippa palustris	Marsh watercress
Sagittaria latifolia	Arrowhead
Sarracenia purpurea	Pitcher plant
Scutellaria lateriflora	Mad dog skullcap
Sium suave	Tall water parsnip
Thelypteris novebroacensis	New York fern
Thelypteris palustris var pubescens	Marsh fern
Triadenum fraseri	Marsh St. John's wort
Viola lanceolata	Lance-leaved violet
Calamagrostis canadensis	Blue joint grass
Carex bebbii	Bebb's sedge
Carex lanuginosa	Wooly sedge
Carex stipata	Awl-fruited sedge
Carex stricta	Tussock sedge
Carex trisperma	Three-seed sedge
Cyperus esculentus	Field nut sedge
Dulichium arundinacea	Three-way sedge
Eleocharis acicularis	Spike rush
Eleocharis obtusa	Blunt spike rush

Eriophorum aungustifolium	Tall cottongrass
Fimbristylis autumnalis	Fimbry
Glyceria grandis	Reed manna grass
Juncus tenuis	Slender/Path rush
Leersia oryzoides	Rice cut grass
Rhychospora alba	White beakgrass
Rhychospora capitellata	Brownish beakgrass
Scirpus atrovirens	Dark green bulrush
Scirpus cyperinus	Wool grass
Scirpus validus	Great/soft stem bulrush

Trees and Shrubs

Botanical Name	Common Name
Andromeda glaucophlya	Marsh rosemary
Betula pumila	Bog birch
Cephalanthus occidentalis	Buttonbush
Chamaedaphne calyculata	Leatherleaf
Ilex mucronata	Catberry

Sedge Meadow (.63 ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Botanical Name	Common Name					**P1 .63 ac**	
Calamagrostis canadensis	Blue joint grass			x		**P2 0 ac**	Abundant per Jesse H
Carex bebbii	Bebb's sedge			x		**P3 0 ac**	
Carex lupulina	Hop sedge			x		**P4 0 ac**	
Carex lanuginosa	Wooly sedge			x		**P5 0 ac**	
Carex scoparia	Pointed broom sedge			x			
Carex stricta	Tussock sedge			x			
Carex vulpinoidea	Fox tail sedge			x			
Eleocharis erythropoda	Red rooted spike rush			x			
Eleocharis obtusa	Blunt spike rush			x			
Elymus virginicus	Virginia wild rye			x			Oberserved per Jesse H
Glyceria canadensis	Rattlesnake grass			x			Abundant per Jesse H
Glyceria striata	Fowl manna grass			x			Abundant per Jesse H
Juncus Dudleyi	Dudley's rush			x			
Juncus tenuis	Slender/Path rush			x			Abundant per Jesse H
Scirpus cyperinus	Wool grass			x			
Spartina pectinata	Prairie cord grass			x			

Forbs

Botanical Name	Common Name	
Aster simplex	Marsh/Panicled aster	x
Cicuta bulbifera	Water hemlock	x
Echinocystis lobata	Wild cucumber	x
Epilobium coloratum	Cinnamon willow herb	x
Erythronium americanum	Yellow adder's tongue	x
Eupatorium maculatum	Spotted Joe pye weed	x
Euphorbia corollata	Flowering spurge	x
Helenium autumnale	Dogtooth daisy	x
Lobelia cardinalis	Cardinal flower	x
Lobelia siphilitica	Great blue lobelia	x
Ludwigia alternifolia	Seed box	x
Lycopus americanus	Water horehound/bugle weed	x
Lysimachia ciliata	Fringed loosestrife	x
Ludwigia palustris	Water purslane	x
Matteuccia struthiopteris	Ostrich fern	x
Mimulus ringens	Monkey flower	x
Onoclea sensibilis	Sensitive/bead fern	x
Penthorum sedoides	Ditch stone crop	x
Physostegia virginiana	Obedient plant	x
Pycnanthemum virginianum	Common mountain mint	x
Solidago gigantea	Tall goldenrod	x
Solidago juncea	Early goldenrod	x
Thelypteris novebroacensis	New York fern	x
Veronica americana	American speedwell	x
Veronica scutellata	Marsh speedwell	x
Verbena hastata	Blue vervain	x
Woodwardia virginica	Virginia chain fern	x

Plants

Botanical Name	Common Name
Echinocystis lobata	Wild cucumber
Lobelia cardinalis	Cardinal flower
Lobelia siphilitica	Great blue lobelia
Matteuccia struthiopteris	Ostrich fern
Onoclea sensibilis	Sensitive/bead fern
Carex stricta	Tussock sedge

Trees and Shrubs

Botanical Name	Common Name
Cornus racemosa	Gray dogwood
Corylus americanus	American hazelnut
Ilex mucronata	Catberry
Sambucus canadensis	Elderberry
Spiraea alba	Meadowsweet
Spiraea tomentosa	Steeple bush

Forested Wetland (Red Maple Hardwood Swamp) (22.35 ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Botanical Name	Common Name					**P1 22.35**	
Calamagrostis canadensis	Blue joint grass			x		**P2 0**	Abundant per Jesse H
Carex bebbii	Bebb's sedge			x		**P3 0**	
Carex crinita	Fringed/Caterpillar sedge			x		**P4 0**	
Carex granularis	Meadow sedge			x		**P5 0**	
Carex grayi	Gray's/Bur sedge			x			
Carex intumescens	Bladder sedge			x			
Carex lacustris	Lake sedge			x			
Carex lanuginosa	Wooly sedge			x			
Carex stricta	Tussock sedge			x			
Cyperus strigosus	Straw-colored nutsedge			x			
Elymus riparius	Riverbank wild rye			x			Oberserved per Jesse H
Elymus virginicus	Virginia wild rye			x			Oberserved per Jesse H
Glyceria canadensis	Rattlesnake grass			x			Abundant per Jesse H
Glyceria striata	Fowl manna grass			x			Abundant per Jesse H
Juncus tenuis	Slender/Path rush			x			Abundant per Jesse H
Scirpus atrovirens	Dark green bulrush			x			
Scirpus cyperinus	Wool grass			x			

Forbs

Botanical Name	Common Name						
Apios americana	American groundnut			x			
Arisaema triphyllum	Jack-in-the-pulpit			x			
Aster cordifolius	Heart leaved blue wood aster			x			
Sarracenia purpurea	Pitcher plant			x			
Aster lateriflorus	Calico aster			x			
Caltha palustris	Marsh marigold			x			
Clematis virginiana	Virgin's bower			x			

Dryopteris marginalis	Leatherwood fern	x	
Epilobium coloratum	Cinnamon willow herb	x	
Eupatorium perfoliatum	Common boneset	X	Abundant per Jesse H
Iris virginica shrevei	Wild blue iris	x	
Lobelia siphilitica	Great blue lobelia	x	
Ludwigia polycarpa	Marsh purslane	x	
Lysimachia quadriflora	Narrow-leaved loosestrife	x	
Lysimachia thyrsiflora	Tufted loosestrife	x	
Matteuccia struthiopteris	Ostrich fern	x	
Onoclea sensibilis	Sensitive/bead fern	x	
Physostegia virginiana	Obedient plant	x	
Solidago graminifolia	Grass-leaved goldenrod	x	
Solidago rugosa	Rough-stemmed goldenrod	x	
Symplocarpus foetidus	Skunk cabbage	x	
Thelypteris palustris var pubescens	Marsh fern	x	
Veronica americana	American brooklime	x	
Woodwardia virginica	Virginia chain fern	x	

Plants

Botanical Name	Common Name
Arisaema triphyllum	Jack-in-the-pulpit
Dryopteris marginalis	Leatherwood fern
Matteuccia struthiopteris	Ostrich fern
Onoclea sensibilis	Sensitive/bead fern
Osmunda cinnamomea	Cinnamon fern
Osmunda claytoniana	Interrupted fern
Osmunda regalis var spectabilis	Royal fern
Symplocarpus foetidus	Skunk cabbage
Thalictrum dasycarpum	Purple meadow rue
Thelypteris palustris var pubescens	Marsh fern
Woodwardia virginica	Virginia chain fern
Carex stricta	Tussock sedge
Elymus riparius	Riverbank wild rye

Trees and Shrubs

Botanical Name	Common Name
Acer rubrum	Red Maple
Aronia prunifolia	Purple chokeberry
Betula papyrifera	Paper birch
Cornus racemosa	Gray dogwood
Gaylussacia baccata	Black huckleberry

Quercus alba	White oak
Quercus ilicifolia	Scrub oak
Quercus palustris	Pin oak
Salix candida	Sageleaf Willow

Forested Wetland Enhancement (22.27 ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Botanical Name	Common Name					**P1 0 ac**	
Calamagrostis canadensis	Blue joint grass			x		**P2 18.03 ac**	Abundant per Jesse H
Carex bebbii	Bebb's sedge			x		**P3 9.24 ac**	
Carex crinita	Fringed/Caterpillar sedge			x		**P4 0 ac**	
Carex granularis	Meadow sedge			x		**P5 0 ac**	
Carex grayi	Gray's/Bur sedge			x			
Carex intumescens	Bladder sedge			x			
Carex lanuginosa	Wooly sedge			x			
Carex stricta	Tussock sedge			x			
Elymus riparius	Riverbank wild rye			x			Observed per Jesse H
Elymus virginicus	Virginia wild rye			x			Observed per Jesse H
Glyceria striata	Fowl manna grass			x			Abundant per Jesse H
Juncus tenuis	Slender/Path rush			x			
Leersia oryzoides	Rice cut grass			x			
Panicum clandestinum	Deertongue			x			
Forbs							
Botanical Name	Common Name						
Apios americana	American groundnut			x			
Aralia hispida	Bristly sarsaparilla			x			
Aralia nudicaulis	Wild sarsaparilla			x			
Arisaema triphyllum	Jack-in-the-pulpit			x			
Aster cordifolius	Heart leaved blue wood aster			x			
Aster lateriflorus	Calico aster			x			
Boehmeria cylindrica	False nettle			x			
Caltha palustris	Marsh marigold			x			
Claytonia virginiana	Spring beauty			x			
Dryopteris marginalis	Leatherwood fern			x			
Epilobium coloratum	Cinnamon willow herb			x			
Geranium maculatum	Wild geranium			x			
Helianthus strumosus	Woodland sunflower			x			
Hypericum virginianum	Marsh St. John's wort			x			

Iris versicolor	Wild iris	x
Lobelia siphilitica	Great blue lobelia	x
Matteuccia struthiopteris	Ostrich fern	x

Plants

Botanical Name	Common Name
Aralia hispida	Bristly sarsaparilla
Arisaema triphyllum	Jack-in-the-pulpit
Caltha palustris	Marsh marigold
Dryopteris marginalis	Leatherwood fern
Helianthus strumosus	Woodland sunflower
Iris versicolor	Blue flag iris
Matteuccia struthiopteris	Ostrich fern
Onoclea sensibilis	Sensitive/bead fern
Osmunda cinnamomea	Cinnamon fern
Osmunda regalis	Royal fern
Osmunda claytoniana	Interrupted fern
Symplocarpus foetidus	Skunk cabbage
thelypteris palustris var pubescens	Marsh fern
Carex stricta	Tussock sedge
Panicum clandestinum	Deertongue

Forested Riparian Wetland (Red Maple Hardwood Swamp) (6.84 ac)

Grasses, sedges, etc.		Matrix	Commercially Available	Hand Collection	Onsite Nursery	Phase Required	Notes:
Botanical Name	Common Name					**P1 0 ac**	
Calamagrostis canadensis	Blue joint grass			x		**P2 6.84 ac**	Abundant per Jesse H
Carex bebbii	Bebb's sedge			x		**P3 0 ac**	
Carex crinita	Fringed/Caterpillar sedge			x		**P4 0 ac**	
Carex granularis	Meadow sedge			x		**P5 0 ac**	
Carex grayi	Gray's/Bur sedge			x			
Carex intumescens	Bladder sedge			x			
Carex lacustris	Lake sedge			x			
Carex lanuginosa	Wooly sedge			x			
Carex stricta	Tussock sedge			x			
Cyperus strigosus	Straw-colored sedge			x			
Elymus riparius	Riverbank wild rye			x			Observed per Jesse H
Elymus virginicus	Virginia wild rye			x			Observed per Jesse H
Glyceria striata	Fowl manna grass			x			Abundant per Jesse H
Glyceria canadensis	Rattlesnake grass			x			Abundant per Jesse H
Juncus tenuis	Slender/Path rush			x			Abundant per Jesse H

Scirpus atrovirens	Dark green bulrush	x	
Scirpus cyperinus	Wool grass	x	

Forbs

Botanical Name	Common Name		
Apios americana	American groundnut	x	
Arisaema triphyllum	Jack-in-the-pulpit	x	
Aster cordifolius	Heart leaved blue wood aster	x	
Aster divaricatus	White woodland aster	x	
Aster lateriflorus	Calico aster	x	
Caltha palustris	Marsh marigold	x	
Clematis virginiana	Virgin's bower	x	
Dryopteris marginalis	Leatherwood fern	x	
Epilobium coloratum	Cinnamon willow herb	x	
Eupatorium perfoliatum	Common boneset	x	Abundant per Jesse H
Iris virginica shrevei	Wild blue iris	x	
Lobelia siphilitica	Great blue lobelia	x	
Ludwigia palustris	Marsh purslane	x	
Lysimachia quadriflora	Narrow-leaved loosestrife	x	
Lysimachia thyrsiflora	Tufted loosestrife	x	
Matteuccia struthiopteris	Ostrich fern	x	
Onoclea sensibilis	Sensitive/bead fern	x	
Osmunda cinnamomea	Cinnamon fern	x	
Osmunda regalis	Royal fern	x	
Physostegia virginiana	Obedient plant	x	
Solidago graminifolia	Grass-leaved goldenrod	x	
Solidago rugosa	Rough-stemmed goldenrod	x	
Symplocarpus foetidus	Skunk cabbage	x	
Thelypteris palustris var pubescens	Marsh fern	x	
Veronica americana	American brooklime	x	
Woodwardia virginica	Virginia chain fern		

Plants

Botanical Name	Common Name
Arisaema triphyllum	Jack-in-the-pulpit
Dryopteris marginalis	Leatherwood fern
Matteuccia struthiopteris	Ostrich fern
Onoclea sensibilis	Sensitive/bead fern
Osmunda cinnamomea	Cinnamon fern
Osmunda regalis	Royal fern
Osmunda claytonia	Interrupted fern
Physostegia virginiana	Obedient plant

Symplocarpus foetidus	Skunk cabbage
Thalictrum dasycarpum	Purple meadow rue
Thelypteris palustris var pubescens	Marsh fern
Woodwardia virginica	Virginia chain fern
Carex stricta	Tussock sedge
Cyperus strigosus	Straw-colored sedge

Trees and Shrubs

Botanical Name	Common Name
Acer rubrum	Red Maple
Diervilla lonicera	Northern bush honeysuckle
Ilex verticillata	Winterberry
Lindera benzoin	Spicebush
Nyssa sylvatica	Blackgum
Pinus rigida	Pitch Pine

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Attachment E. Test Plot Program
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

Introduction

Phase I of the Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Plan (AES 2009) requires the establishment of test plots of varying sand depths to measure and evaluate minimum sand depth and sand quantity needs for restoring desirable open native barrens grassland vegetation, the preferred Karner blue butterfly habitat, on all current and future closed landfill cap surfaces. A set of 2-4, 1-5 acre test plots will be designed collaboratively with the project restoration team and will be located on the level and side slope surfaces of the older Greater Albany Landfill (GAL) cap. Information will be gathered from the test plots over a minimum 5-7 year period and will provide a measure of germination and early establishment success of selected native grasses and forbs characteristic of the open grassland component of the Pitch Pine-Scrub Oak Barrens community important to the goals of the restoration for landfill cap surfaces. Results gathered from the test plots will be used during Phase IV (Years 5 & 6) to re-vegetate the GAL cap and in Phase V (Years 7-10) to re-vegetate the Eastern Expansion landfill cap. Other information gathered from the test plots will help the restoration team to understand the optimum site prep, seeding and mulching strategies, and short- and long-term management strategies necessary to ensure successful development and maturation of the plantings and site stability on the highly exposed surfaces of the landfill cap. This information will also help to determine the minimum sand quantities that the City will need to purchase and inform strategies for reducing importation, trucking, delivery, and grading costs.

Previous efforts by others in 2002 to establish and monitor test plots of native plantings on the landfill cap provide important information to help ensure the success of the current test plot program.

1. Limited availability of locally sourced pine barrens native seed from within the desired 50-mile geographic radius will require careful planning to ensure adequate seed quantities of the desired species and sufficient seed quality are obtained either commercially from reputable native seed producers or by authorized hand collection efforts within the Preserve or from accessible properties within the approved geographic range. It is anticipated that a combination of these and other seed collection and propagation strategies will be necessary to ensure an adequate seed supply for the landfill restoration work.
2. Climatic influences such as prolonged drought versus cool wet periods can influence competitive effects from non-native cool season grasses and weedy forbs and will require close monitoring and timely, effective management responses.
3. Sufficient test plot size is necessary to adequately measure test plot results.
4. Placement of test plots on representative slope and aspect conditions will be important to

measure response to site variability.
5. Test plots must be clearly marked and documented with GPS to relocate boundaries over the life and monitoring period of the test plots.

AES has designed and implemented similar rooting medium substrate-depth test plots for other projects using a time-tested test plot design and analysis protocols that can easily be adapted to inform and guide the restoration efforts at the Albany landfill. Following are the proposed methods for designing, installing, managing, monitoring, and reporting the test plot results. These methods are accompanied by a test plot schematic showing the plot layout on the GAL cap of the landfill (see attachment). It is our intention that the test plot goals and methods undergo review and approval by the project restoration team (steering committee) prior to implementation, and that the team receive regular updates on the progress and outcomes of the test plot program to optimize test plot success.

Test Plot Methods & Design

A. Test Plot Goals

The test plots will serve to address the following project goals:

1. Determine the minimum sand depth, sand quality, and sand quantity needs for restoring desirable Pitch Pine Scrub Oak Barrens vegetation—grasses, forbs, trees, and shrubs—to optimize Karner blue butterfly habitat on all current and future closed landfill cap surfaces.
2. Determine the optimal site prep, seeding rates, erosion control strategies, and short- and long-term management strategies needed to ensure successful development and maturation of the plantings and site stability on the highly exposed surfaces of the landfill cap.
3. Determine the minimum sand quantities that the City will need to purchase and determine strategies for bringing the greatest cost efficiency to acquiring, transporting, stockpiling, and grading imported sands to allow maximizing investment in species diversity.
4. Determine the range of sand quality available and the amendment requirements needed to achieve the permitted sand specifications and/or the targeted vegetation composition and cover.
5. Determine the suitability of the highest quality unamended sand available for use in restoring desired barrens vegetation on the landfill cap.

B. Test Plot Questions

We intend to use the test plots to address the following questions:

1. At what minimum depth will vegetation establish with the most diversity?
2. What minimum sand quantities are required to stabilize steep side slopes of the landfill cap?
3. What minimum sand quality requirements (pH, organic matter, nutrient levels, and CEC) are required to establish target vegetation?
4. What soil amendments will be needed to achieve minimum sand specifications?
5. Will the highest quality unamended sands available be suitable for achieving the target vegetation composition and cover? Or will it favor weedy growth including Phragmites?
6. Will the highest quality un-amended sand available applied as a 6" base layer under amended sands negatively affect target vegetation establishment and long term stability? Or will it favor weedy growth including Phragmites?
7. What erosion control methods are needed to stabilize steep side slopes of the landfill cap?
8. What weed control strategies will be needed to reduce competition from cool season grasses, common reed, and weedy forbs to achieve the highest quality vegetation cover?
9. What species provide rapid soils stabilizing cover, greatest habitat benefits, and are most

cost effective in achieving the desired barrens vegetation goals.

C. Testable Hypotheses

1. The shallowest sand depth will produce the lowest diversity and cover by each species in the seed mix.
2. The shallowest sand depth will produce the least root and above ground biomass.
3. The shallowest sand depth will stabilize the side slopes less quickly as a result of poor root and above ground biomass production.
4. The shallowest sand depth and higher pH un-amended sands will require the greatest weed control inputs.
5. The un-amended higher pH sands will favor weedy growth and Phragmites invasion.
6. The inclusion of a 6" base layer of higher pH un-amended sands will have no negative affect on the establishment and long term sustainability of the target native communities nor favor weedy growth and Phragmites.

D. Test Plot Design & Installation

The test plot layout is presented in the attached graphic. The test plot design will consist of the following parameters:

1. Three test plots ranging from 0.5-2.5 acres in size will be located to represent 1) level conditions on top of the GAL cap, 2) steep side slopes with a southerly aspect, and 3) steep side slopes with a northerly aspect.
2. Each test plot will be divided into 4 subplots, each containing a different sand depth (12", 18", 24", and 24" un-amended), distributed as consistently as possible in each subplot via grading.
3. Each test plot will be permanently marked at the outside corners with permanently labeled metal t-posts and located with GPS to ensure accurate relocation of each test plot and subplot.
4. Test plot borders will be seeded with the same native seed mix and allowed to grow as adjacent test plots. Mowing of borders running parallel with the slopes will not be conducted due to erosion risk caused by operating machinery in sands on steep slopes. However, periodic mowing to control weeds will be conducted and erosion risk will be minimized by operating machinery perpendicular to slopes across adjacent test plots.
5. To minimize herbivory damage to plantings, a solar-powered electric fence suitable for excluding deer will be constructed around the entire test plot area. During winter months when the electrical fencing may be less effective, measures will be taken to protect woody plantings from browse damage. This may require the use of tree tubes suitable for shrubs.
6. Each subplot will be prepared for seeding by removing selected weedy growth and applying imported approved clean sand substrates per test plot design and grading to specified depths. (See plan specifications: Section 31 13 14 Herbaceous Species Removal; Section 32 91 14 Soil Chemistry Parameters; and applicable guidelines related to grading from Section 31 23 00 Excavation and Fill).
7. Each subplot will be seeded spring 2010 and planted with woody species spring 2011 using locally commercially available approved materials and applied at seeding/planting rates designed to achieve optimum vegetation establishment and soil stability: Optional approved species may be included based on availability of seed for hand collection during the remainder of the 2009 growing season. (See proposed native species lists and seeding rates attached, and appropriate guidelines in plan specifications Sections 32 92 19 Seeding, 32 93 43 Trees and Shrubs).

8. Seed will be installed in the test plots with hydro-seeding equipment and will be subsequently mulched with Bonded Fiber Matrix material. (See plan specifications: Section 32 92 13 Hydromulching/Bonded Fiber matrix)
9. Permanent photo point locations will be established to document test plot conditions at the time of installation and at the time of all subsequent monitoring efforts.
10. Electric fencing will be installed around the test plots to discourage deer herbivory.

E. Test Plot Management & Weed Control

Test plots will be managed twice a year by mowing the required borders surrounding each plot to maintain test plot dimensions and to minimize invasion by weeds from test plot borders. Weed control within the test plots and within the borders will utilize chemical applications as specified and approved in the project Integrated Pest and Invasive Species Management Plan. (See specifications and guidelines in the IPM Plan prepare by AES June 2009). Other plot management will include appropriate periodic mowing during early vegetation establishment. If approved, fire may be used to invigorate native growth and discourage competition from cool season grasses and other invasive species.

F. Test Plot Monitoring & Reporting

Test plots will be monitored during the growing season in late spring (late May/early June) and in late summer (late August/early September). Monitoring methods will employ at minimum the following techniques and analysis:

Quadrat sampling—ground cover vegetation will be sampled from meter square quadrats placed randomly or along a permanent study transect established within each subplot. Sampled data from each quadrat will include an estimate of percent cover for each species rooted within each quadrat, and cover by other ground cover features including bare soil, fine and coarse litter, and Bryophytes. A summary analysis of collected data will include presence, frequency, cover, relative frequency, relative cover, and importance values for each species and ground cover feature.

Timed Meander Search—a time equated measure of species diversity within each test plot will be sampled using the Timed Meander Search (TMS) method (Goff et al. 1982). This method requires walking each test plot thoroughly, recording each new species encountered during one-minute intervals until no new species are encountered. Annual TMS data will be graphed as the number of species encountered per minute and compared to graphs in subsequent years to monitor species diversity trends.

Photo Documentation—photographs will be taken at the time of each monitoring visit from the transect end points and other permanent photo point locations. Photos will be taken with digital cameras and photo files will be labeled and archived according to site, date, and location. Photos will accompany the monitoring data in the annual reports to provide a visual depiction of test plot success.

Biomass Sampling—above ground biomass will be sampled from random quadrats within each subplot. All vegetation will be clipped at ground level and separated into paper grocery bags by native versus non-native species for subsequent drying. All bags will be labeled clearly and weighed at the time of sampling. All bags will be stored in an appropriate drying room with proper ventilation to ensure optimum drying conditions. All bags will be weighed subsequently at regular intervals during the drying process until weights stabilize. Weights will be tabulated for inclusion in the annual monitoring report.

Root Depth Documentation—in each test plot, a representative number of individual plant species will be excavated to confirm rooting architecture and depths. This disruptive sampling technique will be very limited in scope and will be limited to sampling plot margins. The primary purpose will be to understand how the plant root architecture responds to different substrate depths.

Soil Sampling & Analysis—depending upon the need for soil amendments to achieve sand quality specifications, we will annually sample and analyze amended soils from each test plot to compare to soil specification parameters.

Reporting & Management Recommendations—the early spring sampling period will allow detection of early flowering species and will assess weed management needs and at the start of the growing season. The fall monitoring assessment will document management success and provide recommendations for late season management.

G. Reporting Final Results, Recommendations & Finalizing Topsoil Specifications & Costs

During the test plot period, interim and final reports will be prepared and submitted to the Steering Committee for review. The report will contain a summary and analysis of the data collected over the test plot period, and recommendations for final topdressing of the balance of the landfill with Pine Bush sand to achieve the ecological, economic, and permitted outcomes. The report will also contain the final refined topsoil and seeding specifications for successfully restoring the remainder of the landfill cap based on the outcomes of the test plot study.

H. Schedule & Milestones

We propose to complete the approved test plot design in the January 2010 and initiate construction of the test plots in the early spring of 2010, assuming proper permits are acquired. The placement of the sand on the test plots will be subcontracted to a local earth moving company.

Final Design and Approval of the Test Plot Program	February 2010
Construction and Seeding of Test Plots	Spring 2010
Monitoring and Maintenance of Test Plots	Five to seven years starting fall 2010
Test Plot Results and Recommendations	2015-2017

Attachment E. Proposed Test Plot Seed Mix

Albany Landfill #09-06360

A single pitch pine-scrub oak barrens native seed mix will be applied consistently on the top and side slopes of the test plot area at a rate of 10-15 lbs/ac of grasses and 2-4 lbs/ac of forbs, or a total of 12-19 lbs/ac native seed. This seeding rate achieves a ratio of 75% grasses and 25% forbs and 800 seeds per sq/yd. A cover crop will be applied at a rate of 100 lbs/ac necessary to stabilize steep sandy slopes.

Species and quantities are estimated pending confirmation of commercial availability and quantities of hand collected seed in 2009 and early 2010.

Estimated seeds per oz
Pounds available
Ounces available
Trace available
Rare in the Pine Bush
Not native to Pine Bush

Test Plot List Top of Slope	1 acre	Total seeds									
Dry Prairie / Sand Flat	**800 seeds per sqyd**	**3,872,000**			**Ratio =70:30**						
Grasses, sedges, etc.	Grasses = 10- 15 lbs						Matrix	Commer-cially Available	Available via Hand Collection	2009 Collection Available for Test Plots(OZs)	AES Nursery
Botanical Name	Common Name	Seeds per oz	% of Mix	# of seeds	oz/ac	lb / ac					
Andropogon gerardii	Big bluestem grass	8160	10.00%	387200	47.45098	2.965686	X	10	X	332.8	
Schizachyrium scoparium	Little bluestem grass	15000	50.00%	1936000	129.06667	8.066667	X	1000			
Sorghastrum nutans	Indian grass	12000	10.00%	387200	32.266667	2.016667	X		X	232	
			70.00%	2710400							
grasses, etc					157	13.04902					
Forbs	Forbs =2-4 lbs										
Botanical Name	Common Name			0	oz/ac	lb / ac					
Anaphalis margaritacea	Pearly everlasting	512500		0	0	0			X	0.01	
Anemone cylindrica	Thimbleweed	35500	1.00%	38720	1.0907042	0.068169	X		X	9.43	
Asclepias syriaca	Common milkweed	4000	1.00%	38720	9.68	0.605	X		X	70.4	
Asclepias tuberosa	Butterfly milkweed	4300	0.00%	0	0	0			X		
Aster ericoides	Heath aster	200000		0	0	0	X		X		
Aster laevis	Smooth blue aster	55000	3.00%	116160	2.112	0.132	X	0.3	X	54.75	
Aster linariifolius	Flax-leaved aster	70875	0.50%	19360	0.273157	0.017072	X		X	1.63	
Aster patens	Late purple aster	50000	0.75%	29040	0.5808	0.0363	X		X	2.32	
Aster pilosus	Frost aster	140000		0	0	0			X		
Aster umbellatus	Flat topped aster	31500	0.50%	19360	0.6146032	0.038413	X		X	3.64	
Aster undulatum	Wavyleaf aster	31500	0.05%	1936	0.0614603	0.003841	X		X	0.48	
Desmodium canadense	Showy tick trefoil	5500	0.05%	1936	0.352	0.022	X		X	1.6	
Fragaria virginiana	Wild strawberry	35000	0.00%	0	0	0			X		
Gnaphalium obtusifolium	Rabbit tobacco	500000	0.75%	29040	0.05808	0.00363	X		X	7.04	
Helianthemum canadense	Longbranch frostweed	35000	3.00%	116160	3.3188571	0.207429	X		X	31.6	
Lespedeza capitata	Round-headed bush clover	9960	5.00%	193600	19.437751	1.214859	X	25	X		
Lupinus perennis	Wild lupine	990	0.00%	0	0	0	X		X		
Monarda fistulosa	Wild bergamot	77800	1.00%	38720	0.4976864	0.031105	X		X	23.68	
Monarda punctata	Dotted Horsemint	93700	5.00%	193600	2.0661686	0.129136	X	X	X	37.65	
Oenothera biennis	Common evening primrose	90000	1.50%	58080	0.6453333	0.040333	X		X	159	
Rudbeckia hirta	Black-eyed Susan	92000	1.00%	38720	0.4208696	0.026304			X	7.2	
Solidago nemoralis	Old-field goldenrod	300000	5.00%	193600	0.6453333	0.040333			X	36.78	
Solidago rugosa	Rough-stemmed goldenrod	62500	1.00%	38720	0.61952	0.03872	X		X	28.03	
Tephrosia virginiana	Goat's Rue	2500	0.00%	0	0	0			X		

forbs

			30.10%			2.654645	475.24 29.7025
Cover Crop							
Botanical Name	Common Name	Seeds per oz	% of Mix	# of seeds	oz/ac	lb / ac	
Avena sativa	Oats				800	50	
Lolium multiflorum	Annual rye				320	20	
Hordeum vulgare	Barley				480	30	
		5 trees/ac					
Trees and Shrubs		15 shrubs/ac	Depending on Commercial Availability				
Botanical Name	Common Name	units / ac					
Aronia melanocarpa	Black chokeberry	2					
Ceanothus americanus	New Jersey tea						
Corylus americana	Hazelnut						
Gaylussacia baccata	Black huckleberry	2					
Pinus rigida	Pitch pine	5					
Prunus pumila	Sandcherry	2					
Quercus ilicifolia	Scrub oak	2					
Quercus prinoides	Dwarf chinkapin oak	2					
Salix humilis	Dune willow	2					
Vaccinium pallidum	Hillside blueberry	3					
Trees and Shrubs / ac							
Trees & Shrubs total / zone		**20**					

LEGEND

- Project Limit Line
- Wetland Boundary
- Trail
- Access Road
- Nursery 2.91 AC
- Test Plot Boundary
- Unamended Soil Stockpile Boundary

Upland Grassland Communities

- Dry Prairie/Sand Flat
- Dune
- Dune/Barren

Upland Forest Communities

- Pitch Pine-Scrub Oak Barrens
- Pitch Pine-Oak Forest Buffer Enhancement

Wetland Communities

- Biofilter Wetland
- Pine Barrens Vernal Pond
- Sedge Meadow
- Forested Wetland (Red Maple Hardwood Swamp)
- Forested Wetland Enhancement (Red Maple Hardwood Swamp)
- Forested Riparian Wetland (Red Maple Hardwood Swamp)

N

0 100 200 400 Feet

Scale: 1" = 200'

To Scale When Printed at 24" x 36"

FOR REVIEW
DO NOT USE FOR CONSTRUCTION

2010 Work Plan
Test Plot Plan
Context Map

Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York

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Applied Ecological Services, Inc.

1 of 3

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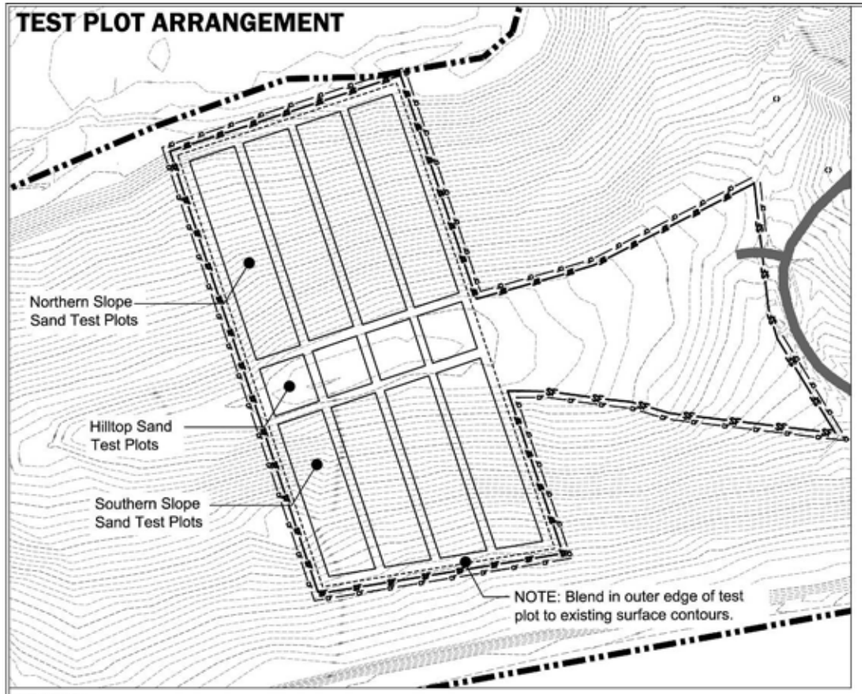
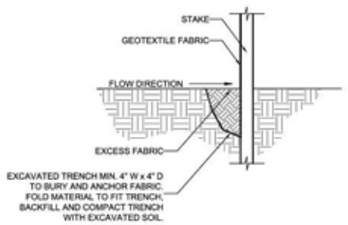
TEST PLOT ARRANGEMENT



LEGEND

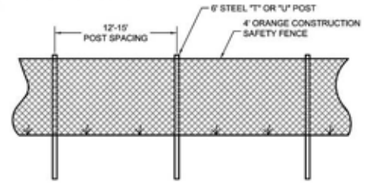
- Project Boundary
- Test Plot Boundary
- Existing 2' Contours
- Existing 10' Contours
- Access Road
- Construction Fence
- Silt Fence

Scale: 1" = 100'
To Scale When Printed at 24" x 36"



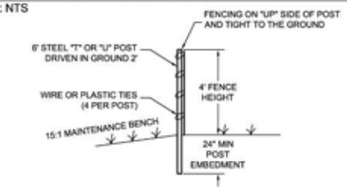
SILT FENCE DETAIL

Scale: NTS



CONSTRUCTION FENCE- ELEVATION

Scale: NTS

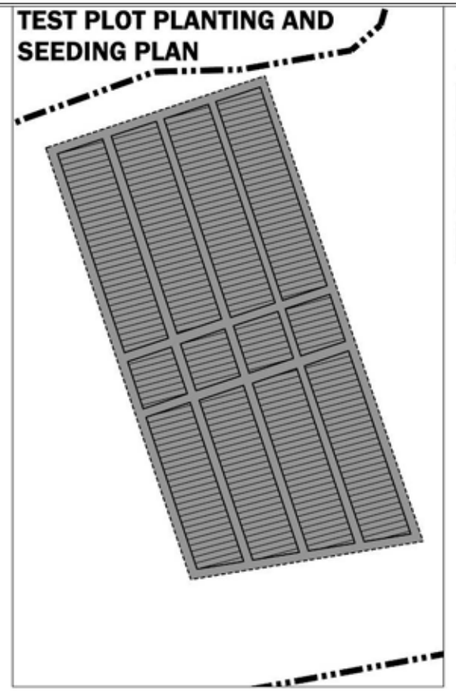


CONSTRUCTION FENCE- SECTION

Scale: NTS

Note:
Orange construction fencing posts will be utilized as part of an electric fence added by others to control deer damage to the test plots.

TEST PLOT PLANTING AND SEEDING PLAN

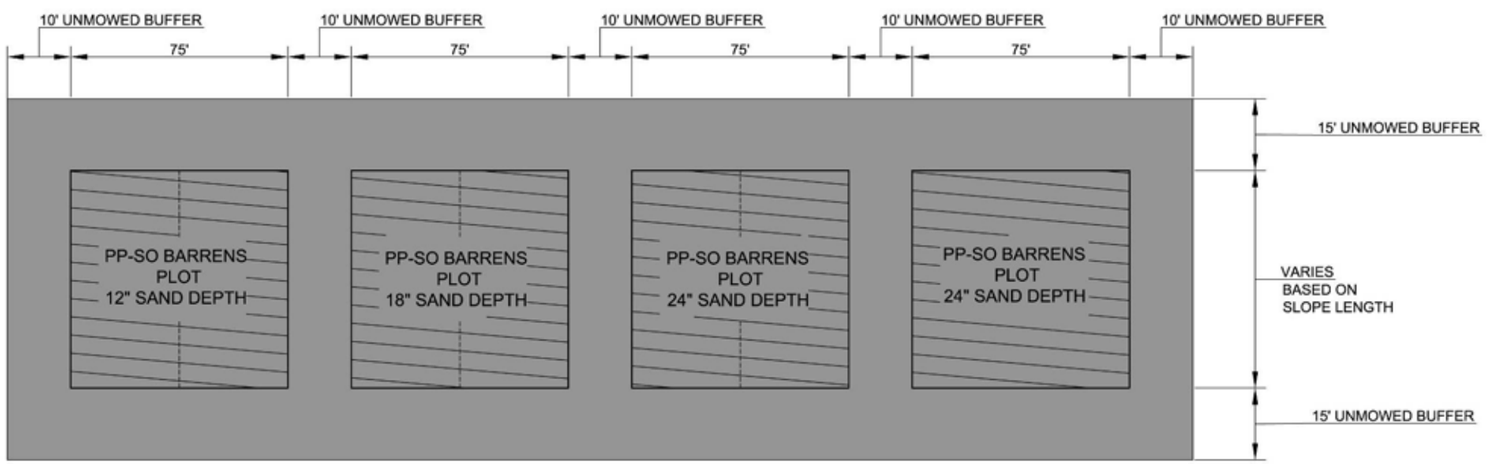


Scale: 1" = 100'
To Scale When Printed at 24" x 36"

LEGEND

- Project Boundary
- Test Plot Boundary
- Pitch Pine-Scrub Oak Barrens Seeding
- Woody Plant Enhancement

TEST PLOT PLAN CLOSE-UP



Scale: N.T.S.

FOR REVIEW
DO NOT USE FOR CONSTRUCTION

Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York

2010 Work Plan
Test Plot Plan

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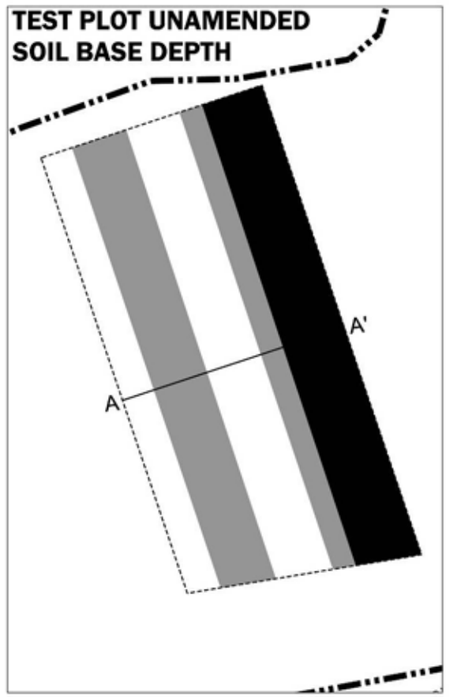
TEST PLOT UNAMENDED SOIL BASE DEPTH



LEGEND

- Project Boundary
- Test Plot Boundary
- 6" Unamended Soil Base
- 24" Unamended Soil Base
- No Unamended Soil Base

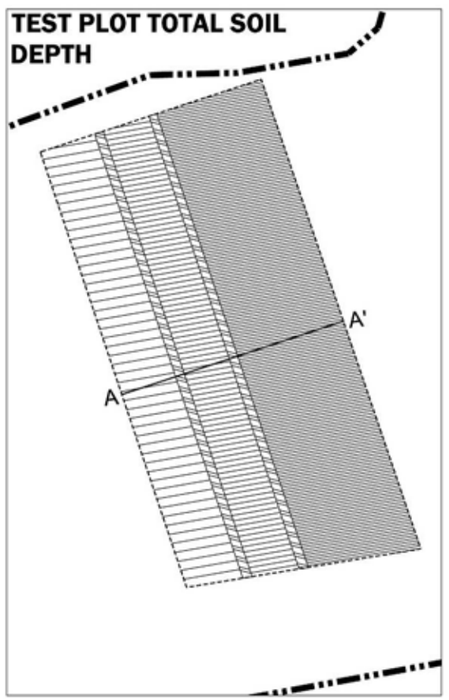
N

0 50 100 200 Feet

Scale: 1" = 100'

To Scale When Printed at 24" x 36"

TEST PLOT TOTAL SOIL DEPTH



LEGEND

- Project Boundary
- Test Plot Boundary
- 12" Total Soil Depth
- 18" Total Soil Depth
- 24" Total Soil Depth
- Sloping Transition

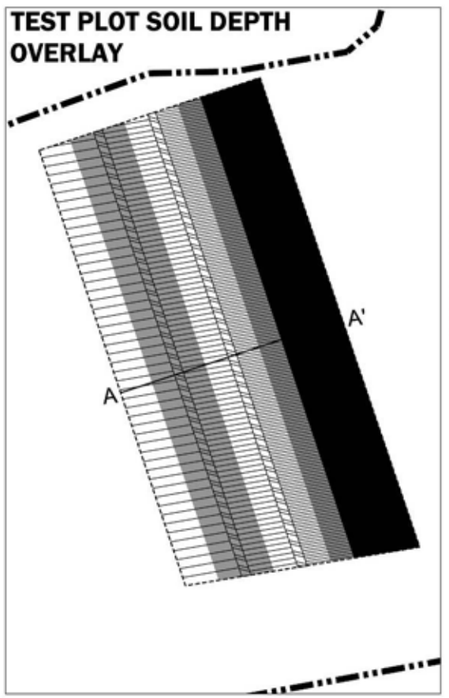
N

0 50 100 200 Feet

Scale: 1" = 100'

To Scale When Printed at 24" x 36"

TEST PLOT SOIL DEPTH OVERLAY



LEGEND

- Project Boundary
- Test Plot Boundary

12" TOTAL DEPTH

- 12" Amended Soil
- 6" Unamended Soil Topped By 6" Amended Soil

SLOPING TRANSITION

- 6" Unamended Soil Topped by Sloping Amended Soil

18" TOTAL DEPTH

- 6" Unamended Soil Topped By 12" Amended Soil
- 18" Amended Soil

SLOPING TRANSITION

- Sloping Amended Soil

24" TOTAL DEPTH

- 24" Amended Soil
- 6" Unamended Soil Topped By 18" Amended Soil
- 24" Unamended Soil Base

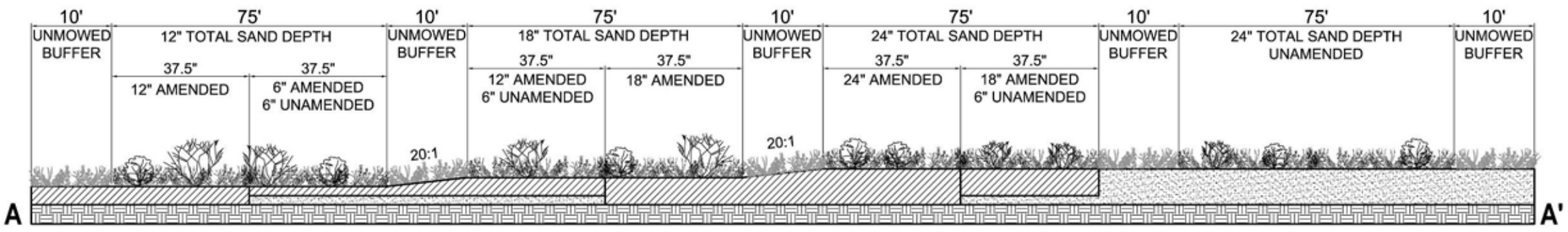
N

0 50 100 200 Feet

Scale: 1" = 100'

To Scale When Printed at 24" x 36"

TEST PLOT SECTION A-A'



LEGEND

- Amended, Low pH Sand
- Unamended, Higher pH Sand
- Landfill Cap

Scale: N.T.S.

FOR REVIEW
DO NOT USE FOR CONSTRUCTION

Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York

Test Plot Plan

REVISIONS

No:	Date:	By:
Description:		
No:	Date:	By:
Description:		
No:	Date:	By:
Description:		

AES Proj. #: 09-0636
Checked:
Approved:
Drawn by: MH
File: 090636Test_Plot_Plan.dwg
Date: 24 Feb 2010
Coordinate System: NAD NY State Plane, East (ft)

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Sheet Number:
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Attachment F. Invasive Plant Management
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

Phase I restoration activities will include the implementation of the Integrated Pest and Invasive Species Management Plan for the Albany Rapp Road Landfill Ecosystem Mitigation, Restoration & Enhancement Project (AES June 2009). Applied Ecological Services will conduct management of several high priority species that we feel pose the greatest risk to the long term success of the restoration plan.

General Task/ SpecificTask (Year)													Area Controlled		
(Planning Month)	1	2	3	4	5	6	7	8	9	10	11	12			
(Calendar Month)	J	F	M	A	M	J	J	A	S	O	N	D		Invasive Species and Pest Management Plan	Construction Specifications
1. Invasive Plant Management in Future Restoration Zones to Prepare Sites for Restoration														Page #	Section #
a. Common Reed Grass (Phragmites australis)								x	x	x			All Phases	94	31 13 14
b. Oriental Bittersweet (Celastrus orbiculatus)					x	x	x	x	x	x	x	x	All Phases	77-80	31 13 14
c. European Buckthorn (Rhamnus cathartica)										x	x	x	Phase 1	95-96	31 13 13
d Russian Olive (Elaegnus angustifolia)										x	x	x	Phase 1	85-87	31 13 13
d. Honeysuckles (Lonicera spp)										x	x	x	Phase 1	88-89	31 13 13
e. Garlic Mustard (Alliaria petiolata)				x	x								All Phases	72-74	31 13 14
f. Knapweed (Centaurea maculosa)					x	x	x	x	x	x			All Phases	80-83	31 13 14
g. Woody control in forested wetland enhancement areas & GAL perimeter											x	x	Phase 1	112-115	31 13 13

Herbicide applications associated with invasive species control will follow all guidelines specified in DEC permit 4-0101-00171/00011, specifically Special Conditions #45 and 48-51, and TRP issued by APBPC.
*Proper PPE shall be worn at all times and consist of listed and approved PPE found on

the herbicide label.

*Only NYS licensed Applicators and Technicians shall apply chemical on site.

*All product labels and MSDS shall be kept on site during applications.

*Appropriate spill kits shall be kept on site during applications. All spills shall be reported immediately to the proper authorities.

*No mixing of chemicals shall take place in or near wetlands or surface waters of the state.

Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York

2010 Work Plan
Invasive Species Control Plan

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Applied Ecological Services, Inc.

Sheet Number
1 of 1

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Attachment G. Salvage of Selected Plants and Animals
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

The lateral expansion of the landfill extends into 7 acres of currently undeveloped lands and as part of the restoration plan Applied Ecological Services intends to conduct salvage of native plants throughout this area. With the creation of the nursery we have designed in a space to collect native species that could be stored in the nursery and either used for seed collection or later transplanted again for final restoration. Ferns and other herbaceous species will be chosen, hand dug and then relocated. We expect to gather as many plants that are of good quality and that could thrive in the nursery.

Applied Ecological Services also intends to conduct a field survey of the areas that will undergo construction in the coming years to identify possible trees and shrubs that could be salvaged once construction begins. We would locate, GPS, and flag salvageable tree, shrubs, and soil. This information will be used to refine our planting plans for areas that will receive the salvaged trees, shrubs and soil. To ensure salvage operations do not damage desirable species and vegetation on dedicated Preserve lands, APBPC staff will accompany the AES/CH team when surveying salvage areas. No actual salvage will occur until APBPC staff has toured the salvage areas designated by the AES/CH team.

LEGEND

- Project Limit Line
- Limits of Proposed Grading
- Wetland Boundary
- Plant Salvage Area
- Existing 2' Contours
- Field Survey Area to Locate Salvageable Plant, Tree, Shrub and Soil Material
- Existing 10' Contours

N

0 100 200 400 Feet

Scale: 1" = 200'
To Scale When Printed at 24" x 36"

IN PROGRESS
DO NOT USE FOR CONSTRUCTION

Albany Rapp Road Landfill

Albany, New York

City of Albany, Dept. of General Services

One Connors Blvd.
Albany, New York

2010 Work Plan
Salvage Plan

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Applied Ecological Services, Inc.

1 of 1

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Attachment H. Soil and Water Quality Control Analyses
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

Replaced surface soil and final cover on the landfill are required to meet the soil chemistry parameters (Specifications Section 32 91 14) in the permit. The soil chemistry parameters were developed based on A-horizon (topsoil) sampling at the site and nearby areas of the Pinebush Preserve.

Soil sampling at the landfill site was completed on November 10th, 11th, and 12th of 2009 (see the following summary report and sample location map entitled Albany – Soil Sampling). Three general areas had soil core samples collected at different depths using a geo-probe drill rig. The sand stockpiled from the Phase 1 expansion of the landfill was sampled. Two dunes in the Pine Bush Preserve and a third dune located within the landfill's Phase 2 expansion area were sampled to a minimum of 20 feet. The third area included 27 core holes from the Fox Run trailer park to a maximum depth of 15 feet.

A total of 192 individual soil samples were analyzed for soil pH, organic matter (OM), buffer pH, phosphorus, potassium, calcium, magnesium, CEC, texture (sand, silt, and clay %) and density. The results indicate that soil pH in the stockpiled sand and below the top five feet in the dunes and trailer court are generally higher than the upper pH limit of 6.3 in the specifications. Additional samples collected by the City's consultants from adjacent areas agree with these higher soil pH readings. The organic matter percentages in the 192 soil samples were below the lower limit (1.0% dry weight) in the specifications for samples that did not include the A-horizon of the soil profile. The other soil chemical and physical parameters were generally within the ranges listed in the specifications.

Two approaches to evaluate the impact of higher pH soils are proposed. The test plot plans include higher pH sands for evaluation, and bench tests are planned to determine if the soil pH at the site can be reduced by adding acid producing amendments. The soil collected in November, 2009 will be used. A bench test evaluation will be conducted during February of 2010 to determine the feasibility of adding amendments such as aluminum sulfate, ferric sulfate, or fulvic acid to reduce the pH of sand soils at the site. In addition, AES's nursery operation at Brodhead is testing the higher pH soil germination studies. The feasibility and estimated costs of adding OM to the top 3-6 inches of replaced soils will be evaluated as part of the bench study.

Soil pH bench tests will be conducted on collected soils with known pH. Published agronomic literature is available that gives basic recommendations on amounts for various amendments to add to soil to a produce a lower soil pH. The published literature will be used to determine possible treatment rates for the bench tests. The bench tests will use a measured soil quantity and determine the pH without amendments. Different amendments will be added to the soil in a plastic bag after the soil has been moistened to approximately field capacity, thoroughly mixed, and then sealed to retain moisture. A laboratory bench pH meter with an appropriate electrode will measure soil pH according to standard testing protocol. At different dates after amendment addition a soil sample from each sealed bag will be removed and pH measured. The bench tests will help define the chemical amendment rates required for various starting soil pH levels to reduce the final soil pH to 6.0-6.3 and provide insight on the time frame the amendment require to reduce the soil pH.

Restoration construction work planned for 2010 will include the trailer court cleanup, construction of the test plots, construction of the nursery, and installation of log vanes in the existing stream. Construction activity involving earthmoving and grading will have on-site supervision to assure the work is completed according to the approved plan. Prior to commencing the earthwork in the field, SWPPP controls required by the permits will be installed. During construction environmental control quality control monitoring will be completed as required for water quality and SWPPP inspections. After the earthwork is completed on the test and the nursery plots, soil samples from the top foot of the placed surface soil will be collected and analyzed for the chemical parameters listed in the specifications. The post construction soil monitoring provides quality data from the site to use in success evaluation and if deemed necessary, planning for soil amendment additions.

Albany – Soil Sampling

Excavation of sand from the Phase 1 expansion of the landfill is complete. The excavated sand was utilized during on-going landfill operations and some was stockpiled to use on the test plots and as landfill cover during restoration. Soil chemical analyses of the stockpiled sand indicate that sands from deeper in the soil profile have higher pH values than the target soil for final cover on the landfill. The soil chemistry parameters for replaced surface soil and final cover on the landfill are listed in Specifications Section 32 91 14 of the permit. The soil chemistry parameters were based on A-horizon (topsoil) sampling at the site and nearby areas of the Pine Bush Preserve.

A soil sampling plan was developed to analyze soil chemical parameters at different depths from the stockpiled sand excavated from Phase 1 of the landfill expansion; the dune in Phase 2 of the landfill expansion; two dunes in the Pine Bush Preserve; and the Fox Run trailer court area. The site was sampled on November 10th to 12th and the samples analyzed by the University of Wisconsin Soil and Plant Analysis Laboratory. The collected data provides a more complete picture about the soil chemistry parameters of soils available at the site. All chemical parameters except soil pH and soil organic matter percentage met the specifications routinely. Soil pH and soil organic matter were outside of the range listed in the specifications on some samples from all locations. The test plots on the GAL will study the success of vegetative establishment on higher pH soils from the site.

This collected soil data will be used to refine where sands are available that meet or closely match the soil chemistry parameters in the specifications. Excavation and grading operations will be planned to save the best sands for surface cover at the project during both restoration and final covering. The detailed soil sampling report is complete and under review. The following sheets summarize sample location, sampling depth, depth to groundwater (if observed), soil pH, and soil organic matter percentage.

Albany Pinebush Landfill - Soil Sample Locations
Sample Dates: November 10-12, 2009 Observer: J Roll

Hole ID	Description - Sample Location (shown on enclosed aerial photo)	Groundwater Observed (depth in ft)
SP1	Stockpiled sand from Phase 1 landfill expansion area	none
SP2	Stockpiled sand from Phase 1 landfill expansion area	none
SP3	Stockpiled sand from Phase 1 landfill expansion area	none
SP4	Stockpiled sand from Phase 1 landfill expansion area	none
SP5	Stockpiled sand from Phase 1 landfill expansion area	none
SP6	Stockpiled sand from Phase 1 landfill expansion area	none
SP7	Stockpiled sand from Phase 1 landfill expansion area	none
SP8	Stockpiled sand from Phase 1 landfill expansion area	none
SP9	Stockpiled sand from Phase 1 landfill expansion area	none
SP10	Stockpiled sand from Phase 1 landfill expansion area	none
SP11	Stockpiled sand from Phase 1 landfill expansion area	none
SP12	Stockpiled sand from Phase 1 landfill expansion area	none
SP13	Stockpiled sand from Phase 1 landfill expansion area	none
SP14	Stockpiled sand from Phase 1 landfill expansion area	none
SP15	Stockpiled sand from Phase 1 landfill expansion area	none
LFD1	Dune in Phase 2 landfill expansion area	none
PBD1	Dune in Pine Bush preserve	17.0
PBD2	Dune in Pine Bush preserve	none
T1	Fox Run Trailer Court Area	9.0
T2	Fox Run Trailer Court Area	6.0
T3	Fox Run Trailer Court Area	9.5
T4	Fox Run Trailer Court Area	10.5
T5	Fox Run Trailer Court Area	12.0
T6	Fox Run Trailer Court Area	10.5
T7	Fox Run Trailer Court Area	10.5
T8	Fox Run Trailer Court Area	10.0
T9	Fox Run Trailer Court Area	12.0
T10	Fox Run Trailer Court Area	9.0
T11	Fox Run Trailer Court Area	10.0
T12	Fox Run Trailer Court Area	11.0
T13	Fox Run Trailer Court Area	11.0
T14	Fox Run Trailer Court Area	11.0
T15	Fox Run Trailer Court Area	7.0
T16	Fox Run Trailer Court Area	8.0
T17	Fox Run Trailer Court Area	10.0
T18	Fox Run Trailer Court Area	7.0
T19	Fox Run Trailer Court Area	9.0
T20	Fox Run Trailer Court Area	7.0
T21	Fox Run Trailer Court Area	6.0
T22	Fox Run Trailer Court Area	6.0
T23	Fox Run Trailer Court Area	8.0
T24	Fox Run Trailer Court Area	8.0
T25	Fox Run Trailer Court Area	5.0
T26	Fox Run Trailer Court Area	5.0
T27	Fox Run Trailer Court Area	5.0

The observed groundwater elevation was determined to the nearest 1/2 foot by saturation location on the core samples.

The stockpiled sand was excavated in the Phase 1 expansion area from deeper layers within the soil profile.

The sampled dune in the Phase 2 expansion adjacent to the landfill and the two dunes sampled within the Pine Bush Preserve were generally undisturbed.

The Fox Run Trailer Court locations all had groundwater present at depths varying from 5' to 12'. The pH and OM within the trailer court were variable with depth and location. The variability may be related to past activity within the trailer court.

Albany Pinebush Landfill - Soil Sample pH and Organic Matter % (OM %)

Sample Dates: November 10-12, 2009 Observer: J Roll

Hole ID	Core Sample (depth in ft)	pH	OM %
SP1	0-4'	8.1	0.4
SP2	0-4'	8.5	0.4
SP3	0-4'	7.8	0.4
SP4	0-4'	7.9	0.5
SP5	0-4'	8.4	0.4
SP6	0-4'	8.5	0.4
SP7	0-4'	8.6**	0.5
SP8	0-4'	8.5	0.4
SP9	0-4'	8.1	0.4
SP10	0-4'	8.1	0.4
SP11	0-4'	7.9	0.3
SP12	0-4'	8.0	0.3
SP13	0-4'	7.8	0.3
SP14	0-4'	8.2	0.4
SP15	0-4'	8.2	0.4
LFD1	0-6"	4.8	1.3
	6"-2'	4.8	0.7
	2'-4'	5.3	0.5
	4'-6'	5.6	0.4
	6'-7'	5.7	0.3
	7'-9'	6.9	0.4
	9'-11'	6.0	0.4
	11'-13'	5.8	0.3
	13'-15'	6.3	0.3
	15'-17'	6.9	0.3
	17'-19'	7.3	0.4
	19'-21'	7.6	0.4
	21'-23'	8.4	0.3
PBD1	0-1'	5.0	1.5
	1'-2'	5.4	1.0
	2'-4'	5.6	0.7
	4'-6'	5.8	0.8
	6'-8'	6.1	0.4
	8'-10'	6.0	0.4
	10'-12'	6.3	0.3
	12'-14'	5.7	0.7
	14'-16'	6.0	0.5
	16'-20'	6.1	0.5
PBD2	0-6"	4.9	1.0
	6"-2'	5.2	0.5
	2'-4'	6.1	0.5
	4'-6'	6.5	0.5
	6'-8'	6.4	0.4
	8'-10'	5.7	0.8
	10'-12'	5.6	0.5
	12'-14'	6.1	0.7
	14'-16'	6.2	0.6
	16'-20'	6.7	0.5

Hole ID	Core Sample (depth in ft)	pH	OM %
T1	0-1'	5.9	1.1
	1'-3'	6.1	1
	3'-5'	5.3	1.5
	5'-6'	5.5	0.8
	6'-10'	6.2	0.3
	10'-15'	6.6	0.3
T2	0-1'	4.7	1.6
	1'-3'	5.2	0.9
	3'-5'	4.8	0.6
	5'-10'	5.9	0.4
	10'-15'	5.5	0.5
T3	0-2'	6.1	0.6
	2'-5'	6.7	0.3
	5'-7.5'	6.6	0.4
	7.5'-10'	6.9	0.4
	10'-12.5'	6.9	0.4
	12.5'-15'	6.7	0.2
T4	0-2.5'	6.8	0.8
	2.5'-5'	6	0.6
	5'-8.5'	6.1	0.4
	8.5'-10'	6.3	0.3
	10'-15'	6.9	0.3
T5	0-2'	7.3	1.1
	2'-5'	7.4	2.6
	5'-8'	10	2.3
	8'-8.5'	7	4.4
	8.5'-10'	7.1	1.1
	10'-15'	7.6	0.3
T6	0-1'	6.1	1.2
	1'-5'	8.2	0.5
	5'-7.5'	6.5	0.5
	7.5'-10'	5.8	0.4
	10'-15'	6.7	0.4
T7	0-1'	7.4	1.0
	1'-5'	7.5	0.5
	5'-6'	7.4	1.1
	6'-10'	7.8	0.4
	10'-15'	7.5	0.2
T8	0-1'	6.0	1.6
	1'-5'	6.6	0.8
	5'-6.5'	6.6	0.5
	6.5'-10'	6.8	0.3
	10'-15'	6.8	0.3
T9	0-18"	6.0	1.3
	18"-5'	6.2	0.5
	5'-7.5'	6.1	0.6
	7.5'-10'	6.2	0.2
	10'-12.5'	6.2	0.8
	12.5'-15'	6.4	0.2
T10	0-1'	6.4	1.1
	1'-5'	6.5	0.4
	5'-7.5'	6.4	0.5
	7.5'-10'	7	0.3
	10'-15'	7.1	0.3

Hole ID	Core Sample (depth in ft)	pH	OM %
T11	0-1'	5.5	1.3
	1'-5'	5.8	0.5
	5'-7'	5.5	0.5
	7'-10'	5.2	0.4
	10'-15'	5.6	0.4
T12	0-1'	7.9	0.5
	1'-5'	8.4	0.2
	5'-7.5'	8.2	0.3
	7.5'-10'	8.2	0.2
	10'-12.5'	8.1	0.3
	12.5'-15'	6.9	0.4
T13	0-1'	7.0	0.7
	1'-5'	8.0	0.3
	5'-7.5'	7.8	0.3
	7.5'-10'	7.9	0.3
	10'-15'	8.1	0.3
T14	0-1'	6.5	0.9
	1'-3'	6.7	1.9
	3'-6'	6.8	1.0
	6'-10'	6.8	0.3
	10'-15'	5.9	0.5
T15	0-1'	6.5	1.0
	1'-3'	6.2	0.4
	3'-7'	7.3	0.2
	7'-10'	7.1	0.2
	10'-15'	6.4	0.2
T16	0-15"	6.2	1.8
	15"-5'	5.2	0.7
	5'-7.5'	5.5	0.6
	7.5'-10'	5.6	0.3
	10'-15'	7.4	0.2
T17	0-1'	6.4	1.6
	1'-5'	7.1	0.5
	5'-7.5'	7.3	0.4
	7.5'-10'	7.1	0.3
	10'-15'	6.7	0.3
T18	0-1'	7.6	0.6
	1'-5'	7.6	0.4
	5'-7.5'	7.3	0.4
	7.5'-10'	6.9	0.3
	10'-15'	7.2	0.3
T19	0-2.5'	7.3	0.6
	2.5'-5'	7.1	0.7
	5'-7.5'	7.0	0.4
	7.5'-10'	6.0	0.3
	10'-15'	6.2	0.3
T20	0-8"	6.0	2.4
	8"-2'	6.5	0.4
	2'-5'	6.0	0.7
	5'-10'	6.1	0.5
	10'-15'	6.2	0.2

Hole ID	Core Sample (depth in ft)	pH	OM %
T21	0-18"	5.1	2.5
	18"-5'	5.0	0.6
	5'-7.5'	5.4	0.8
	7.5'-10'	6.2	0.3
	10'-15'	7.5	0.3
T22	0-1'	5.9	1.1
	1'-5'	5.4	0.2
	5'-7.5'	6.1	0.2
	7.5'-10'	6.0	0.2
	10'-15'	6.6	0.2
T23	0-1'	7.6	0.5
	1'-3'	8.0	0.3
	3'-5'	7.5	0.7
	5'-7.5'	7.7	0.5
	7.5'-10'	5.5	0.2
	10'-15'	6.7	0.2
T24	0-1'	6.9	0.9
	1'-3'	7.3	0.7
	3'-5'	6.6	0.7
	5'-7.5'	7.4	0.4
	7.5'-10'	5.9	0.3
	10'-15'	7.7	0.3
T25	0-1'	6.3	3.4
	1'-5'	6.2	1.8
	5'-7.5'	7.4	0.3
	7.5'-10'	8.1	0.3
	10'-15'	8.1	0.2
T26	0-6"	6.4	1.7
	6"-5'	6.9	0.4
	5'-7.5'	7.0	0.4
	7.5'-10'	7.9	0.3
	10'-12.5'	8.1	0.2
	12.5'-15'	9.4	0.2
T27	0-6"	7.3	1.6
	6"-18"	8.0	0.4
	18"-5'	6.0	3.8
	5'-7.5'	7.6	0.4
	7.5'-10'	8.0	0.3
	10'-15'	8.2	0.3

** pH value is from a second analysis of the soil. Original pH analysis was 9.6 and the sample was retested for verification.

Soil Chemistry Parameters Section 32 91 14		
	pH	% OM
Mean	5.5	4.0
StDev (±)	0.8	3.0

Albany Rapp Road Landfill

Albany, New York

City of Albany, Dept. of General Services

One Connors Blvd.

Albany, New York

Soil Sample Locations

Legend

Site Boundary

Sample Point

2' Contours

Stock Pile Boundary

N

0 200 400 800 Feet

Scale: 1" = 400'

To Scale When Printed at 11" x 17"

1 of 1

Applied Ecological Services, Inc.
17921 Smith Road, PO Box 256 • Brodhead, WI 53520-256
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Attachment I. Pre-Construction Monitoring and Faunal Survey
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

Pre-construction faunal surveys initiated in fall 2009 to establish baseline conditions will be continued and completed in 2010 using the following approved methods and scheduling as presented in the previous work plan. In addition, selected 2006 baseline vegetation study transects and new baseline transects will be re-sampled according to the transect location map presented at the end of Attachment I (Attachment I Transect Location Map).

PRE-CONSTRUCTION SURVEYS

T&E SURVEYS

Detailed vegetative surveys and informal wildlife surveys, among other site investigations such as soil surveys, groundwater and surface water monitoring, and macroinvertebrate surveys, were conducted over the past 2-3 years within the proposed expansion and restoration areas. This analysis documented highly disturbed conditions in all areas. Additionally, no protected or other species of concern were identified over the many hours spent in the field by highly qualified biologists. As a result, the data and observations documented in the SEQR and permitting submittals presents a high level of certainty that no threatened, endangered or other species of concern will be impacted by the proposed expansion or the restoration activities. However, in order to address unforeseen circumstances and provide an even higher degree of certainty that no significant impacts will occur, surveys for threatened and endangered species, species of greatest conservation need, and special concern species will be conducted prior to the start of construction. Additionally, qualified ecologists, who will be overseeing construction activities, will continually monitor site conditions to address unforeseen encounters of protected species. To maximize the chance of detection, surveys will be conducted during periods of 'peak' activity for each species. Table 1 identifies species listed in the EIS and provides for peak detection periods. Surveyors will be proficient on field identification of all listed species.

Survey methods will consist of a combination of Point Counts and Wandering Transects. Prior to the survey, transect routes and point count locations will be identified as appropriate for each species.

In order to increase the efficiency of the survey efforts, surveys for more than one species can be conducted concurrently. For example, transects established for butterflies and dragonflies will occur within the same area as a bird survey point count. Additionally while one surveyor is conducting

point counts the other may search cover objects for reptiles and amphibians. In order to obtain data during peak detection periods four surveys are proposed: late-May - early June, mid to late July, mid to late August and late September - early October.

Butterfly and Dragonfly Surveys
Modified transect counts using the Pollard Walk Method (1977) will be used to detect Karner blue butterfly and Pine Barrens buck moth. Each route will traverse a range of habitats deemed most representative of the majority of terrain at the site. Routes will also represent a variety of topographical and physical aspects of the Expansion and Restoration areas. Each surveyor will be assigned a transect width and is free to slowly wander at will in active search of productive habitats, nectar sites, within the assigned transect. Efforts will be made to record each individual only once.

Surveys will be conducted between 10 am and 5 pm. Optimal field conditions consist of temperatures between 55-64°F, cloud cover not exceeding 50% and no wind.
If identification of a species is difficult, a net may be used to capture the individual. Net dragonflies in flight by swinging at them from behind. Many species will fly a predictable route, so you can watch a while to see the pattern and then set up an ambush at a convenient spot, perhaps where you are partially hidden by a tree or shrub. When perched, approach them with very slow movements. Once in the net, remove the specimen by hand (they don't bite very hard). Hold with its wings held back together and use a hand lens for proper identification.

Equipment needed:
- Binoculars
- GPS
- Butterfly net
- Hand lens
- Data Sheets
- Map
- Field guide
- Wind and temperature meter

Bird surveys
Bird surveys will be conducted using modified USGS Breeding Bird protocols. Survey locations will be identified within each habitat type. If possible suitable habitat for each point survey location will encompass 12 ± acres. Surveys will begin ½ hour before sunrise and be concluded no later than 2 hours after sunrise. Surveys will not be conducted during rain or periods of high wind (greater than 12 mph). Every point will be surveyed during the same day.

Once the observer arrives at the survey point wait 2 minutes before beginning the count. This enables the observer to prepare for the count and allows the birds to calm down and return to normal activity. Surveys will be conducted for a 5-minute period with all birds seen or heard within 100 meters (328 feet) will be recorded. This 3-minute period is divided into two periods; a 3- and a 2-minute period. The observer records the species and number of birds seen or heard during the first 3 minutes, then focus on the listed species only for the remaining 2 minutes.

Record all listed species as less than 25 meters, 25-100 meters or greater than 100 meters away from the survey point. Plot all listed species on a circle map with an abbreviation of the common name.

If you observe a listed species before or after the 5-minute survey or between survey points, write it down and mark time and mark the approximate location on a field map.

Equipment needed:

- Binoculars
- GPS
- Stop watch
- Data sheets
- Map
- Field guide
- Wind and temperature meter

Reptile and Amphibian Surveys

Reptile and Amphibian surveys will be conducted in conjunction with any of the other surveys. Any potential cover objects will be recorded and searched. Visual encounters will also be recorded. Optimal survey times are generally between 60-80 or 85° F, partly sunny or cloudy skies, and little to no wind.

Equipment needed:

- GPS
- Snake Hook
- Leather gloves
- Map
- Field guide

Plants

While conducting the above surveys, observers will also conduct random searches for listed and nectar plants. If plants are found and are not in immediate danger of being destroyed, the exact location of the plant will be recorded and flagged in order to locate the plant during the dormant season for transplanting. If the timing is such that the plant will be destroyed by restoration or construction activities outside the preferred transplant season (fall & spring), ecologists will carefully dig up the plant and immediately relocate it to other appropriate areas within the restoration area using all proper precautions.

Notification

If any species listed in Table 1 are found, notification will be made to the proper DEC official. Information to be provided includes location, habitat type, time of observation, number of individuals, and activity (breeding, foraging, resting). If an animal is found which has constrained mobility (e.g. turtles, snakes, amphibians or nesting birds) the appropriate agency will be notified, and it will be relocated to an acceptable area in the PBP. A GPS location will be obtained noting the exact location of the relocation. If species are highly mobile, a GPS location will be obtained and provided to DEC in an annual report. Areas within the PBP suitable for relocation of species will be determined prior to the conducting surveys.

VEGETATIVE SEED COLLECTION

While moving between transect areas native vegetative species that may be available as a seed source or salvage will be identified, flagged and stage of seed development recorded. Special attention will be given to nectar species, many of which are easiest to identify when they are flowering.

Field collection forms and GIS will be used to document collection area location, along with other important details such as collection dates and the abundance, distribution and health of parent plants.

Collecting seeds at the correct time is crucial for propagation to be successful. Collect seeds only when they are mature. Mature seeds are usually dark in color, firm and dry. The flesh of pulpy fruits often become soft and change from green or yellowish to reddish or blue-purple when ripe. Seeds are often mature a week or more before the fleshy fruits turn color and fall from the plant. Seeds that are green and moist are immature and generally will not germinate. Gather fruits from the ground only if they have recently dropped. Reject any seeds that have been on moist ground for some time.

Grass
Grass seed will be harvested by stripping or shaking the seeds off of the stem, or by clipping the stem with scissors or small scythes just below the spikelet.

Forbes
Many pods or capsules dehisce when ripe and mature at staggered intervals. Once seeds begin to mature, the entire inflorescence will be cut and allowed to dry in a paper bag.

Shrubs
Shrub seeds will be picked or the shrub will be lightly beaten or shaken to encourage the seeds to drop. Seeds will be captured by laying a tarp underneath the shrub.

All seeds will be collected in paper bags and labeled appropriately with species and date of collection. Seeds from different species will be kept separate. Once seeds are collected they should be placed in a cooler to avoid overheating which will reduce viability of the seed.

Equipment needed:
- GPS
- Leather gloves
- Drop cloths
- Pruning shears
- Paper bags
- Cooler

Seed Storage
As soon as possible after collection, mesh trays will be labeled with species and collection dates and the seeds will be spread out to dry. Following drying the seeds will be cleaned as thoroughly as possible using a combination of graded sieves and air current for removing the chaff. Seeds will then be placed in paper bags, labeled and stored in a refrigerator or in a dark cool (30°F) area.

VEGETATION TRANSLOCATION

Translocation of trees and shrubs will occur when the specimen is dormant usually at the start and end of the growing season.

Removal
Two to three days before transplanting begins shrubs will be watered and trimmed. To remove the plant from its current location a circular trench should be dug about two-thirds that of the branch spread and as deep as possible in order to get as much of the tap root as possible.

While removing the plant do not disturb the root system. Wrap the entire root ball in burlap material and tie closed with the proper cording or string. Water the root ball to prevent it from drying out.

Planting
Dig a hole in the new location that is about twice as big as the root system. Mix compost into the hole. Place plant into the hole, the plant should be placed at the same soil elevation that it was removed from. Fill the hole with native soil and tamp down lightly. Water thoroughly and deeply. Keep moist for 3-4 weeks after planting.

Table 1. Time period of greatest observation potential for listed animal species at Albany Landfill.

	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Barrens Dagger Moth												
Karner Blue Butterfly												
Frosted Elfin												
Brook Snaketail												
Common Sanddragon												
Forcipate Emerald												
Mocha Emerald												
Tiger Spiketail												
Eastern Hognose Snake												
Worm Snake												
Eastern Spadefoot toad												
Fowler's toad												
Jefferson Salamander												
Sharp-shinned hawk												
Cooper's hawk												
Woodcock												
Wood Thrush												
Blue-winged Warbler												
Golden-winged Warbler												
Black-throated blue Warbler												
Whip-poor-will												
Yellow-breasted chat												
Rufous-sided Towhee												
Indigo Bunting												

Karner Blue Butterfly (*Lycaeides melissa samuelis*) Survey Protocols Within the State of New York

Prepared by:
U.S. Fish and Wildlife Service (Service), New York Field Office
New York State Department of Environmental Conservation (NYSDEC)
May 2008

The following protocols were developed to determine whether a given site has the potential to support Federally- and State-listed endangered Karner blue butterflies and if so, to determine whether Karner blue butterflies are present at the site. These protocols do not replace methods for the annual monitoring of known occupied sites. These recommendations are based on our current understanding of Karner blue butterflies and their habitat. In addition, the State-listed threatened frosted elfin (*Callophrys irus*) butterfly is also found in the same habitat as Karner blue butterflies and these protocols can be used for that species as well. Note that on Long Island some frosted elfin populations feed on Baptisia rather than lupine. Therefore, surveys for frosted elfin on Long Island should include both lupine and Baptisia habitats. Please contact the NYSDEC for further information regarding the frosted elfin.

Karner blue butterflies have generally been observed to conduct localized movements of approximately ≤200 meters (Service 2003). Therefore, the Service and NYSDEC define "occupied" habitat to include all lupine patches directly observed to be occupied by the butterflies, as well as all additional lupine (whether any of the butterflies were directly observed during surveys or not) within 200 meters of those patches. Therefore, all lupine within 200 meters of each other will be considered as one functioning patch. The definition of "occupied" habitat also may include suitable nectar plants (plants that provide nectar to small butterflies and that bloom during the first and/or second flight periods) and grassy areas (areas not regularly mowed during the growing season) that provide shelter for the butterflies within a lupine patch and extending 200 meters from the edge of a lupine patch. The NYSDEC and Service shall determine whether areas without lupine but containing nectar within 200 meters of occupied lupine are considered occupied.

There are four phases of the surveys:

- Conduct preliminary site assessment;
- Conduct lupine and nectar surveys;
- Monitor for butterfly presence; and
- Continue monitoring for relative butterfly abundance (optional but recommended).

We recommend site assessments be conducted for all project sites within and possibly outside portions of the Glacial Lake Albany Recovery Unit where Karner blue butterfly populations are known or likely to occur. This includes portions of Albany, Schenectady, Saratoga, and Warren Counties.

Site Assessments

Preliminary site assessments are needed to identify potential butterfly habitat and shall be conducted before the first butterfly survey to identify which portions of a given site should be surveyed for wild lupine, nectar plants, and the butterflies. These assessments involve conducting a general field

survey of the site and broadly mapping site features including ecological communities, improved areas, and infrastructure. The map should indicate areas to be excluded and areas to be included as potential butterfly survey areas.

Lupine is generally found in more open areas, however, plants can continue to survive for periods of time in more closed-canopy situations. Therefore, all areas with well-drained, predominantly sandy or other well-drained soils, should be surveyed, except for those listed below.

Areas to exclude from future surveys include:

- Active row-cropped agricultural lands;
- Paved developed areas (buildings, roads, etc.);
- Other non-sandy or poorly drained soil areas;
- Areas regularly mowed during the growing season (lawns); and
- Areas with >50% canopy cover (only if there are no openings, trails, or paths through such areas).

Habitat may exist directly adjacent to, or outside the footprint of the above-listed areas, and should be surveyed for lupine, nectar, and the butterflies.

Lupine and Nectar Surveys

Surveys for wild lupine may be conducted prior to surveying for butterflies, in conjunction with the site assessment, to expedite butterfly surveys or you may chose to initially survey for both wild lupine and the butterflies at the same time. An individual who is knowledgeable in the identification of lupine should conduct the surveys. We provide the following guidance on when to survey for lupine:

- In places where lupine flowers early (sunny areas), survey from late May to mid-June. In places where lupine flowers rarely, or not at all (usually more shaded areas), surveys should be conducted from late May through mid-July.

While lupine is essential for butterfly larvae, adult butterflies rely on a variety of plants as nectar sources, especially during the second flight period as lupine plants senesce. Potential nectar plants will provide nectar to small butterflies and bloom during the first and/or second flight periods. Please refer to Appendix C of the Karner Blue Butterfly Recovery Plan (Service 2003) for a list of potential nectar sources.

To adequately assess the site, both wild lupine and nectar areas should be mapped as accurately as possible. In addition, descriptions of the lupine patches (*e.g.*, estimated size and number of lupine stems within a patch) should be provided. Provide a list of the observed nectar plants and include descriptions on the map (*e.g.*, where vigorous, dense clusters of plants were observed, where nectar plants were scattered throughout, etc.).

Survey Methodology for Potential Karner Blue Butterfly Sites

The Karner blue butterfly has two broods and flight periods per year; the first flight normally begins in mid- to late May and ends in mid- to late June and the second flight normally begins in mid-July and ends in mid-August. However, the timing of the flight periods can vary by as much as 2-3 weeks from year to year and/or site to site due to weather and microclimatic influences. The length of the flight periods may also vary from year to year (generally 2-5 weeks). Since it cannot be known when the flight periods commence until field observers begin to report sightings of the butterflies, discussions with the Service/State are necessary prior to conducting surveys for either species to refine the survey window for any particular year.

Surveys shall be conducted by an individual knowledgeable in identification of the butterflies (see descriptions and photographs in the Recovery Plan for the Karner blue butterfly attached below). Identification photographs of butterflies can also be obtained from the State/Service.

Please note that scientific collector permits are required by the State for butterfly surveys. Please allow for adequate processing time to ensure that permits are in place prior to the first flight period.

Determining Butterfly Presence: Intensive Search Method

- Survey all potential habitat areas for the butterflies. This includes all lupine patches as well as nectar and grassy areas that may provide adult food and/or shelter for butterflies.
    - All of the lupine, nectar, and nearby grass habitat should be carefully searched by slowly walking over it, gently prodding vegetation with a butterfly net or meter stick, and/or stopping frequently and scanning the area for movement. The search should criss-cross all of the potential habitat area until the surveyor can be confident that all potential habitats have been searched. If more than five individuals are found, a zigzag transect may be done in later surveys to establish relative butterfly abundance (see Zigzag Transect Methods below).

- To determine butterfly presence, conduct a minimum of 5 surveys per Karner blue butterfly flight period with a total of 10 surveys needed to establish baseline conditions for the Karner blue butterfly (weather permitting) (call the State to confirm the start and finish of flight periods at nearby locations). Please Note: At least 2 of the surveys should be conducted during the last two weeks of May to overlap with the frosted elfin flight period. The remaining 3 first flight surveys must occur in early June (as stated above, coordinate with Service/State regarding survey windows).

- Conduct all 5 first flight period surveys until both species of butterfly are observed (or all surveys complete).

- If neither species is observed during the first flight, continue with second flight surveys until Karner blue butterflies are observed (or all 5 second flight surveys are complete).

- We recommend conducting all 10 surveys, even if butterfly presence is documented during an earlier survey, to document the use of nectar areas and get the best possible peak count of butterflies within each flight period. This will assist the Service/State with determining an initial index count of butterflies within the site, which can be monitored over time to determine the effects of the proposed management actions.

- Visits should be spaced every 2-5 days.

- Conduct surveys during optimal time and weather conditions as listed below:

  - between 8:00 a.m. and 6:00 p.m.
  - when temperatures are 65-95°F
  - when temperatures are between 65-70°F, surveys should only be conducted under mostly sunny skies with calm to light wind
  - when temperatures are above 70°F, no restrictions on cloud cover
  - when eye-level winds are less than 20 mph

- Additional weather notes:

  - do not survey under drizzly or rainy conditions; however, surveys can continue through very light rain if the sun is shining and the temperature is 75°F or higher. Please Note: No more than 1 site visit per flight period should occur under these conditions.
  - delay surveying after heavy rain until the vegetation and the butterflies have had a chance to dry
  - if suboptimal weather conditions continue for extended periods, contact the Service/State for guidance.

- Time Keeping

  - Record the duration of each survey. For sites with more than one transect, record duration of each transect and provide a total time (and total butterflies) as a separate data sheet entry. Duration must be recorded to the second. Do not round off minutes! Record time of day in military time. Record the time of day you visit the site even if you use a stop watch to time the duration. If you are not using a stopwatch, record your start time and end times in military time and include the second (*e.g.*, 1417:00 - 1418:23). It helps to start at 00 seconds or 30 seconds to make it easier to subtract out later. Include duration of search even for zigzag and exhaustive searches.

Determining Relative Butterfly Abundance at Occupied Sites: Zigzag Transects Method

- Establishing Transects
  - As reported in McCabe (1993), zigzag transects should be designed to cover each site. Transects should remain constant from day to day and for both broods. If monitoring longer term, transects should also remain constant from year to year so that data can be accurately compared through time. If the transect needs to be expanded (i.e., due to expansion of lupine population), it should be segmented so that data collected from the original transect can continue to be compared to that of previous years.

  - The distance between zigzags shall be sufficient to avoid counting an individual butterfly more than once. The distance between zigzags can be increased in areas where high butterfly densities would have resulted in many butterflies being counted more than once.

  - If the zigzag method is employed and surveys do not pick up butterflies regularly, abundance cannot be determined using this method (consult with State).

- Standard Methods

  - Observers walk at a comfortable pace gently swinging a butterfly net above the vegetation to stir the butterflies into motion. All butterflies seen, both at rest and in flight, are counted and their numbers recorded on a data sheet. Butterflies that fly into areas not yet walked are to be counted only if they fly no further than one zigzag ahead. Butterflies which fly farther than one zigzag ahead are left to be counted later in the walk-through (McCabe 1993). Butterflies that fly out of the census area are counted.

  - The sex of a butterfly should be recorded during the walk if it is obvious to the observer (*i.e.*, a butterfly sitting in the path of the observer with its wings open). However, sexing butterflies during the transect walk should be done judiciously so as not to change the length of time necessary to walk the site or introduce inaccuracies caused by losing track of counted butterflies. A separate walk-through should be conducted in order to determine the sex ratio of the butterflies.

  - After completing the transect walk and sex ratio determination, Karner blue butterfly nectar species should be noted and the number of butterflies observed to be nectaring recorded. Other plants in bloom and weather notes should also be recorded on the data sheet.

  - Follow weather and time protocols listed above.

  - Marked transects may be along a continuous line or in zigzags, as long as they cover the entire potential habitat on a site.

  - Keep eyes forward a short distance ahead but regularly glance toward your feet and about 10 feet ahead. This will help you to stay on the transect and avoid trampling too much lupine. Also sometimes the butterflies will not fly up as you step over them.

- Keep walking at a steady pace, about one heart beat per step. Avoid the tendency to slow down as you get into a lot of butterflies and speed up when there is not much lupine. If you wander off the transect route by more than a few feet, start over again. Do not try to slow down or speed up to keep your time exactly the same, but practice your pace to try to keep it steady enough that you are doing the transect within 10-15 seconds of the same duration each time.

- **NOTE: CENSUS NUMBERS SHOULD NOT BE INTERPRETED AS THE ABSOLUTE NUMBER OF KARNER BLUE BUTTERFLIES IN A GIVEN SUB-POPULATION. RATHER, THEY REPRESENT AN INDEX FOR THE SIZE OF AN INDIVIDUAL SUB-POPULATION THAT CAN BE COMPARED FROM YEAR TO YEAR. ONLY IN INSTANCES WHERE THE SUB-POPULATION IS QUITE SMALL AND CONFINED TO A WELL-DEFINED AREA THAT CAN BE CENSUSED THOROUGHLY DO CENSUS NUMBERS APPROACH THE ABSOLUTE NUMBER OF KARNER BLUES IN A GIVEN SUB-POPULATION AT A GIVEN DAY.**

- Zigzag surveys (for sites too small to effectively monitor with marked transects)

  - Monitors should strive to walk the same areas each time, but essentially should cover the entire habitat without counting butterflies twice. The zigzag surveys for unmarked transects should be done as described above for marked transects.

Similar Species

- Karner blue butterfly

  - There are two blue butterflies similar in appearance to Karner blue butterfly that may be present in Karner blue butterfly sites during both adult flights: the eastern tailed blue (*Everes comyntas*) and spring azure (*Celastrina ladon*). (See photographs provided below)

  - Eastern tailed males are blue on the upper side of the wings like male Karner blues, but have small orange dots at the bottom of the upper side of the hind wing. Female eastern tailed blues are similar to female Karner blues except that the orange on the upper side of the hind wing is limited to a few small dots instead of the row of orange crescents along the entire edge of the hindwing. In both sexes, the underside of the wings looks similar to Karner blues except the Karner blue has a row of orange crescents that line the entire edge of the hindwing and sometimes part of the forewing. Eastern tailed blues have only 2 or 3 small orange dots at the bottom of the hindwing. The Eastern tailed blue has small slender projections or "tails" at the bottom of the hindwing, but these may be difficult to see or broken off.

  - Both sexes of spring azures are blue on the upper side of the wings, but have a larger blue margin, especially the females. The underside of the wings has no orange dots or crescents. Spring azures are very likely to fly high up and fly off into tree canopies while Karner blues will do so very infrequently. This behavior is not enough to confirm identification, however.

- The wing markings are extremely difficult to see while the animals are in flight. At sites where Karner blue butterfly presence is not documented or where numbers are known to be very low, blue butterflies must be closely observed for field markings when perched or else captured in nets and seen through the net or placed in a clear jar for confirmation. An unknown blue butterfly should not be recorded as a Karner blue unless it is confirmed. However, a blue butterfly that was not identified should be noted in the field data sheet.

- Frosted elfin butterfly

  - Frosted elfins can easily be confused with both the Hoary elfin (*Incisalia polios*) and Henry's elfin (*I. henrici*). Frosted elfins are brown butterflies, 1" to 1-1/4" in size. They can be identified by a black spot above a short tail stump on the hindwing. They are named for the gray "frosting" on the hindwing.

Frosted elfin butterfly – ventral surface
(www.google.com/images)

Female

Male

Karner blue butterfly – dorsal view (K. Breisch)

Eastern tailed blue
ventral surface
(www.google/images)

Spring azure
ventral surface
(www.google/images)

Karner blue butterfly
ventral view
(K. Breisch)

References Cited:

McCabe, T. 1993. Albany Pine Bush Project 1991-1992 entomological report. Report to The Nature Conservancy.

U.S. Fish and Wildlife Service. 2003. Final Recovery Plan for the Karner Blue Butterfly (*Lycaeides melissa samuelis*). U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 273 pp.

Williams, E. March 5, 2007. Electronic mail to R. Niver.

Eastern tailed blue
ventral surface
(www.google/images)

Spring azure
ventral surface
(www.google/images)

Karner blue butterfly
ventral view
(K. Breisch)

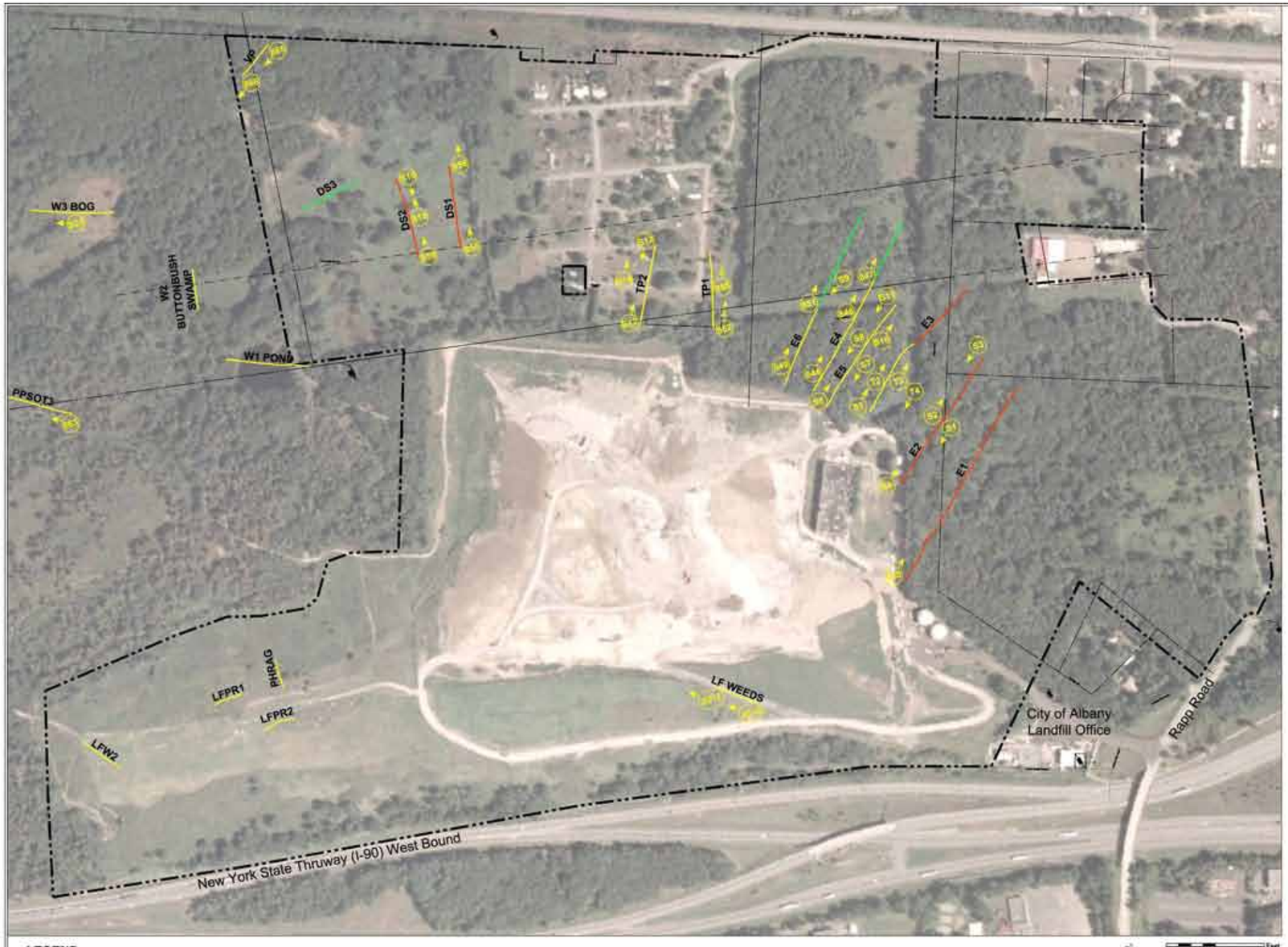
References Cited:

McCabe, T. 1993. Albany Pine Bush Project 1991-1992 entomological report. Report to The Nature Conservancy.

U.S. Fish and Wildlife Service. 2003. Final Recovery Plan for the Karner Blue Butterfly (*Lycaeides melissa samuelis*). U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 273 pp.

Williams, E. March 5, 2007. Electronic mail to R. Niver.

Attachment I. Transect Location Map



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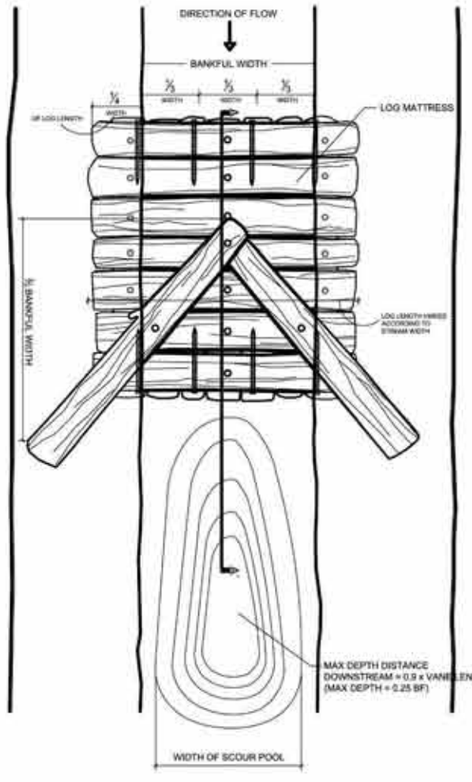
Specialists in Environmental Research, Planning, Construction and Management

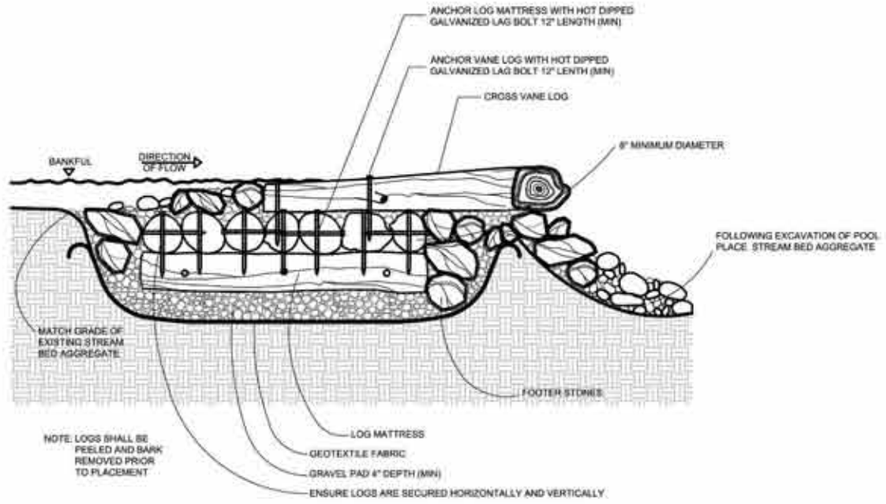
Attachment J. Log Vane Grade Control Structures
Albany Rapp Road Landfill
Ecosystem Mitigation, Restoration & Enhancement Plan
City of Albany, New York

The restoration plans for Albany include improvement to the existing stream that flows under Rapp Road approximately 800 feet north of the landfill entrance road. Prior to Phase 2 expansion by the landfill, restoration construction activity planned for 2011 in the trailer court area will improve the headwater area of this stream and connect it to the existing stream. The planned improvements to existing stream include installation of three log vane grade control structures in the stream channel at specific locations upstream from Rapp Road and downstream of the construction. Installation of these structures in 2010 is anticipated to assure they are in place before the upstream restoration grading and stream replacement is completed in 2011.

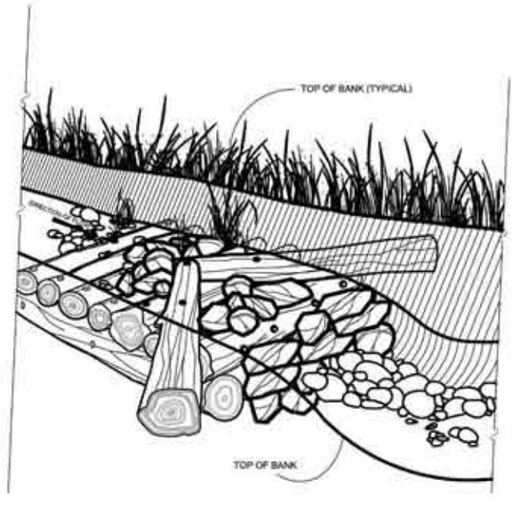
Installation of the log vanes in 2010 is contingent on receiving all required permits and approvals. Permits and approvals are pending and receipt is anticipated within a time that will allow installation of the log vanes. The log vanes will be installed during late summer or early fall of 2010 when stream flow is typically low. Each structure will be installed by AES contracting personnel using small equipment (mini-excavator) to assist in placing the logs and rock in each structure. Construction of the three log vanes is expected to be completed within one week. Sediment control during installation and post-construction revegetation and sediment control will be used as per approved plans.



CROSS VANE WITH LOG MATTRESS - PLAN VIEW
Scale: NTS



CROSS VANE WITH LOG MATTRESS - SECTION A - A'
Scale: NTS



CROSS VANE WITH LOG MATTRESS - PERSPECTIVE VIEW
Scale: NTS

IN PROGRESS
DO NOT USE FOR CONSTRUCTION

Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York

2010 Work Plan
Log Vane Details

CHA
Applied Ecological Services, Inc.

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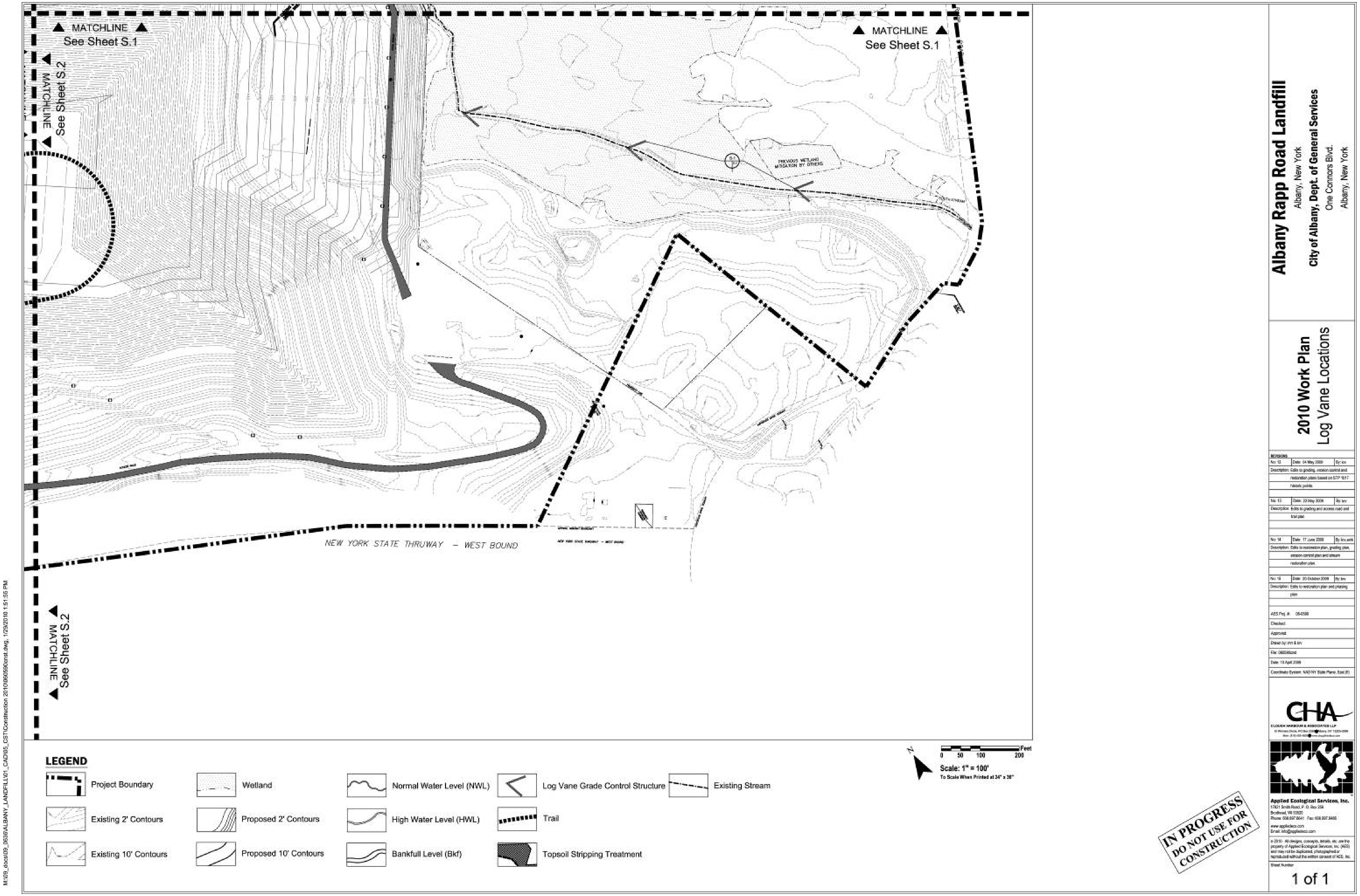
MATCHLINE
See Sheet S.1
MATCHLINE
See Sheet S.1
MATCHLINE
See Sheet S.2
MATCHLINE
See Sheet S.2
PREVIOUS WETLAND MITIGATION BY OTHERS
NEW YORK STATE THRUWAY – WEST BOUND
LEGEND
Project Boundary
Wetland
Normal Water Level (NWL)
Log Vane Grade Control Structure
Existing Stream
Existing 2' Contours
Proposed 2' Contours
High Water Level (HWL)
Trail
Existing 10' Contours
Proposed 10' Contours
Bankfull Level (Bkf)
Topsoil Stripping Treatment
Scale: 1" = 100'
To Scale When Printed at 24" x 36"
0 50 100 200
Feet
IN PROGRESS
DO NOT USE FOR CONSTRUCTION
Albany Rapp Road Landfill
Albany, New York
City of Albany, Dept. of General Services
One Connors Blvd.
Albany, New York
2010 Work Plan
Log Vane Locations
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